

**SORGHUM  
BIBLIOGRAPHY  
1981**



**ICRISAT**

**SORGHUM AND MILLETS INFORMATION CENTER**



# **Sorghum Bibliography 1981**

Compiled by  
**D JOTWANI**



**ICRISAT**

**Sorghum and Millets Information Center**

International Crops Research Institute for the Semi-Arid Tropics

ICRISAT Patancheru P.O.

Andhra Pradesh 502 324, India

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# CONTENTS

PREFACE	V
GUIDE TO SUBJECT INDEX	VII
LIST OF ACRONYMS	VIII
LANGUAGE CODES USED IN ENTRIES	IX
BIBLIOGRAPHY	1
GENERAL	1
ANATOMY AND MORPHOLOGY	3
TAXONOMY AND GEOGRAPHIC DISTRIBUTION	4
PHYSIOLOGY AND BIOCHEMISTRY	5
GENETICS AND BREEDING	30
Hybrids, Varieties, and Performance Trials	46
AGROCLIMATOLOGY	52
SOIL SCIENCE	53
SOIL MICROBIOLOGY	56
WATER MANAGEMENT	60
AGRONOMY AND CULTIVATION	
General	61
Land Preparation and Cultivation	67
Fertilizers and Plant Nutrients	70
Planting Seasons and Dates	82
Farming Systems	84
Weeds and Weed Control	96
Harvesting and Equipment	106
PLANT DISEASES, PESTS, AND CONTROL	106
Pathology	
Fungus Diseases	107
Smuts	109
Rust	110
Downy Mildews	110
Leaf Spot/Blight	113
Rots	114

Ergot	116
Fungi on Grain Seeds (Molds)	116
Bacterial Diseases	119
Virus Diseases	120
Nematode Diseases	123
Parasitic Plants- Striga	123
Entomology	125
Soil Pests	130
Aphids	130
Shootfly	132
Armyworms	141
Stem Borers	141
Spider Mites	142
Sorghum Midge	143
Head Caterpillars	145
Stored Grain Pests	145
Other Insect Pests	146
Birds, Rodents, and Other Pests	148
Plant Protection and Seed Treatment	149
CHEMICAL COMPOSITION	151
POSTHARVEST OPERATIONS	157
SEED AND SEED PRODUCTION	160
UTILIZATION	
Feeds	161
Food Products	177
Industrial Uses	182
ECONOMICS AND MARKETING	183
SWEET SORGHUM	187
WEED SORGHUM	192
FORAGE SORGHUM	197
AUTHOR INDEX	213
SUBJECT INDEX	229

## PREFACE

This bibliography is the fourth in the series of sorghum bibliographies compiled and published by the Sorghum and Millets Information Center (SMIC). The bibliography includes literature published during 1981. Unlike earlier bibliographies, the present one is annotated. The annotations are generally based on the author's abstract or summary, edited wherever necessary for consistency of style and economy of space. Wherever required, abstractors at SMIC have prepared annotations specially for the bibliography.

A number of sources have been used in compiling this bibliography. Six hundred primary periodicals received at ICRISAT, and secondary sources such as the different abstracting journals of the CAB, Bibliography of Agriculture, Bulletin Signaletique, Dissertation Abstracts International, and Indian Science Abstracts being received at ICRISAT have been used in identifying and selecting entries for the bibliography. In addition, the bibliography also includes items of literature generated within ICRISAT, and non-conventional literature that SMIC collects from its contacts with research centers, libraries and documentation centers in India, Africa and Latin America. Computer output from data bases such as the AGRIS, AGRICOLA, BIOSIS, Science Citation Index, has also been monitored in identifying entries for the bibliography.

Entries are arranged by broad subject groups indicated in the table of contents. Within each subject group, the arrangement is alphabetical by authors. Titles in foreign languages have been translated into English and AGRIS abbreviations have been used to designate languages other than English. The titles of periodicals are cited in full. However, only the acronyms of well known organizations have been used rather than their names in full. A list of acronyms is included in the preliminary pages of the bibliography.

The bibliography has an author and a subject index. The subject index is based on a technique called Pragmatic Approach to Subject Indexing (PASI) developed at SMIC.

A novel feature of this bibliography is the use of the VAX 11/780 computer system for the production of all its components. The main part has been generated using the VAX/VMS Text Editor. A general purpose program has been written at SMIC to format the Text Editor created files into two columns. The output produced by this program has been used directly for offset production. The author and subject indexes have also been produced by programs written at SMIC. The output program permits flexibility in formatting the output. The number, width, and length of columns of the

output can be varied to suit a variety of page formats. The software to generate the main part, indexes, and to format the outputs have been written by P K Sinha of SMIC.

The collection and compilation work for the bibliography has been done by D Jotwani. The editing of the bibliography has been done by P K Sinha and S Prasannalakshmi. The data-entry for the bibliography was done by M Krishna Murthy. The overall responsibility for the bibliography including its computerisation has been that of P K Sinha.

The publication of the bibliography has been made possible by the financial assistance received from the International Development Research Centre (IDRC) for the SMIC Project.

I. J Haravu  
Manager, Library and  
Documentation Services,  
ICRISAT



# GUIDE TO SUBJECT INDEX

The Computer produced subject index is based on the Pragmatic Approach to Subject Indexing (PASI) system developed at SMIC. The original sequence of the keywords provided by the indexer are the logical entries and convey subject content of documents unambiguously. Other entries are generated by rotating the logical entries to enable access from all the keywords. Thus for the title "Effect of nitrogen and phosphorus fertilizers on the growth of Sorghum sudanense" (Doc.No.128), the logical index entry is-

Sorghum sudanense,  
Growth,Nitrogen fertilizers :Phosphorus  
fertilizers, Effect, 128

The entries obtained by the rotation of keywords are:-

Growth,  
Nitrogen fertilizers :Phosphorus fertilizers,  
Effect ; Sorghum sudanense, 128

Nitrogen fertilizers :Phosphorus fertilizers,  
Effect ; Sorghum sudanense,Growth, 128

Phosphorus fertilizers:Nitrogen fertilizers,  
Effect ;Sorghum sudanense,Growth, 128

It is always possible to rebuild the logical entry from any entry if keywords are read starting from the first keyword after the semicolon in an anti-clockwise direction.

Certain keywords are considered in combination because of the close relationship existing between them. The symbols used to depict the relationships are colon(:), slash(/), and parentheses. The comma(,) acts as a separator between the keywords.

Common and botanical names have been used in the subject index. The choice of keywords has largely been made using the AGROVOC Thesaurus and the Sorghum and Millets micro-thesaurus. Cross references have been provided wherever required.

# LIST OF ACRONYMS

ASAE	American Society of Agricultural Engineers
CAB	Commonwealth Agricultural Bureaux
CLSU	Central Luzon State University
CMU	Central Mindanao University
DAIS	District Agricultural Improvement Station
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization of the United Nations
FEBS	Federation of European Biochemical Societies
IARI	Indian Agricultural Research Institute
IBPGR	International Board for Plant Genetic Resources
INIA	Instituto Nacional de Investigaciones Agrícolas
INTA	Instituto Nacional de Tecnología Agropecuaria
IRRI	International Rice Research Institute
ISRA	Institut Senegalais de Recherches Agricoles
JNKVV	Jawaharlal Nehru Krishi Vishwa Vidyalaya
MAFES	Mississippi Agricultural and Forestry Experiment Station
MARDI	Malaysian Agricultural Research and Development Institute
NAFPP	National Accelerated Food Production Project
OAU/STRC	Organization of African Unity/Scientific, Technical and Research Commission
PKV	Punjabrao Krishi Vidyapeeth
SABRAO	Society for the Advancement of Breeding Researches in Asia and Oceania
UNDP	United Nations Development Programme
USDA	United States Department of Agriculture
USM	University of Southern Mindanao
WSSP	Weed Science Society of the Philippines

## LANGUAGE CODES USED IN ENTRIES

Af	Afrikaans	It	Italian
Al	Albanian	Ja	Japanese
Ar	Arabic	Ko	Korean
Bg	Bulgarian	Nl	Dutch
Ch	Chinese	Pe	Persian
Cz	Czech	Pl	Polish
Da	Danish	Pt	Portuguese
De	German	Ro	Romanian
En	English	Ru	Russian
Es	Spanish	Sh	Serbo-Croat
Fr	French	Sk	Slovak
Ge	Georgian	Sn	Slovenian
He	Hebrew	Sv	Swedish
Hu	Hungarian	Tr	Turkish
In	Indonesian	Uk	Ukrainian



## BIBLIOGRAPHY

- 0001 MENAT., H. 1981. Venezuelan bibliography on sorghum. (Es). Maracay, Venezuela: Centro Nacional de Investigaciones Agropecuarias. 61 pp. 200 ref.  
Partially annotated bibliography on sorghum in Venezuela.

## GENERAL

- 0002 ANONYMOUS. 1981. Cereals: maize, rice, sorghum. Asia Research Bulletin 10(10):785-786.
- 0003 ANONYMOUS. 1981. Grain sorghum. (Es). Bolsa de Cereals, Numero Estadistico. pp.122-133.
- 0004 AGUNBIADE, R.M.O., UBI, E.O., NJOKU, J.E., OYEDOKUN, A.O., ADEGBITE, A.A., and RAMALAN, A.A. 1981. Progress report NAFPP National Centre for Sorghum/ Millet/Wheat. Pages 164-194 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University.
- 0005 BRAZIL: CENTRO NACIONAL DE PESQUISA DE MILHO E SORGO. 1981. Technical yearly report of the National Center of Maize and Sorghum Research 1979-80. (Pt). Sete Lagoas, MG, Brazil: Centro Nacional de Pesquisa de Milho e Sorgo. 207 pp.
- 0006 BRAZIL: EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. 1981. National programme of sorghum research. (Pt). Brasilia, DF, Brazil: Empresa Brasileira de Pesquisa Agropecuaria.
- 0007 BRAZIL: UNIDADE DE EXECUCAO DE PESQUISA DE AMBITO ESTADUAL DE PELOTAS, and UNIVERSIDADE FEDERAL DE PELOTAS. 1981. Annals of the ten yearly technical meeting on sorghum. (Pt). Presented at the Tenth Reuniao

Tecnica Anual do Sorgo, 18 August 1981, Pelotas, RS, Brazil. 148 pp. (Summaries only).

- 0008 COATS, R.E., JYV, R., Jr., and HARMAN, R.D. 1981. Report of research progress, Black Belt Branch 1979 and 1980 (soybean, corn, sorghum, sunflower, forages). MAFES Research Highlights 44(10):1-8.
- 0009 DEMO, M.A., SAYAGO, F.F., and ZORZA, E.J. 1981. Situation of grain sorghum Rio Cuarto district. (Es). Serie Extension Rural, Universidad Nacional de Rio Cuarto, Facultad de Agronomia y Veterinaria (Argentina) 6:1-12. (Summary: En).
- 0010 GEBREKIDAN, B., and MENKIR, A. 1981. Ethiopian Sorghum Improvement Project January 1, 1980 - December 31, 1980. Nazareth, Ethiopia: Addis Ababa University, College of Agriculture. 163 pp. (Progress Report, 8).  
Results obtained during the first year of operation of Phase III of Ethiopian Sorghum Improvement Project (ESIP) are reported. Information is provided on weather introduced trials and nurseries, crossing programs, segregating populations and advanced lines, hybrid program, sorghum national yield trials, preliminary yield trials, striga related trials and nurseries, agronomic trials, crop protection, and ESIP's cooperative activities.
- 0011 HOUSE, L.R. 1981. Interaction of Sorghum Program at the ICRISAT Center with Programs in Africa. Paper prepared for the Program Committee Meeting of the ICRISAT Governing Board, 9-11 March 1981.  
Current situation of the program at the Center and programs in Africa is outlined. Plans for the next ten years about operational approach are presented.
- 0012 ICRISAT. 1981. Sorghum. Pages 11-44 In Annual report 1979-80. Patancheru, Andhra Pradesh, India: ICRISAT.

- Presents information on international yield testing, breeding, biochemistry, physiology, and microbiology. Future plans of sorghum research at ICRISAT are also outlined.
- 0013 ICRISAT. 1981. Summary of progress in sorghum improvement 1974-81: prepared for the UNDP Expert Review Committee for Sorghum and Millet. Patancheru, Andhra Pradesh, India: ICRISAT. 23 pp.
- Information is summarized under sorghum germplasm, insect pests problems, diseases problems, physical environmental problems, plant nutrition, food quality, improvement of populations, development of hybrids, and international sorghum yield testing.
- 0014 ICRISAT, MALI COOPERATIVE PROGRAM. 1981. Sorghum improvement program. Pages 2-22 In ICRISAT Mali preliminary report for the 1981 season. Bamako, Mali: ICRISAT. (Summary: Fr).
- 0015 ICRISAT, SENEGAL COOPERATIVE PROGRAM. 1981. Annual report (1980-81): ISRA/ ICRISAT Cooperative Program in Senegal. Bambey, Senegal: Institut Senegalais de Recherches Agricoles. 40 pp.
- 0016 ICRISAT, SUDAN COOPERATIVE PROGRAM. 1981. Annual report of the Sudan Cooperative Sorghum and Millet Crop Improvement Program 1981 (R.P.Jain, and G.Ejeta). Wed Medani, Sudan: ICRISAT. 151 pp. (Report, 5).
- Sorghum and millet improvement activities carried out during 1981 crop season in Sudan are reported.
- 0017 ICRISAT, UPPER VOLTA COOPERATIVE PROGRAM. 1981. Sorghum improvement. Pages 2-9 In ICRISAT Cooperative Program in Upper Volta: prepared for the ICRISAT Board of Governors, 11 September 1981, Kamboinse, Upper Volta.
- 0018 INDIA: ALL INDIA COORDINATED SORGHUM IMPROVEMENT PROJECT. 1981. Annual report 1980-81, Navsari campus, Gujarat. Navsari, Gujarat, India: Gujarat Agricultural University, Sorghum Research Centre. 120 pp.
- 0019 INDIA: ALL INDIA COORDINATED SORGHUM IMPROVEMENT PROJECT. 1981. Progress report 1980-81. New Delhi, India: Indian Council of Agricultural Research. 181 pp.
- 0020 INDIA: ALL INDIA COORDINATED SORGHUM IMPROVEMENT PROJECT. 1981. Report for 1980-81: Akola Centre, Maharashtra. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 18pp + 36 pp.
- 0021 INDIA: TAMIL NADU AGRICULTURAL UNIVERSITY. 1981. Sorghum research in Tamil Nadu: annual report 1980-81. Coimbatore, Tamil Nadu, India: Tamil Nadu Agricultural University. 106 pp.
- 0022 INDIA: UNIVERSITY OF AGRICULTURAL SCIENCES. 1981. Sorghum research in Karnataka: annual report 1980-81. Dharwar, Karnataka, India: University of Agricultural Sciences, Regional Research Station. 158 pp.
- 0023 ISAKOV, IA.I. 1981. Greater attention to sorghum. (Ru). KOLOS 6:35-37.
- 0024 JEGEDE, J.F.O. 1981. The past, present and future of National Accelerated Food Production Programme. Pages 11-20 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University.
- 0025 NIGERIA: NATIONAL ACCELERATED FOOD PRODUCTION PROJECT. 1981. Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 358 pp.
- 0026 PAKISTAN AGRICULTURAL RESEARCH

## ANATOMY AND MORPHOLOGY

- COUNCIL. 1981. Cooperative Research Programme on Maize, Millets and Sorghum 1975-81: progress report. Islamabad, Pakistan: Pakistan Agricultural Research Council.
- 0027 SENEGAL: MINISTERE DE DEVELOPPEMENT RURAL, SOCIETE DE DEVELOPPEMENT DES FIBRES TEXTILES. 1981. Project for cereal crop intensification, maize, sorghum, millet: Tambacounda area, Senegal. (Fr). Dakar, Senegal: Ministere du Developpement Rural. 42 pp.
- 0028 SWINDALE, L.D. 1981. A time for rainfed agriculture. Presented as the Eleventh Coromandel Lecture, 10 December 1981, Coromandel Fertilisers Limited, New Delhi, India. 42 pp.
- 0029 VIDYABHUSHANAM, R.V. 1981. Coordinator's report for the year 1980-81. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 6 pp.
- 0030 WANG, F.D., and LIAO, J.L. 1981. A preliminary approach to the origin and evolution of sorghum in China. (Ch). Liaoning Agricultural Sciences 4:23-26. 16 ref.
- 0031 YEMEN ARAB REPUBLIC: NATIONAL SORGHUM AND MILLET CROP IMPROVEMENT PROGRAM. 1981. Final report. Tucson, Arizona, USA: University of Arizona, College of Agriculture. 148 pp.
- This report highlights the project details and technical results. Information is provided on plant breeding methods, outreach program, training program, research development, and cropping practices research. Administrative methods used to make the project possible included on-campus backstopping, training techniques, plans of action and cooperation with other projects.
- 0032 ASROROV, K.A., and DOBRITSKAYA, Z.V. 1981. Determining meyer lemon leaf area on the basis of parameters. (Ru). Izvestiya Akademii Nauk Tadzhikskoi SSR Otdelenie Sel'sko Khozyaistvennykh i Biologicheshikh Nauk 2:94-96.
- 0033 ATKINS, R.E., and BUENO, A. 1981. Estimation of total-plant leaf area in grain sorghum. Iowa State Journal of Research 56(2):193-204. 8 ref.
- Relationships between the area of individual leaves and leaf area of the whole plant in Sorghum bicolor were examined by using correlation and regression procedures, to identify the individual leaf or leaves most closely associated with total-plant leaf area and to establish the appropriate prediction equation for estimation of total-plant leaf area from the area of that leaf. The results indicate that the fourth leaf from the top of the plant serves best for estimating total-plant leaf area. Commonly the largest leaf showed moderately good coefficients of determination with total-plant leaf area across diverse environments and genotypes. The regression coefficient of the prediction equation seemed the most useful parameter for estimating total-plant leaf area.
- 0034 BUENO, A., and ATKINS, R.E. 1981. Estimation of individual leaf areas in grain sorghum. Iowa State Journal of Research 55(4):341-349. 16 ref.
- Leaf lengths, maximum widths, and areas were measured by using linear regression methods over a wide range of leaf sizes, from early vegetative stages until completion of plant growth: (1) to determine the relationship between linear

measurements of leaves taken from all sections of the plant at different stages of growth and actual leaf area, and (2) to assess the reliability of the leaf area factor (0.75) as a single factor for estimating the area of all leaves from linear measurements. The formula  $A = L \times W \times 0.75$  estimated the area of most individual leaves on fully developed plants with reasonable accuracy, but it tended to overestimate the area of small leaves. For studies that analyze growth during several stages of plant development, a single factor for leaf-area estimation does not seem adequate.

0035 JIMENEZ C., A.A., and MENDOZA O., L.E. 1981. Comparison of indirect methods for leaf area estimation in sorghum (*Sorghum bicolor* (L.) Moench). (Es). *Agricultura Tecnica en Mexico* 7(2):113-125. 8 ref. (Summary: En).

Leaf area measured directly and estimated with three indirect methods are compared. The first method involves a conversion factor. In the second method, regression equations are used with flag leaf area as estimation. The last one is similar to the second method except in the use of second leaf instead of flag leaf. The conclusions are: (1) regression methods provide better estimation, (2) the second method results in higher correlation coefficient but it is useful for handling large number of lines.

0036 PATEL, J.D., BHAT, K.V., SAKUNTHALA DEVI, G., and KOTHARI, I.L. 1981. Fibro-vascular strands in the great millet (*Sorghum vulgare* Pers.). *Flora* 171(4): 410-418. 7 ref.

Morphology of various types of vascular bundles in shoot axis of sorghum has been studied. Mesocotyl internode and coleoptile have four to six collateral endarch vascular strands. In the vegetative internode three strata of vascular bundles can be recognized. All vascular bundles of internode have a sclerenchyma

sheath around them. Peripheral bundles of the internode have a heavy sclerenchyma sheath. The amount of sclerenchyma sheath gradually decreases in the central vascular bundles. Nodal vasculature is most complex. Some bundles in the node lack sclerenchyma sheath, whereas some of them have a radiating parenchyma sheath around them. The fibro-vascular system varies not only in various parts of the axis but also in a radial plane of any given point in the axis.

0037 TARUMOTO, I., MIYAZAKI, M., and MATSUMURA, T. 1981. Scanning electron microscopic study of the surfaces of glossy and non-glossy leaves in sorghum, *Sorghum bicolor* (L.) Moench. *Bulletin of the National Grassland Research Institute* 18:38-44. 12 ref. (Summary: Ja).

The non-glossy plants showed high density of star-shape epicuticular waxes on their leaf surfaces, whereas the glossy plants were characterized both by a reduction in the number of epicuticular waxes and by different shapes of the waxes. The gene of glossiness (g1/G1) is considered to control only the wax extrusion on the surfaces of leaf blades from the visual and/or ultrastructural phenotypes examined. The relationships between glossiness, trichomes and resistance to sorghum shoot fly are discussed.

## TAXONOMY AND GEOGRAPHIC DISTRIBUTION

0038 ANDREW, M.H., and MOTT, J.J. 1981. Annual sorghum-species of tropical Australia: successful despite the lack of a seed bank. *Proceedings of the International Botanical Congress* 13:111. (Abstract).

Native annual sorghum species dominate large areas of tropical Australia. Visually they are very



striking, growing in extensive swards to 3m tall over the wet season. Plant densities may reach 400 plants m<sup>-2</sup> with an aerial biomass of 4 t ha<sup>-1</sup>. The various species have similar phenologies. Populations are initiated following germination on the first storms of the wet season (October) when all viable seed is non-dormant. After several storms, no viable seed remains ungerminated. Thus there is no carry over of viable seed into subsequent wet seasons. Seed set occurs from late February to May, depending on the taxa and habitat. The seed is at first dormant, but this dormancy breaks down over the dry season.

0039 MAINRA, A.K., and NAINAWATEE, H.S. 1981. Species relationship in sorghum by protein and esterase electrophoresis. Pages 113-115 In Perspectives in cytology and genetics: proceedings of the Third All India Congress of Cytology and Genetics, 23-27 October 1978, Hissar, Haryana, India (eds. G.K.Manna, and U.Sinha). v.3. Delhi, India: Hindasia Publishers. 9 ref.

Eight different sorghum species viz. bicolor, caffrorum, caudatum, durra, halepense, nervosum and roxburghii were studied by protein and esterase electrophoretic analysis. Different species exhibited different protein and esterase isoenzymic spectrum, yet there was some identity between some pairs of species, thereby indicating the phylogenetic relationship.

0040 WANG, F.D., and LIAO, J.L. 1981. On the classification of Chinese sorghum (Kaoliang) cultivars. (Ch). Liaoning Agricultural Sciences 6:18-22. 10 ref.

## PHYSIOLOGY AND BIOCHEMISTRY

0041 ANONYMOUS. 1981. Sorghum: from seeding to blooming. (It).

Terra e Vita 22(13):55.

0042 ANONYMOUS. 1981. Sorghum: from seeding to flowering. (Fr). Cultivar 136:60-61.

0043 AFRIA, B.S., and MUKHERJEE, D. 1981. Biochemical changes in leaves of certain C3 and C4 plants under prolonged darkness and on exposure to light. Plant Biochemical Journal 8(1):1-12. 20 ref.

Changes in total soluble proteins, free amino acids, keto acids, organic acids, ascorbic acid, chlorophylls and carotenoid contents were studied in certain C3 (*Hordeum vulgare*, *Lathyrus odoratus*) and C4 (*Zea mays*, *Sorghum vulgare*) plants. The amount of total protein decreased in all the plants while concentration of total free amino acids increased in dark except in *L. odoratus*. Citric acid, ascorbic acid, total chlorophylls and carotenoids declined in all the starved plants. The levels of ascorbic acid in dark was comparatively higher in C3 than that in C4 plants and its level at 4.0 fa-light stage was either equal or higher than initial 26-day stage in C4 plants while C3 plants failed to regain it. Chlorophyll a/b ratio was higher in C4 than in C3 plants.

0044 AFRIA, B.S., and MUKHERJEE, D. 1981. Metabolic studies in *Sorghum vulgare* Pers. and *Zea mays* L. during seedling growth. Proceedings of the Indian Academy of Sciences (Plant Sciences) 90(1):71-78. 29 ref.

Protein content declined in the endosperm while an increase was noticed in root and shoot of young seedlings of *S. vulgare* and *Z. mays*. Seedlings of both plants in light had a larger pool of alpha-alanine, leucine-phenylalanine, glutamic acid, aspartic acid, valine, asparagine, serine-glycine and gamma-aminobutyric acid than other amino acids. Tyrosine, proline, threonine and tryptophan which were recorded in light could not be detected in dark. Asparagine and glutamine increased

with the seedling growth in most of the samples studied. Phosphoenolpyruvate and pyruvic acid constituted the bulk of keto acid pool while succinate, malate and citrate, of organic acid pool. Protein content and citric acid level were found higher in light than in dark grown seedlings of both plants. The higher level of PEP and pyruvic acid in young shoots in light and their sharp decline at advanced stages may be due to a shift from C3 to C4 metabolism.

0045 ANDEREGG, B.N., and LICHTENSTEIN, E.P. 1981. A comparative study of water transpiration and the uptake and metabolism of <sup>14</sup>C phorate by C3 and C4 plants. *Journal of Agricultural and Food Chemistry* 29(4):733-738. 18 ref.

Physiological and anatomical differences existing between C3 (*Atriplex patula*, oats, peas, barley, wheat) and C4 (*Atriplex rosea*, corn, sorghum, and millet) plants were utilized to investigate the mechanism of uptake, translocation, and metabolism of soil-derived <sup>14</sup>C phorate residues by plants. C3 plants transpired 2.5 times more water and took up twice as much <sup>14</sup>C phorate residues than did C4 plants, indicating that a direct correlation existed between the water transpired and the uptake of radiocarbon by all plants. Ranked in decreasing order of water transpired, were barley, oats, wheat, peas, *A.patula*, sorghum, *A.rosea*, corn, and millet. A similar pattern was noticed for radiocarbon accumulation.

0046 ANDERSON, J.W., BARRETT, J., and THORNE, S.W. 1981. Chlorophyll-protein complexes of photosynthetic eukaryotes and prokaryotes: properties and functional organization. Pages 301-315 in *Proceedings, International Congress on Photosynthesis*, 7-13 September 1980, Halkidiki, Greece. v.3. Philadelphia, USA: Balaban International Science Services. 77

ref.

In each algal class, all the chlorophyll Beta-carotene and the major xanthophyll are complexed to a few specific polypeptides. These pigment-protein complexes, PS1 complex (P700-chl alpha-proteins), PS2 complex (P680-chl alpha-proteins) and light harvesting complexes are the main intrinsic proteins of thylakoids. The extrinsic water-soluble peridinin-chl alpha-proteins and phycobiliproteins are not considered in detail.

0047 ANDREWS, D.J., BIDINGER, F.R., PEACOCK, J.M., MAITI, R.K., SEETHARAMA, N., MAHALAKSHMI, V., and SOMAN, P. 1981. Evaluation of sorghum and pearl millet for tolerance to drought and problems of seedling emergence. *Agronomy Abstracts* 73:38.

In sorghum, using the line source irrigation technique, yield loss due to stress was found greater in high yielding genotypes. Mild stress was not effective in detecting drought tolerance. In experiments on the effects of various stresses on crop establishment, large genotypic differences were found in both sorghum and millet. Among 30 genotypes of sorghum 85% gave good emergence when temperature reached a maximum of 38 deg C at seed depth while only 36% emerged when temperature reached 48 deg C. Sorghum was able to emerge from greater sowing depths and through harder crusts than millet.

0048 BAFNA, A.M., and PARIKH, N.M. 1981. Effect of salinity on seed emergence of pearl millet (*Pennisetum americanum*) and sorghum (*Sorghum bicolor*) in kyari and goradu soils. *Gujarat Agricultural University Research Journal* 6(2): 118-120. 5 ref.

A greenhouse experiment was conducted to test the effect of varying Na/Ca ratios on germination in kyari and goradu soils. Data revealed that germination in both types of soils was cent percent in control and in Ca soil. Sorghum failed to

germinate at 0.27 Na/Ca ratio in kyari soil while pearl millet withstood at 0.33 and 0.41 Na/Ca ratios. In goradu soil also the pearl millet showed 31.25% and sorghum 22.50% germination at 0.41 Na/Ca ratio. Thus pearl millet was more tolerant than sorghum. Seeds ceased to germinate at low salinity level in kyari soil than in goradu soil.

0049 BELYAEVA, E.V., TEREKHOVA, I.V., and DOMAN, N.G. 1981. Effect of substrates on the activity of ribulose diphosphate carboxylase EC-4.1.1.39 from 3 carbon and 4 carbon pathway plants. (Ru). Prikladnaya Biokhimiya Mikrobiologiya 17(3):422-429.

0050 BENNETT, J.M., and SULLIVAN, C.Y. 1981. Effects of water stress pre-conditioning on net photosynthetic rate of grain sorghum. Photosynthetica 15(3):330-337. 14 ref.

The effect of preconditioning water stresses on four grain sorghum hybrids was evaluated by measuring leaf net photosynthetic rates (PN) during more severe, subsequent stress periods. Hydroponically-grown grain sorghum plants were subjected to osmotically-induced water deficits by adding polyethylene glycol (Carbowax 600) to the nutrient solutions. A preconditioning stress of -0.6 MPa (-6.0 bars) for 8 d during 10-18 d of age conditioned the plants to maintain higher leaf PN during the subsequent stress (-0.65 MPa) imposed at 37 d of age. The subsequent stress of -0.65 MPa reduced the PN of preconditioned and non-preconditioned plants by 10% and 24% respectively, when compared with non-stressed controls. In a second experiment, in which the interval between the preconditioning stress (-0.6 MPa for 7 d) and the subsequent stress (-0.75 MPa for 1 d) was reduced to 5d, leaf PN of preconditioned and non-preconditioned plants during the latter stress was reduced by 60% and 99% respectively, when compared with non-stressed controls.

0051 BLUME, D.E., and SAUNDERS, J.A. 1981. High-pressure liquid chromatography for assaying several plant phenolic enzymes. Analytical Biochemistry 114(1):97-102. 15 ref.

The technique was developed to quantitate the activities of several enzymes involved in plant phenolic biosynthesis. L-Phenylalanine ammonia-lyase, L-tyrosine ammonia-lyase, trans-cinnamic acid 4-hydroxylase, and p-coumarate hydroxylase activities were determined in crude enzyme preparations of barley, tobacco, sorghum, and tomato. The method involves isocratic reverse-phase high-pressure liquid chromatography on a micro Bondapak C18 column using an aqueous methanol solvent. Phenolic acid products are chromatographically separated from substrates and endogenous enzyme mixture components in less than 12 min.

0052 BODSWORTH, S., and BEWLEY, J.D. 1981. Osmotic priming of seeds of crop species with polyethylene glycol as a means of enhancing early and synchronous germination at cool temperatures. Canadian Journal of Botany 59(5): 672-676. 6 ref. (Summary: Fr).

Optimum priming levels were determined. Priming with solutions of Polyethylene glycol (all at 10 deg C) at -10 bars (1 bar = 100 K Pa) for 6 days for maize, -10 bars for 2 days for wheat and barley, -10 bars for 1 day for sorghum, and -5 bars for 6 days for soybean had the maximum promotive effect. Air-drying of primed seeds reduced the advantages gained by priming; the longer the period of drying the greater the reduction.

0053 BRAKKE, T.W., KANEMASU, E.T., STEINER, J.L., ULABY, F.T., and WILSON, E. 1981. Microwave radar response to canopy moisture, leaf-area index, and dry weight of wheat, corn and sorghum. Remote Sensing of Environment 11(3):207-220. 26 ref.

A truck-mounted microwave radar

unit was used in this study. The approximately weekly scans were taken at four frequencies (8.6, 13.0, 17.0, and 35.6 GHz), three angles from nadir (30 deg, 50 deg, and 70 deg), and three polarizations (HH, HV, and VV). The highest correlations of the scattering coefficient with canopy moisture (millimeters of water divided by plant height) and leaf-area index occurred at 30 deg. At higher angles the radar was less responsive as it looked more through the side of the canopy. Plant dry weight's highest correlation with the scattering coefficient was at 70 deg, indicating that dry weight is related to surface roughness. Leaf-area index and dry weight were modeled as functions of the scattering coefficient, spectral reflectance ratios, and canopy temperature. Diurnal readings of the scattering coefficient were found to be unresponsive to windspeed or leaf water potential.

0054 BRAR, D.S., GAMBORG, D., and CONSTABEL, S. 1981. In-vitro culture of somatic cells and protoplasts of sorghum and corn. Proceedings of the International Botanical Congress 13:219. (Abstract).

0055 BUENO, A. 1981. Dry matter accumulation in grain sorghum, (Pt). Pesquisa Agropecuaria Brasileira 16(5):709-718. 18 ref. (Summary: En).

Results of growth analysis in grain sorghum experiments were examined from early vegetative stages until completion of plant growth. The average relative growth rate (RGR) decreased during vegetative and flowering phases and increased during the grain filling stage. The average net assimilation rate (NAR) was influenced by external factors which affect the photosynthesis and also by an internal regulatory process that controls the quantity of photosynthesized material. When the demand was high, photosynthesis and NAR were also high. But, during periods of low energy utilization both

photosynthesis and NAR showed low values. NAR values were significantly higher at the low density due to less leaf shading. The tall hybrid presented higher NAR values only during the vegetative phase. Variations in density and height of hybrids caused a greater impact than variations in spacings, in the average leaf area rate (LAR). Conditions that promoted high LAR values were associated with low NAR values due to more leaf shading and a consequent low photosynthetic efficiency. It was evident that materials photosynthesized before the flowering stage and stored in the stem were translocated again to the panicle during the period of grain development.

0056 CHANG, S.C. 1981. Flowering and seed development of sorghum. (Ch). Report of the Corn Research Center, Tainan DAIS 15:1-10. 9 ref. (Summary: En).

Experiments were carried out at Potzu Corn Research Center Tainan DAIS, Taiwan in the fall 1980 and spring 1981. In 4 dose, white martin and C.K.605, maximum dry weight accumulation were found 25-29 days after pollination with 35.6-39.1% moisture in spring, and at 49-51 days with 32.7-35.6% moisture in fall. All varieties flowered between 6 a.m. to 9 a.m. When heavy with dew and fog in the morning flowering took place at 9 a.m. The moisture condition of the air influenced the time of flowering.

0057 CHAUDHURI, U.N., and KANEMASU, E.T. 1981. Effect of soil moisture gradient on sorghum growth, water relations, and yield. Agronomy Abstracts 73:9.

A field study was conducted on 4 hybrids of Sorghum bicolor ('G-623 GBR', 'RS 626', 'RS 671', and 'A 28+'). June to September was warmer than normal (2.3 to 4.8 C), with precipitation only 16.2 cm during the cropping season. Sprinklers provided a continuously decreasing moisture gradient away from the water source.

- Plant height, dry matter, and leaf area index (LAI) decreased as watering level decreased. Higher leaf diffusive resistance and lower water potentials were associated with decreasing plant height and decreasing LAI. Canopy temperatures (Tc) of the water-stressed sorghum were generally 3.2 to 3.7°C warmer than canopy temperatures of well-watered plants. Canopy temperature also correlated well with water use by all hybrids. The average canopy minus air temperature (Tc - Ta) was positive for all hybrids receiving less than 25 cm of irrigation and precipitation which corresponds to soil moisture values of 0.32 maximum available.
- 0058 CHEN, J.Z., CHEN, D.L., WU, M.X., and SHI, J.N. 1981. Comparison of some characteristics of NADP-malic enzyme from sorghum and wheat leaves. (Ch). *Acta Phytobiologica Sinica* 7(4):345-350. 14 ref. (Summary: En).
- Malic enzyme was isolated from young leaf extracts by (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> fractionation. The eluates, collected from a Sephadex G25 column, were assayed for enzyme activity. Some enzymological properties of this enzyme from sorghum and wheat leaves were studied. The activity of sorghum leaf NADP-malic enzyme appeared to be modulated by pH, malate, Mg<sup>++</sup> and Mn<sup>++</sup>. In a variety of pH conditions the effects of Mg<sup>++</sup> and Mn<sup>++</sup> on the activity of NADP-malic enzyme were synergistic to some extent. The affinity of enzyme for Mg<sup>++</sup> and Mn<sup>++</sup> increased with rising pH of the reaction medium. But the affinity of the enzyme from wheat leaf was not affected by the same pH change. Acetyl CoA, glycine, G 6 P, FDP, succinate and fumarate did not exhibit any effect on the activity of sorghum NADP-malic enzyme.
- 0059 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: growth analysis 1948-72. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 11 pp. 84 ref. (Annotated Bibliography G538).
- 0060 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: growth analysis 1973-80. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 53 pp. 124 ref. (Annotated Bibliography G538A).
- 0061 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: water relations 1948-72. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 20 pp. 157 ref. (Annotated Bibliography G536).
- 0062 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: water relations 1973-75. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 29 pp. 109 ref. (Annotated Bibliography G536A).
- 0063 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: water relations 1976-78. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 40 pp. 152 ref. (Annotated Bibliography G536B).
- 0064 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: water relations 1979-80. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 38 pp. 129 ref. (Annotated Bibliography G536C).
- 0065 CONN, E.E., and CUTLER, A.J. 1981. The biosynthesis of cyanogenic glycosides: the enzymatic oxidation of amino-acids to cyanohydrins by plant microsomal preparations. Presented at the Seventy-Second Annual Meeting of the American Society of Biological Chemists, 31 May - 4 June 1981, St. Louis, Missouri, USA.
- 0066 CREELMAN, R.A., and MILLER, F.R. 1981. Leaf temperatures of sorghums

having different base metabolic temperatures for germination. Agronomy Abstracts 73:83.

Leaf temperatures of twenty sorghum lines and hybrids were monitored. Temperatures were taken by the use of an I.R. thermometer gun pointed at the top most collared leaf between 1:00 - 2:00 p.m. 3 times a week during the growing season. Sorghums selected, had differing base metabolic temperature (BMT) for germination. All sorghums had increased temperatures at 50% anthesis. At 50% anthesis the hybrids had generally lower temperatures than did either parent.

0067 CUTLER, A.J., HOSEL, W., STERNBERG, M., and CONN, E.E. 1981. The in-vitro biosynthesis of taxiphyllin and the channeling of intermediates in *Triglochin-maritima*. Journal of Biological Chemistry 256(9):4253-4258. 19 ref.

In Sorghum bicolor, p-hydroxyphenylacetonitrile is the best substrate for cyanide production ( $V_{max} = 224$  nmo l/h/g, fresh wt) and the physiological substrate tyrosine is the poorest ( $V_{max} = 18.8$  nmol/h/g, fresh wt). The substrates exhibit alkaline pH optima between 7.5 and 9, and all except tyrosine show pronounced substrate inhibition. It was found that p-hydroxyphenylacetonitrile generated in situ from tyrosine is free to equilibrate by diffusion with exogenous material. On the other hand, neither N-hydroxytyrosine nor p-hydroxyphenylacetaldoxime will readily exchange with exogenous intermediates. N-hydroxytyrosine and p-hydroxyphenylacetonitrile are channeled and the aldoxime is freely exchangeable.

0068 DENISOVA, R.R., ELIZAROV, V.P., PAVLOV, S.A., KROKHINA, V.A., and STRUTINSKIJ, F.A. 1981. Treatment of fodder grain by infra-red irradiation. Soviet Agricultural Sciences 11:29-31. 1 ref.

Bench experiments were conducted

to study the influence of IR radiation on wheat, oat, barley, corn, and sorghum grain. All the grains exhibited an increase in volume; the hull split and cracks extending in several directions were visible. Part of the endosperm protruded in some grains, while the hulls separated from the sorghum and oat grain. The treated grains had the pleasant aroma of the roasted product. It was established that treatment time and uniformity differed for the crops in question; treatment time and total exposure increased with the initial moisture content of the grain.

0069 DOHN, D.R., and KRIEGER, R.I. 1981. Oxidative metabolism of foreign compounds by higher plants. Drug Metabolism Reviews 12(1):119-158.

0070 DRUMM-HERREL, H., and MOHR, H. 1981. A novel effect of UV-B in a higher plant (*Sorghum vulgare*). Photochemistry and Photobiology 33(3):391-398. 22 ref.

The action of blue/UV light in light-mediated anthocyanin synthesis in the sorghum seedling was reported in detail. A strong positive interaction between blue/UV-A and the UV-B part of the spectrum was found in addition to the obligatory sequential action with regard to blue/UV light and light acting via phytochrome. Since even small amounts of the UV-B are strongly effective it is concluded that this effect plays a role under natural conditions and may not be considered as a mere laboratory effect.

0071 DUNCAN, .R.R., BOCKHOLT, A.J., and MILLER, F.R. 1981. Descriptive comparison of senescent and nonsenescent sorghum genotypes. Agronomy Journal 73(5): 849-853. 23 ref.

Several plant characteristics were measured to characterize genotypic differences. The non-senescent genotype required 2 days longer to reach 50% anthesis, averaged 3 to 4 cm shorter height, produced two

to three more basal tillers per plant, had larger stem diameters, maintained higher basal stem sugar concentrations, and produced higher leaf blade chlorophyll contents than did the senescent genotype. Data involving leaves favored the nonsenescent genotype. The grain-leaf ratio of the senescent genotype exceeded that of the nonsenescent genotype 30 days after anthesis because of a consistent reduction in leaf area due to senescence. Except for test weight (which was higher in the nonsenescent genotype), yield and yield components were generally inconsistent between genotypes.

0072 DUNCAN, R.R., and BOSWELL, F.C. 1981. Seed element uptake, grain yield, and bird damage of methiocarb-treated sorghum hybrids. *Agronomy Journal* 73(2): 290-292. 10 ref.

This field study, conducted on a Cecil sandy loam soil (Typic Hapludult) during the 1978 and 1979 growing season, sought to investigate uptake of elements into the seed, yield and yield components, height, and bird damage ratings of five sorghum hybrids and to compare results on methiocarb-treated and check plots. Spray treatments, applied in a randomized block split plot design, significantly reduced seed concentrations of N, K, Mn, and Cu, increased P, and did not affect Zn and Fe. The reduction in N resulted in a 5.1% reduction in crude protein. Copper concentration in the seed was reduced by more than 25% after methiocarb treatment. Grain yields were 1,080 kg/ha higher on the treated than on the check plots. Test weight was 2.2 kg/h higher, 300 kernel weight was 0.7g higher, plants were 8 cm taller, and bird damage was 39% lower on the treated than on the check plots.

0073 DUNLAP, J.R., HANKS, A.H., and MORGAN, P.W. 1981. Preflowering levels of phytohormones in sorghum. 1. Analytical procedure. *Crop*

*Science* 21(1):82-88. 32 ref.

Procedures for the analysis of indole-3-acetic acid (IAA), abscisic acid (ABA), and gibberellin (GA)-like compounds in sorghum are described. Shoots of seedlings were harvested, frozen in liquid N, lyophilized, ground in a Wiley mill, and replicate samples extracted with methanol/water. After vacuum removal of methanol the residual was fractionated by partitioning against petroleum ether and ethyl acetate. Free acidic forms of the phytohormones were recovered in the final ethyl acetate fraction, and a portion of the conjugated forms were obtained by mild acid hydrolysis of the aqueous residue followed by partitioning into ethyl acetate. Fractions containing IAA-, ABA-, or GA-like compounds were further purified by ascending paper chromatography. The identity of IAA and ABA was tentatively confirmed by: (a) identical retention times as authentic standards on gas-liquid chromatography, (b) co-chromatography with their respective standards on HPLC operated at different flow rates or solvent compositions. GA-like compounds were tentatively identified by comparison to standards chromatographed on paper and bioassayed. The putative GA, was the most abundant GA-like compound present.

0074 DUNLAP, J.R., and MORGAN, P.W. 1981. Preflowering levels of phytohormones in sorghum. II. Quantitation of preflowering internal leaves. *Crop Science* 21(6):818-822. 15 ref.

Levels of free and bound indole-3-acetic acid (IAA), abscisic acid (ABA), and gibberellin-like (GA-like) compounds were determined over a 25-day period prior to flowering in the above ground portions of an intermediate (60M) and a late (90M) maturing genetic line of *Sorghum bicolor*. Following purification of the plant extract, IAA and ABA were analyzed with high performance liquid chromatography (HPLC); GA-like

substances were assayed with the lettuce hypocotyl<sup>1</sup> elongation bioassay. The preflowering levels of GA-like activity did not differ significantly between the two sorghum genotypes; however, the preflowering levels of both free IAA and ABA consistently increased with age in the later maturing genotype (90M). The differences in phytohormone levels in closely related genotypes differing in photoperiod requirement for floral initiation suggest the need for a detailed examination of the phytohormone status of the sorghum maturity genotypes relative to the mechanism of photoperiodism.

0075 DUNLAP, J.R., and MORGAN, P.W. 1981. Preflowering levels of phytohormones in sorghum. III. Photocontrol. Crop Science 21(6):823-827. 21 ref.

Indole-3-acetic acid (IAA), abscisic acid (ABA) and gibberellins (GAs) were determined in two different maturity genotypes of *Sorghum bicolor* as a function of lighting conditions. Phytohormone levels were determined in bulked samples of preflowering shoot tissue from 28-day-old plants grown in a controlled environment and sampled during the day, night and after exposure to far red radiation (FR) (710-730 nm). Levels of both IAA and ABA were highest in the later flowering genotype (90M) when sampled just prior to the beginning of darkness. The high tissue levels of both phytohormones in 90M declined during the night by 200 ng/g dry weight to levels near the lower limit of detectability. A similar trend was noticed in an earlier maturing genotype. There was a net increase in the level of GA-like activity during the night. Exposure of plants to 5 min of FR, had no effect on levels of IAA or ABA, but increased the level of GA-like compounds. The decline in IAA and ABA levels during the night in both genotypes as well as the increase in GA-like activity, especially in the relatively early genotypes (60M), produce an apparent shift in hormone

balance which may favor floral initiation.

0076 DURLEY, R.C., KANNANGARA, T., and SIMPSON, G.M. 1981. Hormone levels and drought resistance in sorghum. Plant Physiology 67(4, suppl):59. (Abstract).

Ten cultivars of varying drought resistance grown under irrigated and unirrigated field conditions showed few differences for ABA, phaseic acid and conjugated phaseic acid concentrations in the leaf, throughout the vegetative stage. However, marked differences were seen during panicle initiation and grain maturation. Great differences were exhibited in IAA and conjugated-IAA concentrations in the vegetative stage, with little differences during flowering and maturation.

0077 EL RAYAH, A.H. 1981. Studies on emergence and establishment of crops. Pages 1-8 In Gezira Research Station and Sub-stations annual report 1974-75. Gezira, Sudan: Ministry of Agriculture, Food and Natural Resources.

Experiments were conducted to study the effect of sowing method, time and method of watering, condition of seedbed surface, and depth of sowing on the initial emergence and establishment of cotton, wheat, groundnuts and dura (*Sorghum arundinaceum aethiopicum*) crops. In dura, method of sowing had a significant effect on initial emergence in first two seasons but not in the final one. The superiority of ridging up was also indicated. Watering at sowing was better than watering 6 days before sowing. Grain yield was not affected but straw yield improved. Increased number of seeds per hole reduced the percentage initial and final emergence. Emergence increased with depth of sowing.

0078 GADAL, P., VIDAL, J., BOUVILLE, J., and GOBILLON, G. 1981. Influence of light on phosphoenol



- pyruvate carboxylase EC.-4.1.1.31 in sorghum leaves: immunochemical study. Pages 81-90 In Proceedings, International Congress on Photosynthesis, 7-13 September 1980, Halkidiki, Greece. v.4. Philadelphia, USA: Balaban International Science Services. 9 ref.
- 0079 GATHAARA, M.P.H. 1981. Pre-soving seed treatment effects on the germination and seedling growth in sorghum. M.Sc. thesis, University of Reading, Reading, UK. 77 pp. 66 ref.
- 0080 GEETHA, V., MOHAMMED, A.H., and GNANAM, A. 1981. Identification of chloroplast NADP linked malate dehydrogenase as a product of chloroplast protein synthesis. FEBS Letters 126(2):223-226.
- 0081 GNANAM, A. 1981. Role of chloroplast genome and the development of photo-synthetic function. Indian Journal of Biochemistry and Biophysics 18(4):18-19. (Abstract).  
Light dependent in vitro protein synthesizing systems from isolated chloroplasts of Sorghum vulgare and spinach were characterized and compared. Preincubation of the chloroplasts in light at 25 deg C for 45 min. depleted the endogenous translated exogenously added homologous, heterologous and synthetic templates efficiently and with high fidelity. Substantive evidence for the fidelity of both the systems were obtained by immunological analysis of specific products using whole leaf cellular RNA and chloroplast RNAs as templates for translation in the preincubated chloroplasts, the origin of message and the site of synthesis of a number of structural and soluble proteins of these chloroplasts were ascertained.
- 0082 GRAS, G., HASSELMAN, C., PELLISSIER, C., and BRUGGERS, R. 1981. Residue analysis of methiocarb applied to ripening sorghum as a bird repellent in Senegal. Bulletin of Environmental Contamination and Toxicology 26(3): 393-400.
- 0083 GRINCHENKO, A.L., and NAZARENKO, O.A. 1981. Effect of retardants on maize and sorghum growth and productivity. Fiziologiya i Biokhimiya Kulturnykh Rastenii 13(5):451-457.
- 0084 HAGERMAN, A.E., and BUTLER, L.G. 1981. The specificity of proanthocyanidin-protein interactions. Journal of Biological Chemistry 256(9):4494-4497. 28 ref.  
The specificity of the interaction was investigated using a competitive binding assay to compare directly the affinities of various proteins and synthetic polymers for the tannin obtained from Sorghum bicolor. At pH 4.9, the relative affinities range over more than 4 orders of magnitude, indicating that this proanthocyanidin interacts quite selectively with protein and protein-like polymers. The affinity for tannins is an inverse function of the size of the polymer, and peptides with less than six residues interact very weakly with tannin. Proteins are precipitated by proanthocyanidins most efficiently at pH values near their isoelectric points. Proline-rich proteins and polymers have very high affinities for tannin. Tightly coiled globular proteins have much lower affinities for tannin than conformationally loose proteins.
- 0085 HITAKA, N. 1981. Effects of light intensity on photosynthesis of grain sorghum and photosynthetic ability of the stem with leaf sheath and of the ear. (Ja). Kinki Chugoku Agricultural Research 61:23-27. 14 ref.
- 0086 HOESEL, W. 1981. In-vitro biosynthesis of cyanogenic glucosides. Proceedings of the International Botanical Congress 13:314. (Abstract).
- 0087 HOLMSEN, T.W., and HERERO, M.P.

1981. Increased yields of crop plants from DOWCO 391X plant regulator. Proceedings of the International Botanical Congress 13:307. (Abstract).
- 0088 HORROCKS, R.D., and JORGENSEN, M.E. 1981. Tillering of Sorghum bicolor under various temperature regimes. Agronomy Abstracts 73:106.
- Nine sorghum cultivars, ranging in tillering ability from very little to profuse, were grown in growth chambers to evaluate effect of temperature, from planting through the 8-leaf stage of development, on tiller formation. Eight temperature regimes were used. Six of the eight treatments consisted of combinations of cool ( $15C \frac{1}{4} t \frac{1}{4}$ ) and warm ( $18C \frac{1}{4} t \frac{1}{4} 24C$ ) temperatures. The other two treatments consisted of continuous temperatures either at  $\frac{1}{2} 18C$  or  $\frac{1}{4} 18C$ . Cultivars with a common parental line were consistent in response to temperature. Plants exposed to continuous temperatures  $\frac{1}{2} 18C$  produced at least twice as many tillers as those subjected to both warmer and cooler temperatures. In treatments in which cool temperatures were applied, 8 of 9 cultivars did not tiller if temperatures  $\frac{1}{4} 18C$  were not applied between the 2- and 8-leaf stages of development. There was some evidence that plants exposed to cool temperatures half the time and warm temperatures the other half, produced more tillers if exposure sequence was cool-warm rather than warm-cool. 'Greenleaf' tillered profusely regardless of temperature.
- 0089 HUDA, A.K.S., SIVAKUMAR, M.V.K., VIRMANI, S.M., DUGAS, W.A., and ARKIN, G.F. 1981. Evaluation of a dynamic grain sorghum growth simulation model (SORGF) in the semi-arid tropics. Agronomy Abstracts 73:11.
- The model was used to assist in the development of improved cropping systems and the quantification of associated risk. Simulation results based on standardised data sets collected from 9 locations in India showed that the subroutines on emergence, soil water, light interception, leaf area and phenology need modifications. Using measured data on interception of PAR, LAI and dry matter, subroutines on light interception and dry matter computations were evaluated and changes were made to improve model estimates. To improve the estimates of water stress coefficients, a layered model wa6 incorporated to compute available soil water in those layers of the soil profile where roots are present. Subroutines dealing with phenology, leaf area development and dry matter partitioning are under revision and procedures are being developed to account for the effect of water stress on these processes.
- 0090 HUSSAIN, F., and GADOON, M.A. 1981. Allelopathic effects of Sorghum vulgare Pers. Oecologia 51(2):284-288.
- 0091 IQBAL, J., and AZIZ, G. 1981. Effects of acute gamma irradiation, developmental stages and cultivars differences on yield of gamma-2 plants in wheat and sorghum. Environmental and Experimental Botany 21(1):27-33. 17 ref.
- Plants (gamma-1) from three cultivars each of wheat and sorghum (Pq.7. dwarf, Ks 12-medium dwarf and Ts. 100.tall) were irradiated at 3 developmental stages (1-leaf, ear emergence, and anthesis). Seed borne by these gamma-1 plants were raised as gamma-2 plants in subsequent year. Results showed that yield of gamma-2 plants was most reduced when gamma-1 plants were irradiated at the anthesis stage while it was least affected when irradiation was done at 1-leaf stage. Significant increases in yields were observed at certain exposures in wheat (0.5 kR) and sorghum (2-3 kR in dwarf and medium dwarf cultivars and at 1-3 kR in the tall cultivar).
- 0092 JACOBI, J., BUJAN, A., and GBELFI, R. 1981. Determination of root depth by means of a radioisotopic technique (Sorghum spp. Glycine max).

(Es). Pages 39-44 In Proceedings, Ninth Argentina Meeting of Soil Science, 15-21 September 1980, Parana, Entre Rios, Argentina. Parana, Entre Rios, Argentina: Asociacion Argentina de la Ciencia del Suelo. 5 ref.

0093 JORDAN, W.R., and MONK, R.L. 1981. Enhancement of drought resistance of sorghum: progress and limitations. Pages 185-204 In Proceedings, Thirty-fifth Annual Corn and Sorghum Industry Research Conference, 9-11 December 1980, Chicago, Illinois, USA. Washington, DC, USA: American Seed Trade Association. 54 ref.

This review tries to place the role of drought resistance in perspective regarding other options which can enhance the efficiency of water use. Some of the recent progress made toward achieving drought resistant cultivars, and major limitations to additional progress are also discussed.

0094 JORDAN, W.R., MONK, R.L., and MILLER, F.R. 1981. Sorghum root systems: characterization and relation to soil water stress. Agronomy Abstracts 73:43.

Root systems of Sorghum bicolor grown in defined media were characterized and compared with field rooting patterns observed during a 4 year period under rainfed conditions. Evidence for genotypic differences in rooting depth was obtained which was positively correlated with water extraction from deep within the soil profile. Field rooting patterns were greatly modified by rainfall distribution within the growing season, and genotypic separations were possible only during long soil drying cycles.

0095 KETCHERSID, M.L., and MERKLE, M.G. 1981. The effect of CGA-43089 on adsorption and metabolism of metolachlor in grain sorghum. Proceedings of the Weed Science Society of America 215:100.

(Abstract).

Growth chamber studies were conducted to determine the effect of soil moisture on the uptake of metolachlor by grain sorghum when seeds were unprotected or protected by CGA-43089 at a rate of 1.25 g/kg. Less herbicide was absorbed by protected sorghum coleoptiles than by non-protected coleoptiles grown under identical soil conditions. Sorghum retained the ability to degrade metolachlor even after phytotoxic effects were apparent. Over a 48 hour period, excised sorghum coleoptiles had the ability to rapidly metabolize both CGA-43089 and metolachlor from an incubation medium containing the compounds alone or in combination. Dissipation of metolachlor from the incubation medium was slower in the presence of CGA-43089 indicating that uptake of the herbicide was decreased. Since metolachlor is rapidly metabolized, CGA-43089 might protect by decreasing the rate of uptake sufficiently to prevent a phytotoxic accumulation at the site of action.

0096 KUSHNIRENKO, M.D. 1981. Adaptation of plants to drought. (Ru). Izvestiya Akademii Nauk Moldavskoi SSR Seriya Biologicheskikh i Khimicheskikh Nauk 3:40-48.

0097 LADYGIN, V.G., and BIL, K. YA. 1981. Chlorophyll form absorbing at 684 nm as antenna of photosystem 2 in chloroplasts of C4-plant leaves. Photosynthetica 15(1):49-54. 19 ref.

Low temperature fluorescence spectra and second derivatives of absorption spectra of chlorophyll (Ch1) were measured in leaves and chloroplasts of mesophyll and bundle sheath (BS) cells of Zea mays, sorghum and Panicum miliaceum. In ontogenetic development of BS chloroplasts, the 695 nm Ch1 fluorescence band decreased in parallel with a decrease in Photosystem 2 (PS 2) activity and granal stacks reduction. Vanishing of the 695 nm fluorescence band was connected with a decrease of the 684 nm absorption band attributed to PS 2

antenna Ch1 alpha-protein complex. The distribution of Ch1 native forms in pigment-protein complexes of chloroplast membranes is similar in higher plants and green algae.

0098 LEON-DIAZ, J.R., TOVAR, D., TABORDA, F., RICELLI, M., CAMPOS-GIRAL, H., and QUINTANA, H. 1981. Repercussion of technology in the development of the main products in Venezuela: sorghum. (Es). Maracay, Venezuela: Centro Nacional de Investigaciones Agropecuarias. 77 pp. 59 ref.

0099 LI, Z.J., ZHANG, K.T., GENG, Y.X., and XU, J.X. 1981. Effect of climate on male sterility in sorghum. (Ch). Acta Agronomica Sinica 7(2):129-133. 7 ref.

0100 LONG, F.L. 1981. The influence of sorghum-sudangrass roots on nutrient leaching. Agronomy Journal 73(3):537-546. 22 ref.

This study was conducted to determine the influence of Sorghum-sudangrass (*Sorghum bicolor* x *S. sudanense*) roots on the movement of N03, K, Ca, and Mg in a simulated field soil profile. Sorghum-sudangrass roots proliferated the soil profile to 160 cm and reached a maximum density of 3 cm root length/square cm of soil in the Ap horizon, with lesser amounts in the A2 and B horizons. Roots took up N03 and did not allow any appreciable leaching below 80 cm at 250 kg of N/ha or below 100 cm at 500 kg of N/ha. Root uptake of K was sufficient to prevent any appreciable accumulation of K at any depth measured. Uptake of Ca and Mg was sufficient to virtually prevent leaching of these nutrients below 40 cm at 250 kg of N/ha or below 80 cm at 500 kg of N/ha. From the results of this study, it is evident that nutrient leaching through soil can be virtually eliminated by the natural mechanism of root uptake, thereby preventing any possible pollution of groundwater.

0101 LUGG, D.G., YOUNGMAN, V.E., and

HINZE, G. 1981. Leaf azimuthal orientation of sorghum in four row directions. Agronomy Journal 73(3):497-500. 9 ref.

The objective of this study was to determine if the leaf azimuthal orientation of sorghum bicolor was at random. Plants were grown in each of four row directions, north-south, northeast-southwest, east-west, and northwest-southeast. In 1972, from 8 to 16 August, there was a strong bimodal azimuthal orientation which was either east-west or perpendicular to the rows. In addition, there was a significantly larger proportion of leaves to the south of the east-west axis than to the north. In 1973, three readings were taken: 17 or 18 July, 2 or 3 August, and 29 or 30 August. On the earliest sampling, a significant proportions of leaves faced west rather than east. Orientation was altered with the emergence of the flag leaves, of which 60% faced east. It was found that leaf orientation was not distributed randomly either year.

0102 MAITI, R.K. 1981. Evaluation of multistress resistance for dryland sorghum crop improvement: a new approach. Lecture delivered at the Summer Institute on Production Physiology of Dryland Crops, 11 May - 5 June 1981, Andhra Pradesh Agricultural University, Hyderabad, Andhra Pradesh, India.

0103 MAITI, R. K., RAJU, P.S., and BINDER, F.R. 1981. Evaluation of visual scoring for seedling vigour in sorghum. Seed Science and Technology 9(2):613-622. 8 ref. (Summaries: De, Fr).

A simple method for visual scoring for seedling vigour in sorghum is described. A test of this method indicated that vigour score is closely related to measured seedling dry weight and leaf area. Visual scores proved as or more efficient in distinguishing genotype differences than did direct measurement of seedling dry weight in a large set of

lines. Because of the ease of use and effectiveness of this technique it should find a ready place in breeding programmes emphasising seedling vigour.

0104 MALALI, S.B., GOWDA, B.T.S., and GOUD, J.V. 1981. Studies on synchronization of flowering of parental lines of sorghum hybrid CSH-5. Seed Research 9(1): 39-44. 16 ref.

Studies were carried out to investigate the possibilities of achieving synchronization of flowering in the parents of CSH-5 in November planting. Nitrogen manipulation and gibberellic acid application to female parent (2077A) and maleic hydrazide application to male parent (CS - 3541) could be used with best advantage to bridge the gap in flowering of parental lines of sorghum hybrid CSH-5. The nitrogen manipulation to female parent hastened the flowering by about 5 days; application of gibberellic acid hastened flowering by 5.53 days and maleic hydrazide application at the concentration of 500 ppm to the male parent delayed the floral initiation by 3 days and flowering by 4 days; staggered planting of male parent by 10 days resulted in proper synchronization.

0105 MALLOCH, K.R., and FENTON, R. 1981. Reversible effects of farnesol on *Commelina communis* L. New Phytologist 88(2):249-254. 8 ref.

The application of farnesol to isolated epidermis of *Commelina* causes stomatal closure and death of guard cells. Experiments are reported in which the toxic effects were reduced by manipulation of the assay conditions. Reversible stomatal closure by farnesol was observed in intact plants. These results are discussed in relation to similar physiological effects in sorghum and the possible role of farnesol as an endogenous antitranspirant.

0106 MANDAVA, N.B., WORLEY, J.F., and KAPADIA, G.J. 1981. Inhibition of plant growth by phenethylamines and

tetrahydroisoquinolines. Journal of Natural Products 44(1):94-100. 20 ref.

Growth inhibitory effects in a bean second internode bioassay were shown by a preliminary screening of those phenethylamines and tetrahydroisoquinolines that have been found to occur in peyote and other cacti. Some compounds showed phytotoxicity at all concentrations, whereas others induced toxic effects only when their concentrations were above the tolerance limits of plant growth inhibition. Dopamine hydrochloride and the methiodides of candicine and trichocerine were also evaluated in a sorghum bioassay for growth-inhibiting properties. An attempt was made to interpret the results on the basis of structure-activity relationships.

0107 MARES, J., KASPER, P., and LEBLOVA, S. 1981. Phosphoenolpyruvate carboxylase from leaves of maize (*Zea mays*), sorghum (*Sorghum vulgare*) and millet (*Panicum miliaceum*). Proceedings of the International Botanical Congress 13:237. (Abstract).

0108 MARSHALL, R.J., and NEL, P.C. 1981. Effect of propachlor on growth and yield of grain sorghum. Crop Production 10:197-200.

Root and shoot length of NK 222 was significantly less reduced than that of seven other grain sorghum cultivars, where germinated seedlings were exposed to propachlor in petri dishes. Dorado M had the slowest development rate and was most severely injured. In a pot experiment NK 202 was the only one of eight cultivars displaying marked propachlor injury. In a field experiment the tolerance of five cultivars to propachlor was tested. Total grain mass of Dorado M was reduced by 24% over control by 7.80 kg a.i./ha.

0109 MCBEE, G.G., WASKOM, R.M., III, and MILLER, F.R. 1981. Carbohydrates in senescing and nonsenescing sorghum

cultivars during late maturity stages. Agronomy Abstracts 73:91-92.

Culms from four Sorghum bicolor cultivars, inherently different in degree of senescence and sugar production were sampled over a maturity spectrum including 15 days post anthesis, black layer and 15 days post black layer. Panicles were also harvested from some plants within each cultivar at black layer. Glucose and fructose levels decreased in three cultivars with maturity whereas one decreased from anthesis to black layer and then increased. Sucrose ranged from 30-240 and 50-347 mg/g O.D. wt at the first and last maturity stages, respectively. Two of the cultivars had decreased in sucrose at black layer but increased by the last harvest. Kernel weights were significantly higher for the same two cultivars, also. Nonsenescent plants were higher in all sugar fractions and kernel weights than senescent plants. Accumulation patterns for starch were similar to sucrose and levels ranged from 4.5-14 and 2.7-25.8 mg/g O.D. wt, respectively at the first and last harvest stages. Carbohydrates continued to accumulate in the culms of those sorghum plants when panicles were removed at black layer. Total plant weight continued to increase with maturity whereas culm weight tended to vary in a pattern similar to that for the sugars.

0110 MECKENSTOCK, D. H. 1981. Characteristics of caryopsis development in Sorghum bicolor (L.) Moench. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 110 pp.

0111 MENA T., H. 1981. Poisoning of commercial cultivars of grain sorghums (Sorghum bicolor) by insecticides. (Es). Agronomia Tropical 30(1-6):213-229. 8 ref.

0112 MOHR, H. 1981. Interaction of UV and visible light in controlling plant development. Proceedings of the International Botanical Congress 13:1.

(Abstract).

0113 MOHR, H. 1981. Light and development: the phytochrome system of plants. Naturwissenschaften 68(4):193-200.

0114 MORARD, P. 1981. Distribution of <sup>22</sup>Na in the various organs of sorghum after root absorption. (Fr). Comptes Rendus des Seances de l'Academie des Sciences (Serie III) 292(23):1231-1236. 14 ref. (Summary: En).

The kinetics of <sup>22</sup>Na migration corroborate the distribution pattern of the non-radioactive element after root absorption: the sodium content of the leaf laminae is very low whereas a building-up is observed in the conductive tissues, particularly in the roots. After absorption, sodium seems to be rapidly translocated to all the organs, then moves downwards to accumulate in the roots. The absorption of radiosodium is independent of the specific activity of the nutrient solution and appears to be related to its volumic activity. Thus, sodium is not taken up selectively by the roots of sorghum; its translocation mechanism is therefore of the passive type.

0115 MUSTAIN, B.C. 1981. Germination and emergence of grain sorghum (Sorghum bicolor (L.) Moench) at low and high temperatures: maternal and hybrid effects. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 154 pp.

0116 NIU, T.T., and DU, Y.T. 1981. Studies on the cause of floret abortion of male sterile lines in sorghum. (Ch). Shanxi Agricultural Science 9:2-4.

0117 NIU, T.T., YU, H.S., ZHAO, X.M., ZHAO, N.L., and LUI, A.L. 1981. Preliminary study on drought-resistant physiology of hybrid sorghum. (Ch). Shanxi Agricultural Science 4:2-5.

0118 NORMAN, J.M., SULLIVAN, C.Y.,

HARRISON, T., and ECKLES, R. 1981. A comparison of four porometers under field conditions. *Agronomy Abstracts* 73:93.

Stomatal resistance measurements from the following porometers were compared under field conditions on sorghum and soybeans; (1) Licor LI-1600 steady state porometer, (2) Delta-T Mark II, (3) a transient convection porometer, (4) three Licor LI-65 porometers and (5) Licor LI-60 unit. The best agreement was obtained between the LI-1600 and Delta-T, within the range from 1 to 20 sec/cm, both agreed within 20%. The transient convection porometer agreed with the LI-1600 within about 30% at resistances less than 4 sec/cm and within 50% up to 20 sec/cm, which appeared to be the upper limit of its usable range. The LI-60 porometer had relatively poor sensitivity at low resistances indicating values between -1 and 7 sec/cm when LI-1600 and Delta-T indicated about 2 sec/cm. There was considerable scatter among the three LI-65 porometers. Between 1 and 2 sec/cm all LI-65 units agreed (within 1 sec/cm) with the LI-1600 and Delta-T. Between 5 and 40 sec/cm the LI-65 units tended to yield resistances that averaged about double the LI-1600 or Delta-T values, with a spread of about 50% of the mean of the measured LI-65 values.

0119 OELZE-KAROW, H., and MOHR, H. 1981. Two steps in initial phytochrome action on chlorophyll synthesis. Pages 923-932 In *Proceedings, International Congress on Photosynthesis*, 7-13 September 1980, Halkidiki, Greece. v.5. Philadelphia, USA: Balaban International Science Services.

0120 PALANIVEL, S., and RAMANATHAN, K.M. 1981. Studies on root growth of sorghum under different mulching systems. *Madras Agricultural Journal* 68(9):599-603. 4 ref.

A mulching experiment was carried out in the black soil area of the Coimbatore, India, with Co 24 sorghum

as test crop. The treatments consisted of the mulching materials cumbu straw (T1), sugarcane trash (T2), maize straw (T3), and control (T4). A randomised block design was adopted with five replications. The root growth measurements like root length, number of adventitious roots/plant, volume of roots and dry weight of roots were taken at flowering and at harvest stages. The results indicated that the above said root characters were found to be superior in the mulched plots compared to control at both the stages of crop growth. Among the different mulches tried the sugarcane trash applied plots recorded the highest dry weight of roots. A positive relationship between root weight and yield of sorghum was brought out.

0121 PAO, C.I., and MORGAN, P.W. 1981. Growth and development of the sorghum maturity genotypes. Presented at the Annual Meeting of the American Society of Plant Physiologists, and the Canadian Society of Plant Physiologists, 14-18 June 1981. Ste.-Foy, Quebec, Canada. (Abstract).

Four mutations are recognized in sorghum which hasten floral initiation at suboptimal night lengths. These genes have been collected in one genetic line and termed the sorghum maturity genotypes. Eleven genotypes are available varying at three of the four loci including an allelic mutation at the third position (ma3 R). A detailed analysis of growth and floral initiation of the eleven genotypes has been conducted in a controlled environment room for 50 days. The three genotypes with the ma3 R gene are earliest to differentiate a floral bud at both 10 and 12 hr photoperiods and have less leaf area, greater culm height and greater total height than the eight genotypes which are ma3 or Ma3. These traits are characteristic of GA3 effects on sorghum. The ma3 R allelic mutation appears to increase gibberellin activity in vegetative sorghum plants.

0122 PARADIES, I., EBERT, E., and ELSTNER, E.F. 1981. Metolachlor (2-chloro-N- [2-ethyl-6-methylphenyl] -N- [2-methoxy-1-methylethyl] acetamide) and the metolachlor safener CGA 43089 [alpha- (cyanomethoximi.no) -benzacetoneitrile] in sorghum seedlings: correlations between morphological effects and ethylene formation. Pesticide Biochemistry and Physiology 15(3):209-212. 9 ref.

Treatment of germinating sorghum seeds with metolachlor, causes growth retardation, promoted by thickening of the first leaf and thus inhibition of unfolding of secondary leaves, and increased ethylene production. Sorghum seeds pretreated with the safener CGA 43089 exhibit neither morphological deformations nor ethylene production upon metolachlor treatment. Aminoethoxy vinylglycine, a specific inhibitor of ethylene formation in higher plants, decreases ethylene formation by metolachlor-treated sorghum seedlings; the observed deformations, however, remain unchanged. Sorghum control seedlings which grow against a covering plate build up ethylene concentrations as after herbicide treatment, but without induction of the morphological symptoms. It is suggested that the plant hormone ethylene is a symptom and not the inducer of the morphological effects visible after metolachlor treatment of sorghum seedlings.

0123 PATRA, H.K., and MISHRA, D. 1981. ATPase activity during leaf development and senescence. Photosynthetica 15(1):80-86. 20 ref.

0124 PERKINS, H.F., and KAIHULLA, E. 1981. Some characteristics of plinthite inhibiting plant growth. Agronomy Journal 73(4):671-673. 19 ref.

Field and laboratory studies indicate that bulk density of plinthite is higher than non-plinthic material surrounding nodular plinthite bodies. Bulk density of non-plinthic material associated with nodular

plinthite bodies is comparable to soil without plinthite. Samples from the Ap, B2t1p1, and C horizons of a Tifton soil (fine-loamy, silicious, thermic family of Plinthic Palcudults) were collected and placed in containers to simulate field arrangement of soil horizons and a test crop of grain sorghum was grown under different treatments of CaCO<sub>3</sub> and CaSO<sub>4</sub>. Aluminium toxicity was overcome by adding CaCO<sub>3</sub>. Soluble Al was reduced by CaCO<sub>3</sub> but not by CaSO<sub>4</sub>. The addition of CaSO<sub>4</sub>, had less effect on yield, Ca uptake, and suppression of Al uptake by sorghum plants than CaCO<sub>3</sub>. There was no major root growth in the plinthic layer except when soluble Al was removed by CaCO<sub>3</sub> addition.

0125 PERRÔT, C., VIDAL, J., BURLET, A., and GADAL, P. 1981. On the cellular localization of phosphoenol pyruvate carboxylase in sorghum leaves. Planta 151(3):226-231. 26 ref.

The localization of phosphoenol pyruvate carboxylase (EC 4.1.1.3.1.) in the leaf cells of Sorghum bicolor was investigated by using three techniques. The conventional aqueous and non aqueous methods gave conflicting results, and the immunocytochemical techniques clearly showed that the enzyme is predominantly located in the cytoplasm of mesophyll cells.

0126 RAJASEKHAR, V.K., RAO, L.V.M., GUHAMUKHERJEE, S., and SOPORY, S.K. 1981. Phytochrome control of chlorophyll and carotenoid accumulation in Sorghum bicolor. Plant and Cell Physiology 22(5):773-780. 22 ref.

0127 RAO, N.K.S., and SINGH, S.P. 1981. Translocation of 14C metabolites from different leaves to the grain sorghum. Current Science 50(12):537-538. 6 ref.

Studies were undertaken in sorghum var. Swarna, to trace the direction of translocation of



- photosynthates from different leaves using  $^{14}\text{C}$ . The photosynthates of top six leaves were labelled with  $^{14}\text{C}$  (10 micro ci) one week after anthesis. Each of these leaves was exposed separately to radioactive  $\text{CO}_2$  for half an hour. The  $^{14}\text{C}\text{O}_2$  was fed to the leaves while still attached to the plants. It was seen that upto 48 hours after treating the leaves with  $^{14}\text{C}$ , about 50-85% of the total radioactivity recovered from the whole plant, was still in treated leaves. The labelled photosynthates from each of the upper six leaves were translocated to the grain also within 48 hours after feeding. The rate of translocation was dependent on the position of a particular leaf in relation to the site of sink i.e. ear.
- 0128 RENGASAMY, A., and GNANAM, A. 1981. Preferential solubilization of energy transducing coupling factors with butanol. Indian Journal of Biochemistry and Biophysics 18(4):300-301. 15 ref.
- Energy transducing coupling factors have been solubilized from chloroplast of Sorghum bicolor and mitochondrial membranes of fish muscle using n-butanol. The preferential solubilization of these coupling factors with n-butanol is comparable to other methods. The coupling factors obtained by this method from chloroplast and mitochondrial membranes are electrophoretically homogeneous.
- 0129 RENGASAMY, A., SELVAM, R., and GNANAM, A. 1981. Isolation and properties of acid phosphatase from thylakoid membranes of Sorghum vulgare. Archives of Biochemistry and Biophysics 209(1):230-236. 32 ref.
- 0130 ROSENTHAL, W.D., and BLANCHARD, B.J. 1981. Microwave responses from vegetation: an aid to classification and biomass estimation. Agronomy Abstracts 73:13.
- Active microwave responses (13.3 GHz [2cm], 4.75 GHz [6cm], 1.6 GHz [19cm], and 0.4 GHz [75cm]) from agricultural fields near Dalhart, Texas, and Guymon, Oklahoma were related to morphological and biomass differences. Crop types studied included alfalfa, sorghum, corn, and millet. Microwave combinations using data from the four frequencies at a 40 deg angle from nadir are well correlated to morphological differences. Results indicate calibrated microwave data can be an aid in classifying agricultural crops and estimating biomass.
- 0131 SADASIVAM, S., and GOWRI, G. 1981. Activities of phosphoenol pyruvate carboxylase,  $\text{NAD}^+$ -malate dehydrogenase and aspartate aminotransferase and chlorophyll a/b ratio in leaves of sorghum cultivars during plant growth. Photosynthetica 15(4):453-456. 15 ref.
- The enzymes connected with the photosynthetic C4 pathway, phosphoenol pyruvate carboxylase (PEPC),  $\text{NAD}^+$ -malate dehydrogenase (MDH) and aspartate amino-transferase (AA), were estimated in the topmost fully expanded leaves of 12 cultivars of Sorghum bicolor at five different stages of growth (10 to 70d). All studied enzyme activities increased to a maximum in 30 d old plants and then declined. Chlorophyll (Chl) a/b ratio was maximal in 10 d old plants.
- 0132 SAJJAN, C.C., ITNAL, C.J., PATIL, S.S., and PARVATHIKAR, S.R. 1981. Growth and yield attributing characters of rabi sorghum are influenced by furadon. Current Research 10(3):50-51. 3 ref.
- 0133 SARAN, G., and PAL, M. 1981. Effect of soil moisture stress at different stages of plant development on the yield of grain sorghum. Indian Journal of Agronomy 26(4):463-464. 3 ref.
- Experiment was undertaken to determine critical growth stages in grain sorghum for soil moisture. The treatments were formulated to provide soil moisture stress at seedling

(10-30 days), primordial (30-50 days), blooming (50-70 days) and grain filling (70-90 days) stages. Grain yield data revealed that withholding irrigation at seeding stage caused maximum reduction in the yield from 39.8 to 9.9 q/ha followed by flower primordial stage. Blooming and grain filling stages were least critical. Of the cultivars, Swarna variety appeared to be more sensitive to moisture stress than hybrid CSH-1.

0134 SASTRY, K.P. 1981. Influence of agronomic practices on flowering behaviour in the parental lines of sorghum hybrid CSH-5. Ph.D. thesis, University of Agricultural Sciences, Bangalore, Karnataka, India. 415 pp.

0135 SCOTT, K.J., CHIN, J.C., and WOOD, C.J. 1981. Isolation and culture of cereal protoplasts. Pages 293-315 In Proceedings, Symposium on Plant Tissue Culture, 25-30 May 1978, Peking, China. London, UK: Pitman Publishing. 26 ref.

0136 SEETHARAMA, N., SIVAKUMAR, M.V.K., BINDER, F.R., SARDAR SINGH, S., MAITI, R.K., REDDY, B.V.S., PEACOCK, J.M., REDDY, S.J., MAHALAKSHMI, V., SACHAN, R.C., SHIVRAJ, A., MURTHY, S.R.K., NARAYANAN, A., KANANGARA, T., DURLEY, R.C., and SIMPSON, G.M. 1981. Problems and prospects for increasing yield under drought: criticism and synthesis with sorghum. Presented at the Symposium on Plant Physiology and Biochemistry in the 80's, 23-25 November 1981, IARI, New Delhi, India. 60 pp. 126 ref.

Major reasons for slow progress in increasing yield under water stress are listed and the relationships between crop productivity and drought resistance are examined. Adaptations to drought in sorghum are discussed in order of their utility in the immediate future's: phenological, morphological, physiological and biochemical. Results of interdisciplinary research at ICRISAT in understanding drought resistance

are discussed with respect to available screening methods, genetic variability and breeding methods.

0137 SHI, J.N., WU, M.X., and ZHA, J.J. 1981. Studies on plant phosphoenol pyruvate carboxylase. V. A reversible cold-inactivation of sorghum leaf carboxylase. (Ch). Acta Phytophysiological Sinica 7(4):317-326. 21 ref. (Summary: En).

The results suggest that the loss of phosphoenolpyruvate carboxylase (PEP) activity at 0 deg C might be accompanied by dissociation of enzyme polymer, and G6P and glycine protected PEP carboxylase against inactivation by preventing enzyme dissociation under low temperature. The nature of dissociation-reassociation of PEP carboxylase and its physiological role have been discussed.

0138 SHKOL'NIK, M.YA., KRUPNIKOVA, T.A., and SMIRNOV, YU.S. 1981. Activity of polyphenol oxidase and sensitivity to boron deficiency of some monocotyledonous and dicotyledonous plants. (Ru). Fiziologiya Rastenii 28(2):391-397. 23 ref. (Summary: En).

0139 SINGH, R., KAUR, J., ARYA, A.K., and BHATIA, I.S. 1981. Accumulation of starch, protein and the activities of invertase and sucrose ADP (UDP) glycosyl transferase in developing Sorghum vulgare grains. Biochemie und Physiologie der Pflanzen BPP 176(7):606-613. 30 ref.

The role of invertase and sucrose ADP (UDP) glucosyl transferase in starch synthesis in the developing grains of Sorghum bicolor was studied. The level of invertase was high during the initial stages of grain development. There was a close correspondence between the activities of sucrose-ADP glucosyl transferase and sucrose-UDP glucosyl transferase and the rate of starch synthesis, suggesting thereby, an active involvement of these enzymes in starch synthesis. Grain protein was also determined in relation to starch accumulation. The rate of protein

synthesis and the flux of soluble sugars continued to increase beyond the stage when the rate of starch synthesis had already started to decline. Exogenously supplied Mg<sup>++</sup> through liquid culture stimulated the in vivo incorporation of from 14C[U-14C]-sucrose into starch.

0140 SINHA, S.K., and RAJAGOPAL, V. 1981. Proline stimulates nitrate reductase in turgid tissues. Indian Journal of Experimental Biology 19(2):195-196. 7 ref.

The effect of exogenous proline application to the seedlings of maize, sorghum and wheat on the nitrate reductase activity under non-inductive conditions was studied. It was found that the activity of the enzyme in presence of proline was higher than in control.

0141 SIVAKUMAR, M.V.K., SEETHARAMA, N., GILL, K.S., and SACHAN, R.C. 1981. Response of sorghum to moisture stress using line source sprinkler irrigation. 1. Plant-water relations. Agricultural Water Management 3(4):279-289. 8 ref.

The response of Sorghum bicolor to moisture stress during the post-rainy season was studied at ICRISAT research center, India on a medium deep Alfisol using a line source sprinkler irrigation system. Changes in soil moisture content, stomatal conductance, leaf-water potential and leaf temperature of sorghum as a function of distance away from the line source sprinkler system were monitored throughout the season. Use of the line source technique facilitated the imposition of a range of moisture stress levels as indicated by increased water use by sorghum closer to the line source compared with the crop farther away from the line source. Canopy response measured in terms of stomatal conductance, leaf-water potential, and leaf temperature clearly reflected the gradient in moisture stress perpendicular to the line source.

0142 SOMANI, L.L., and SAXENA, S.N. 1981. Studies on phytotoxic substances from some crop residues. Agrochimica 25(3-4):349-355. 9 ref. (Summaries: De, Es, Fr, It).

Effects of phytotoxic substances of sorghum, paddy and wheat crop residues soluble in water and in solutions of CaCl<sub>2</sub> and NaCl were studied on germination and seedling growth of some crop varieties. The phytotoxicity of substances extracted in these solvents in general was in the order: NaCl<sup>1/2</sup>/CaCl<sub>2</sub><sup>1/2</sup> water. Not only germination percentage, root growth or shoot length was decreased but the germination was also delayed. Root growth was found to be more adversely affected as compared to shoot length. Varieties of the same crop exhibited differential resistance to the phytotoxic substances of different crop residues. Of all the wheat varieties tested, Kalyan sona<sup>1</sup> was found most tolerant against phytotoxicity of all crop residues under study.

0143 SRINIVASAN, RAO, C.S.R., and NAIK, M.S. 1981. Regulation of nitrate assimilation by light in higher plants. Journal of the Indian Institute of Science (Section C: Biological Sciences) 63(4):71-80. 44 ref.

Assimilation of nitrate in higher plants including sorghum is strictly light dependent. Light regulates the activity of the nitrate reductase, indirectly by blocking the mitochondrial oxidation of NADH, thus making it available for nitrate reduction. Subsequent assimilation of nitrite is carried out in the chloroplasts by nitrite reductase, glutamine synthetase and glutamate synthase which are all light dependent. Recent evidence also suggests that NADH for nitrate reduction is generated by the mitochondrial citric acid cycle dehydrogenases and NAD<sup>+</sup>-malic enzyme. It has also been shown that in light, carbon skeleton for citric acid cycle turnover is perhaps provided by

2-carbon compounds generated during photorespiration. Thus, combined activities of chloroplasts, mitochondria, cytoplasm and perhaps peroxisomes regulate nitrate assimilation in plants.

0144 STREK, H.J., WEBER, J.B., SHEA, P.J., MROZEK, E., Jr., and OVERCASH, M.R. 1981. Reduction of polychlorinated biphenyl toxicity and uptake of carbon-14 activity by plants through the use of activated carbon. *Journal of Agricultural and Food Chemistry* 29(2):288-293. 44 ref.

The use of soil-applied activated carbon in reducing the phytotoxicity and uptake from soil of polychlorinated biphenyls (PCB's) by a variety of crop plants was investigated. Growth parameters taken at harvest showed no apparent inhibition of corn and *Sorghum bicolor* by PCB. The activated carbon treatment substantially reduced growth inhibition caused by PCB. Treatment with soil-applied activated carbon reduced <sup>14</sup>C uptake into foliage of beet, corn, sorghum, and peanut in studies using a mixture of U-<sup>14</sup>C-labelled polychlorinated biphenyls mixed with unlabelled PCB and applied to soil at 20 ppm (total PCB).

0145 SUBBIAIAH, M.M. 1981. Leaf elongation and changes in biochemical constituents in genotypes of sorghum (*Sorghum bicolor* (L.) Moench) under stress. M.Sc. thesis, University of Agricultural Sciences, Bangalore, Karnataka, India. 131 pp.

0146 THAYER, S.S., and CONN, E.E. 1981. Subcellular localization of dhurrin Beta-glucosidase and hydroxynitrile lyase in the mesophyll cells of sorghum leaf blades. *Plant Physiology* 67(4):617-622. 20 ref.

The subcellular localization of the enzymes has been examined using linear 30 to 55% (w/w) sucrose gradients by fractionation of mesophyll protoplast components. The hydroxynitrile lyase is found in the

supernatant fractions suggesting a cytoplasmic location. The dhurrin beta-glucosidase (dhurrinase) is particulate and mostly chloroplast-associated. In studies of chloroplasts isolated from ruptured mesophyll protoplasts by differential, low-speed centrifugation, the dhurrinase partitions in the same manner as the chloroplast marker triose phosphate dehydrogenase. Chloroplast localization of the beta-glucosidase has also been shown in histochemical studies using 6-bromo-2-naphthyl-beta-D-glucosidase substrate coupled with fast Blue B.

0147 TSAI, S.L. 1981. Comparison on the physiological characters of drought resistance among sorghum varieties. (Ch). *Journal of the Agricultural Association of China, New Series* 116:15-28. 49 ref. (Summary: En).

Nine varieties were evaluated by several tests. Drought resistant varieties had greater root volume and heavier root weight. Higher stem-elongation rate and lower leaf-fir rate was observed in varieties subjected to water stress. The degree of drought resistance of the varieties in Polyethylene glycol (PEG-6000) solution was reflected in their germination rates. The proline content was significant in the excised leaves submerged in PEG-6000 solution. The chlorophyll stability index was not related to the degree of drought resistance.

0148 TURNER, N.C. 1981. Correction of flow resistances of plants measured from covered and exposed leaves. *Plant Physiology* 68(5):1090-1092. 18 ref.

The difference in water potential between an enclosed nontranspiring leaf and an adjacent exposed transpiring leaf, and the transpiration rate of a similarly exposed leaf, were used to calculate the change in hydraulic resistance of *Sorghum bicolor* and sunflower leaves

throughout the day and at various rates of transpiration. The leaves were enclosed in polyethylene bags shielded with aluminum foil. Enclosing the exposed leaf in a plastic sheath just prior to excision led to the water potential measured by the pressure chamber technique being 0.3 to 0.4 megapascals higher at rapid transpiration rates than in exposed leaves not sheathed just prior to excision. This error, led to an overestimation of the leaf hydraulic resistance in both species. Correction of the error reduced the resistance by 40 to 90% in irrigated sorghum and by about 40% in irrigated and unirrigated sunflower. After correction, the hydraulic resistances were still flow-dependent, but the dependency was markedly reduced in sorghum.

0149 VAN SCOYOC, S.W., and AXTELL, J.D. 1981. Dry weight, amino acid, and protein fraction changes in developing grain of P-721-opaque sorghum. *Agronomy Abstracts* 73:136.

Changes in seed dry weight, volume, protein and oil content, and amino acid profiles and in the proportion, amino acid patterns, and electrophoretic mobility of Landry-Moureaux endosperm protein fractions were followed at weekly intervals from 10-59 days after half-bloom (DAHB) for P-721-Opaque (0) and its normal sib line, P-721-N, grown at a low population. Seed weight, volume, and N content increased steadily through 45 DAHB for P-721-N but slowed at 31 DAHB and ceased at 38 DAHB for P-721-0. Seed protein content did not change during development, but seed oil and seed and endosperm lysine declined in both lines. Landry-Moureaux fraction I albumins and globulins differed little among lines. Fraction II plus III kafirin accumulation plateaued at 24 DAHB for P-721-0 but continued to increase rapidly through 38 DAHB for P-721-N. Fraction IV plus V total glutelin synthesis ceased beyond 24 DAHB for P-721-N but increased

steadily through 45 DAHB for P-721-0. Shifts in protein fraction amino acid profiles during endosperm development were small and differed little between lines.

0150 VAUGHN, K.C., and DUKE, S.O. 1981. Cytochemical localization of photo6ystem II donor sites. *Histochemistry* 73(3):363-369. 18 ref.

0151 VAUGHN, K.C., and DUKE, S.O. 1981. Tissue localization of polyphenol oxidase in sorghum. *Protoplasma* 108(3-4):319-327. 24 ref.

Plastidic polyphenol oxidase (PPO) was localized in various plastid types of Sorghum bicolor using cytochemical and biochemical fractionation techniques. PPO was found to be present in the mesophyll plastids yet absent from the bundle sheath and guard cell plastids. Mechanical fractionation of mesophyll and bundle sheath plastids, with subsequent electrophoretic or spectrophotometric assay of the preparations, also indicated that PPO was absent from the bundle sheath but present in the mesophyll fraction. A developmental study revealed that, although all leaf plastids near the basal meristem were ultrastructurally similar, the mesophyll and bundle sheath plastids were already differentiated with respect to PPO activity.

0152 VEGA G., J.D., and CANTU G., F.J. 1981. Determination of the evapotranspiration/evaporation ratio in four crops. Maize NLVS-1 and NLVS-1E (*Zea mays*), sunflower Tecmon 1 (*Helianthus annuus*), bean Delicias 71 (*Phaseolus vulgaris*) and sorghum Topaz (*Sorghum vulgare*). (Es). Pages 112-113 In XVII informe de investigacion, 1979-80. Monterrey, Nuevo Leon, Mexico: Instituto Tecnologico de Monterrey, Division de Ciencias Agropecuarias y Maritimas.

0153 VENKATARAMAN, S. 1981. Lysimetric observations on moisture accretion for and use by M.35-1 rabi

jowar at Solapur. Journal of Maharashtra Agricultural Universities 6(1):36-40. 10 ref.

For the 1977-78 and 1978-79 rabi season at Solapur (India), lysimetric data on soil moisture recharge and evaporative depletion in wet and dry spells in the pre-sowing season and of evapotranspiration of M.35-1 sorghum crop in relation to weather and crop factors are presented. Striking differences in crop-water consumption in the drier year of 1978-79 were noticed. The moisture need was low and steady in the month after sowing. The crop reached ground shading stage in 45 days time. In a dry spell, it could consume 8 cm at potential rate and another 5 cm at a constant rate. Early sowing in August with 10 cm storage is recommended.

0154 WANG, C.Y., CHEN, H.Y., and CHU, T.M. 1981. Source sink relationship in sorghum. 2. Effects of defoliation or wrapping position of leaves on yield. (Ch). National Science Council Monthly 9(11):975-982.

0155 WANG, M.Q. 1981. Study on the localization of ribulose-1,5-bisphosphate carboxylase in leaves of *Spartina anglica* and *Sorghum vulgare* by immunofluorescence technique. (Ch). Acta Phytophysiological Sinica 7(3): 291-293. 4 ref.

0156 WANJARI, K.B., and BHOYAR, M.P. 1981. Nature of coleoptile length and its effect on germination in sorghum. Pages 515-519 In Perspectives in cytology and genetics: proceedings of the Third All India Congress of Cytology and Genetics, 23-27 October 1978, Hissar, Haryana, India (eds. G.K.Manna, and U.Sinha). v.3. Delhi, India: Hindasia Publishers. 2 ref.

Coleoptile growth in sorghum was studied separately on paper towel, sand and soil media. Genetic differences were seen for coleoptile length on paper towel. However it was influenced by radicle growth under sand and soil media. Coleoptile and

radicle length were having negligible negative phenotypic correlation under paper towel experiment, whereas positive considerable association was recorded under other media. It explains the differences in the results under different media. As one to five cms of sowing depth in the field did not express significant differences in germination count, five cms of depth of sowing has been recommended.

0157 WARDLAW, I.F., and BAGNALL, D. 1981. Phloem transport and the regulation of growth of *Sorghum bicolor* (Moench) at low temperature. Plant Physiology 68(2):411-414. 20 ref.

Leaf expansion in *Sorghum bicolor* was severely retarded by low night temperatures (5 C). However, this was not reflected in the early measurements of relative growth rate, indicating that the response was not associated with a deterioration of the photosynthetic system. For plants grown at 30/25 C (day/night) and subsequently held at an ambient temperature of 30 C, phloem transport was inhibited by temperatures below 10 C. The speed of movement of 32P through the temperature controlled zone was more sensitive to temperature with reductions apparent below 20 C. Although there was some recovery in the movement of 32P following 3 days equilibration at low temperature (1 to 10 C), the new values (approximately 100 cm/hour) were still only about one-third of those obtained in the high temperature controls. For plants held at an ambient temperature of 21 C, translocation was only inhibited by temperatures below 5 C.

0158 WATSON, B.T., and WARDLAW, I.F. 1981. Metabolism and export of 14C-labelled photosynthate from water stressed leaves. Australian Journal of Plant Physiology 8:143-153. 42 ref.

The effect of water stress on the translocation of 14C-labelled photosynthate from leaves was examined

in Sorghum sudanense, Triticum aestivum, Amaranthus caudatus, and Helianthus annuus. Water stress reduced the rate of loss of <sup>14</sup>C from the leaves of all species following a pulse application of <sup>14</sup>CO<sub>2</sub>, but the effects of stress were most apparent in sorghum, and sunflower. Prevention of translocation of photosynthate out of a leaf of either wheat or sorghum, by steam killing the tissue altered the pattern of labelling of metabolites with <sup>14</sup>C following a pulse of <sup>14</sup>CO<sub>2</sub>. Changes in translocation due to reduced export associated with a reduction in growth under water stress did not play a part in the responses observed.

0159 WEIMBERG, R., LERNER, H.R., and POLJAKOFF-MAYBER, A. 1981. Kinetics of toluene induced leakage of low molecular weight solutes from excised sorghum tissues. Plant Physiology 68(6) :1433-1438. 26 ref.

The relationship between toluene concentration and the rate of leakage of solutes from toluene-treated roots and leaves of Sorghum bicolor was studied to determine the effect of toluene on plant cell membranes. A threshold concentration of 0.2% toluene was needed to induce leakage. Maximal leakage rates were obtained with 0.5% toluene. Low molecular weight solutes, leaked from treated tissue, while macromolecules were retained. The rates at which the low molecular weight solutes diffused from treated cells decreased with increasing molecular weight. At 25 deg C, treatment of roots and leaves with 0.5% toluene resulted in the quasi-quantitative leakage of solutes within 180 minutes. At 1 deg C, roots and leaves differed in their response to toluene. The rates of leakage from roots at 1 deg C were much lower and the total amounts much smaller than at 25 deg C, while in leaves the difference between the two temperatures was very small.

0160 WENDT, W. 1981. Effect of mulch and plant distribution in the

field on some growth and development parameters of sorghum. (Pt). Pesquisa Agropecuaria Brasileira 16(4):517-525. 7 ref. (Summary: En).

The growth analysis method was used to study the response of Sorghum bicolor to the variations of some environmental factors introduced by the use of dead mulching at different plant population rates in a trial in Brazil. Data on soil temperature were obtained at 2, 5, 10 and 20 cm depths for each treatment. From the analysis of the results, a variation in the behavior of sorghum crop was observed as a consequence of the effects caused by dead mulching. Based on the physiological parameters evaluated, it was concluded that the effect of dead mulching, processed through the soil temperature regime, is higher than the effect resulting from the spacing used.

0161 WERNICKE, W., BRETTELL, R., and POTRYKUS, I. 1981. Somatic embryogenesis from cereal leaves. Presented at the Annual Meeting of the German Society for Cell Biology, the German Society for Genetics, and the Society for Developmental Biology, 26-28 March 1981, Freiburg, German Federal Republic.

0162 WESTERMAN, R. L., EDLUND, M.G., and MINTER, D.L. 1981. Nitrapyrin and etradiazole effects on nitrification and grain sorghum production. Agronomy Journal 73(4):697-702. 17 ref.

Sorghum bicolor was grown in five field experiments at three locations during 1976, 1977, 1978, and 1979, with two nitrification inhibitors and three N sources. Four of these five experiments received supplemental irrigation water. Soil textures at experimental locations were sandy, silt, and clay loams and pH's ranged from 5.2 to 7.8. Nitrification inhibitors evaluated were nitrapyrin and etradiazole. Sources of N were anhydrous ammonia and urea in 1976, urea and urea-ammonium nitrate (UAN)

solution in 1977, and UAN in 1978 and 1979. Soil N forms were altered by nitrification inhibitors at various time intervals during the growing seasons. The changes observed did not lead to increased efficiency of applied N or to an increase in yield of grain sorghum. It was concluded that little benefit could be derived from nitrification inhibitors in grain sorghum production in Oklahoma (USA).

0163 WHITE, P.J., and NEWTON, R.J. 1981. Soluble carbohydrates as influenced by water stress in sorghum. *Agronomy Abstracts* 73:15.

The role(s) of soluble carbohydrates in response to environmental stress was investigated in dark-grown Sordan seedlings. Fructose, glucose, sucrose and dhurrin were the primary soluble carbohydrates detected in the shoot by gas-chromatography. A psi w of -15 bars was experienced by shoots from 11-day old seedlings stressed for 8 days with addition of PEG to a sand medium. Eleven day old non-stressed seedlings had shoots with a psi w of -3 bars when treated with water. Coleoptiles from stressed plants had a 69% reduction in dry wt and a 32% reduction in length as compared to non-stressed plants. Mesocotyls from stressed plants had a 24% reduction in dry wt and a 44% reduction in length. Stress caused slight increases in sugar levels (micro g/mg DW) in coleoptiles as well as mesocotyls. The effect was most pronounced in the upper 2 cm portion of the mesocotyl. Sucrose, fructose, and glucose levels in stressed upper mesocotyl tissue were much higher than those levels found in non-stressed upper mesocotyl tissue; glycoside levels increased slightly.

0164 WHITELEY, G.M., and DEXTER, A.R. 1981. Elastic response of the roots of field crops. *Physiologia Plantarum* 51(4):407-417. 16 ref.

The elasticity of root tips was investigated in experiments of the static clamped-beam type. The

response was non-linear. The results were interpreted in terms of a generalized elastic modulus M, and two parameters, alpha and beta, which account for the non-linearity. Seminal axes and primary lateral roots of 16 crop species grown in the laboratory show significant inter-species differences but insignificant inter-variety differences in the elastic properties. A smaller set of results for field-grown roots with two tillage treatments shows that the elastic modulus is smaller and the diameter is larger than with laboratory-grown roots. Environmental factors such as water potential, and nutrition had significant influences on the diameters and elastic behaviour of roots.

0165 WILKINSON, R.E. 1981. Influence of metolachlor on phospholipid synthesis in cotton, soybean, and sorghum. *Proceedings Southern Weed Science Society* 34:263. (Abstract).

Metolachlor did not inhibit incorporation of choline-1, 2-14C or ethanolamine-2-14C into phosphatidyl choline or phosphatidyl ethanolamine, respectively, of cotton leaves or roots, soybean leaves or roots, or sorghum leaves. Phospholipid degradation occurred and products were demonstrated to be from demethylation, deacylation, and removal of the polar group.

0166 WILKINSON, R.E. 1981. Metolachlor influence on growth and terpenoid synthesis. *Pesticide Biochemistry and Physiology* 16(1):63-71. 30 ref.

Height and fresh weight of Sorghum bicolor L. var GA 522 DR grown in sand were reduced by metolachlor (0, 0.125, 0.25, 0.5, or 1 ppm) applied preemergence. Significantly different responses were obtained from plants grown at two light intensities (270 and 27 micro ein/square m/sec). When grown in nutrient solution containing 0,



0.0156, 0.0625, 0.25, 1, 16, or 64 ppmw metolachlor, shoot and root lengths were inhibited fresh and dry weights of shoot, root, and total plant decreased as metolachlor concentration increased. Carotene content in sorghum leaves was decreased by metolachlor. Thus, terpenoid biosynthesis is influenced by metolachlor. Gibberellin<sup>6</sup> are terminal products of plant terpenoid biosynthesis, and GA<sub>3</sub> reverses metolachlor inhibition of growth at specific ratios of GA<sub>3</sub> and metolachlor but not at other concentrations. Thus, one effect of metolachlor on plants may be an inhibition of GA synthesis that results in shoot and root growth reductions as metolachlor concentration increases.

0167 WILKINSON, R.E. 1981. Metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl-N-(2-methoxy-1-methylethyl) acetamide] inhibition of gibberellin precursor biosynthesis. *Pesticide Biochemistry and Physiology* 16(3):199-205. 15 ref. [2-14C] Mevalonic acid incorporation into gibberellic acid precursors was measured in cell-free extracts from sorghum (var. G-522 DR) coleoptiles. <sup>14</sup>C incorporation into ent-kaur-16-ene was inhibited ca 90% by 10<sup>-7</sup> to 10<sup>-4</sup> M metolachlor. [14C] Geranylgeraniol (GG) content increased. [14C] Farnesol content was not altered and [14C] geraniol content decreased. Total <sup>14</sup>C incorporation was decreased by metolachlor. In the safener-treated sorghum seed coleoptile cell-free system, total <sup>14</sup>C incorporation increased, [14C] kaurene and relative kaurene content increased 4 x upto 100000 M metolachlor, and [14C] farnesol, and [14C] GG contents increased while relative farnesol and relative GG contents were not influenced by metolachlor. Thus, the inhibition of kaurene synthesis by metolachlor was reversed by the safener. Since the biosynthetic processes are mevalonic acid-geraniol-farnesol-GG-copalylol-kaurene, these data

corroborate a proposed gibberellic acid biosynthesis inhibition between GG and kaurene as well as a partial blockage between mevalonic acid and geraniol. Thus, a portion of metolachlor-induced growth inhibitions of sorghum could be explicable on the basis of gibberellic acid biosynthesis inhibitions.

0168 WITT, M.D. 1981. Physiological studies of pearl millet and grain sorghum subjected to high temperature and moisture stress. Ph.D. thesis, University of Nebraska, Lincoln, Nebraska, USA. 203 pp.

0169 WRIGHT, G.C. 1981. Adaptation of grain-sorghum to drought stress. Thesis, New England University, Armidale, Australia.

0170 WU, M.X., ZHA, J.J., and SHI, J.N. 1981. Studies on plant phosphoenol pyruvate carboxylase. IV. Modification of functional arginyl residues in PEP carboxylase of sorghum leaves with butanedione. (Ch). *Acta Phytophysiological Sinica* 7(1):33-41. 12 ref. (Summary: En).

Allosteric effectors and substrates protected the enzyme against butanedione modification to different extents, among them PEP and G 6 P were the most potent protectors. The degree of the protection reached eventually a saturation value on increasing the concentrations of PEP and G 6 P, and the concentrations required for the half-maximal protection were 4 mM and 1.5 mM, respectively. It is revealed that arginyl residues existed not only at the catalytic site but also at the G 6 P-binding site and indicated that these residues play an essential role in the enzymatic catalysis and regulation of sorghum leaf PEP carboxylase, presumably as a recognition site for the negatively charged phosphorylated substrates or allosteric effectors.

0171 YATES, D.J. 1981. Effect of the angle of incidence of light on the

net photosynthesis rates of Sorghum alnum leaves. Australian Journal of Plant Physiology 8:335-346. 14 ref.

This study was made using attached leaves of Sorghum alnum. Gas exchange measurements indicated that at oblique angles of incidence there was a marked reduction (up to 50% at 70 deg) in net photosynthesis rate below than expected on the basis of the reduced leaf surface irradiance. This 'angle effect' was shown to be at least partially the result of increased leaf reflectivity at oblique angles of incidence of light. The inclusion of this effect in a canopy model indicated that it could lead to a maximum overestimation of daily canopy production by about 7%.

0172 YUSUFOV, A.G., and GADZHIEVA, I.KH. 1981. Polarity of growth and morphogenesis in isolated organs and in intact plants. (Ru). Fiziologiya Rastenii 28(2): 432-435. (Summary: En).

In an experiment conducted in USSR during 1975-79, chlorophyll contents of leaves of sorghum plants grown under different conditions were determined over a period of 55 days. In normally orientated plants under natural illumination, the chlorophyll content was 2.0 mg/g of green tissue and they flowered after 50 days. It was 1.7 mg/g in inverted plants in a natural illumination and they flowered after 54 days. In normally orientated and inverted plants grown under 24-h photoperiod it was 1.3 and 1.1 mg/g respectively without flowering. The influences of daylength and orientation on shoot length, internode length and leaf blade width were studied, and the characteristics of plants cultivated whilst differently orientated were compared.

0173 ZHANG, B.L., and TAO, S.H. 1981. On the effective period of crop zygote irradiation. I. Fertilization process and duration of zygote stage of sorghum. (Ch). Application of Atomic Energy in Agriculture 3:1-6. 10 ref. (Summary: En).

It was found that the duration from germination of pollen grain on the stigma to the first mitosis of the zygote was about 24 hours. The germination of pollen grains and the growth of pollen tubes in the styles took about 1-2 hours, at about the 3rd hour after pollination, the pollen tube grew deep in the wall of the ovary and entered into the embryo sac; the fusion period of male and female nuclei occurred from the 4th hour to the 7th hour; and after a 17 hours interval first mitosis of the zygote took place at the 24th hour. The effective period of irradiation of sorghum zygote was from the 4th hour to the 24th hour after pollination.

0174 ZHOU, J.Y. 1981. Embryoids produced from somatic plant cell in vitro. I. In vitro embryogenesis of somatic plant cells. (Ch). Acta Phytophysiological Sinica 7(4):389-397. 58 ref.

## GENETICS AND BREEDING

0175 ALI, A.H., ABDEL FATTAH, M.S., EL ATTAR, F.I., and FAYED, M.F.S. 1981. Estimates of general and specific combining ability in F1 hybrids for grain yield and its components in grain sorghum (*Sorghum bicolor* (Linn.) Moench). Annals of Agricultural Science 16:177-192.

0176 ARQUIZA, R.P., and CENA, R.L. 1981. Inbreeding depression of F2 sorghum hybrids. USM Research Journal 3(1):34-45. 6 ref.

0177 AXTELL, J.D. 1981. Breeding for improved nutritional quality. Pages 365-432 In Plant breeding II (ed. K.J.Frey). Ames, Iowa, USA: Iowa State University Press. 113 ref.

0178 BAPAT, D.R., DESHAMANE, N.B., SHINDE, M.D., and PADHYE, A.P. 1981. Annual report of research work on plant breeding at Mahatma Phule

Agricultural University, Rahuri 1980-81. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 9 pp.

In kharif, MSH-37, MSH-42, SIH-197 and SIH-182 hybrids performed well but their yields were not higher than CSH-9 and CSH-5. Varieties SIV-101, SIV-107, SIV-221, SIV-232, SIV-310, SIV-243, SIV-351, SIV-417 appeared promising. In rabi, CSH-8R recorded highest grain yield followed by new hybrids viz. SIH-204, MSH-37 and MSH-42. Varieties SIV-43, SIV-441, SIV-430, SIV-440 and SIV-438 showed better performance than check M.35-1.

0179 BHATT, K.C., VAISHNAV, P.P., SINGH, Y.D., and CHINYOY, J.J. 1981. Biochemical basis of heterosis in sorghum: changes in chlorophylls and ascorbic acid turnover during seedling growth. *Annals of Botany* 47(3):321-328. 27 ref.

Shoots of three F1 hybrids of Sorghum bicolor with their inbred parents were analyzed for chlorophyll a and chlorophyll b contents as well as for ascorbic acid turnover during the early stages of seedling growth. In all the hybrids both chlorophyll and ascorbic acid turnover showed better-parental and/or mid-parental heterosis. Since ascorbate participates in photosynthesis and nitrate reduction, it is suggested that a well co-ordinated system incorporating photosynthetic efficiency and nitrate assimilation may be associated with the manifestation of hybrid vigour in sorghum.

0180 BIJAPUR, U.K., GOWDA, B.T.S., and GOUD, J.V. 1981. Evaluation of newly developed male-sterile and pollinators in a line x tester analysis in grain sorghum. *Mysore Journal of Agricultural Sciences* 15(1):56-60. 6 ref.

A line x tester analysis with 4 male sterile lines and 20 male lines of sorghum was made under three

environments. From the analysis, gene action for economically important characters has been estimated. The parents for the hybrids suitable for different environmental conditions have been identified. The cross combinations 323A x P20 with high specific effects for rainfed cultivation and 1258A x P18 and 1258A x P10 for irrigated rabi cultivation have been identified.

0181 BITTINGER, T.S., CANTRELL, R.P., and AXTELL, J.D. 1981. Allelism tests of the brown-midrib mutants of sorghum. *Journal of Heredity* 72(2):147-148. 5 ref.

Allelism crosses among twelve mutants of sorghum gave inconsistent results but indicated that more than one locus is involved in the brown-midrib trait. Additional crosses among the three most promising genotypes revealed bmr-12 and bmr-18 to be allelic and bmr-6 to have another location on the genome.

0182 BITTINGER, T.S., CANTRELL, R.P., AXTELL, J.D., and NYQUIST, W.E. 1981. Analysis of quantitative traits in PP9 random mating sorghum population. *Crop Science* 21(5):664-669. 25 ref.

Genetic variability was investigated in a diverse, random-mating population of Sorghum bicolor. Fifty random pollen parents each were crossed to a different set of three random seed parents. The 150 resulting progenies were evaluated for flowering, height, lodging, panicle weight, seed weight, panicle length, and grain yield. Additive genetic variance was found greater than dominance variance for all traits except yield. The ratio of dominance variance to additive variance was 1.24 for yield and from 0.18 to 0.66 for other traits. Yield showed positive phenotypic and genetic correlations with flowering and panicle weight. The effects of major height and maturity genes on variation for yield are also discussed.

0183 BORIKAR, S.T. 1981. Genetics

of seed size in sorghum. Research Bulletin of Marathwada Agricultural University 5:5-7. 3 ref.

To study the genetics of seed size, 3 testers were crossed with 5 varieties viz. 285, PD-3-1-11, 168, IS-84 and CS-3541. The testers included CK-60A (L1), 36A (L2) and CK 60A x 36B (L3) in set I and CK 60A (L1), 1202A (L2) and CK60A x 1202 B (L3) in set II. Five three-way and 10 single-crosses were evaluated in each set. The values of correlation coefficients were found negative but were of lower magnitude in both the sets, which confirmed the predominance of additive gene action than dominance gene action in controlling grain size in sorghum.

0184 BROWN, W.L. 1981. Exotic germplasm in cereal improvement. Proceedings of the International Botanical Congress 13:117. (Abstract).

Since exotic germplasm varies greatly in its capacity to contribute positively to the improvement of cereals, the choice of the correct exotic genotype has become as important as the choice of the correct adapted breeding lines as parents for a mating. To identify useful exotics an understanding of the evolutionary history of the species involved is emphasized. Though the cultivated pools of most cereals contain sufficient genetic variability to permit further genetic gains in yield and other traits it is suggested to enrich gene pools of cereals through the introgression of exotic and semi-exotic genotypes.

0185 CLARK, J.W. 1981. The inheritance of fermentable carbohydrates in stems of Sorghum bicolor (L.) Moench. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 98 pp.

0186 DACI, E., and GUGA, E. 1981. Sorghum hybrids and assessment of the combining ability of the lines for producing them. (A1). Buletini i

Shkencave Bujqesore 20(4):97-104. (Summary: Fr).

0187 DREMLYUK, G.K. 1981. Phenotypic classification of grain sorghum and its role in selection. (Ru). Seleksiya i Semenovodstvo 10:10-12.

0188 DREMLYUK, G.K., and KOBELEVA, E.N. 1981. Classification of inbred lines of grain sorghum by phenotype. (Ru). Nauchno-tehnicheskii Byulleten Vsesoyuznogo Seleksionnogeneticheskogo Instituta 1:29-33. 5 ref.

0189 DUVICK, D.N. 1981. Genetic diversity in major farm crops on the farm and in reserve. Proceedings of the International Botanical Congress 13:216. (Abstract).

In U.S., cultivars of cotton, soybeans, wheat, sorghum, and maize are replaced every 7-9 years on average to provide genetic diversity in time and in reserve by reserving cultivars number thousands per crop. Though the breeding pools are reported to be more diverse genetically than in 1970, it is suggested that National Plant Germplasm System should be provided more funds to increase collection and more complete descriptions of the collections.

0190 FINKNER, R.E., FINKNER, M.D., GLAZE, R.M., and MAESE, G. 1981. Genetic control for percentage grain protein and grain yield in grain sorghum. Crop Science 21(1):139-142. 20 ref.

To study the inheritance of grain protein and yield in Sorghum bicolor, divergent selection was applied to a series of individual plants. Protein percentage was determined from a random sample of finely ground grain by the Udy dye-binding method. The selected lines were crossed onto A-lines 'Martin' (high protein), and 'Wheatland' (low protein). Significant differences were detected between the lines selected for high and low protein content for both traits. Genetic analyses indicated

that low protein content was partially conditioned by dominant genes. Grain yield was determined by dominant or overdominant gene action as 43% of the test crosses yielded significantly above their midparent mean, and 35% of the crosses yielded significantly more than the highest yielding parent. Protein percentage had a highly significant negative correlation with yield. Partitioning of the genetic variance indicated that additive gene action was more important than nonadditive gene action for both attributes studied.

0191 FINKNER, R.E., FINKNER, M.D., GLAZE, R.M., and MAESE, G. 1981. Quantitative genetic studies of plant and seed characteristics in sorghum. Bulletin, New Mexico Agricultural Experiment Station no.687. 30 pp. 28 ref.

Data were obtained from test crosses and their respective parents from 7 different replicated tests from 1976 through 1979. Positive heterosis and dominant genetic effects were the main inheritance response for height, exertion, grain yield and grain protein per acre. Partial dominance and dominant genes controlled test weight and seed weight. Heterosis also was important for seed weight. Negative heterosis or dominant effects of the early blooming and low protein parents were important for days to half bloom and seed protein. 7% of the test crosses showed positive heterosis for seed moisture and the remainders were evenly divided. Partitioning of the genetic variance of the test crosses indicated that additive gene action was more important than nonadditive for all attributes. Genetic variance in males was greater than in females.

0192 FRITZ, J.O., CANTRELL, R.P., LECHTENBERG, V.L., AXTELL, J.D., and HERTEL, J.M. 1981. Brown midrib mutants in sudangrass and grain sorghum. Crop Science 21(5):706-709. 12 ref.

Three low lignin, brown midrib

(bmr) Sorghum bicolor mutants (bmr-6, bmr-12, and bmr-18), were each backcrossed to normal grain- and grassy-type sorghums, to determine the effect of the brown midrib mutants on fiber composition in grain- and grassy-type genetic backgrounds. Analysis for fiber composition and in vitro dry matter disappearance (IVDMD) was conducted on mature stem tissue of mutant and normal plants from the F2 generation of the first and second backcross. The bmr-6 mutant reduced lignin percentage from 10.3 to 8.5 ( $P^{1/4}0.01$ ) and increased IVDMD percentage from 39.6 to 48.7 ( $P^{1/4}0.01$ ). The effect of the bmr-6 mutant was expressed as well in grassy-type as in grain-type backgrounds. Similar results were obtained with the bmr-12 and bmr-18 mutants. Results indicate that sudangrass sorghums containing brown midrib mutant genes are lower in lignin percentage and higher in digestibility than normal genotypes. Mutant sudangrasses of this nature should be higher in digestible energy percentage and should result in greater animal production than normal sudangrasses when fed to ruminant animals.

0193 GIARDINI, A. 1981. Grain sorghum Sorghum vulgare Pers. or Sorghum bicolor (L.) Moench: economic importance, botanical classification, genetics. Pages 185-210 In Coltivazioni erbacee (R.Baldoni, and L.Giardini). Bologna, Italy: Patron Editore.

0194 GIRIRAJ, K., and GOUD, J.V. 1981. Heterosis for grain yield in winter sorghum (Sorghum bicolor (L.) Moench). SABRAO Journal 13(2):92-97. 20 ref.

The extent of heterosis was measured in 28 hybrids resulting from crossing four tall, late winter, sorghum varieties (M35-1, Muguthi, RCR-408, FR-169) and four dwarf, early varieties (CS-3541, 148, IS-3691, IS-84). The hybrids averaged 22% higher grain yield than the mean of the parents. Heterosis for grain

- yield was the result of heterotic effects for 100-seed weight (13.7%) and for the number of grains/panicle (9.9%). The high heterotic effect for seed weight came primarily from the tall, late winter-sorghum parents.
- 0195 GIRIRAJ, K., and GOUD, J.V. 1981. Studies on genetic diversity in sorghum. Crop Improvement 8(1):42-46. 8 ref.
- Genetic diversity using D2 analysis was studied in eight selected parents of Sorghum bicolor and their 28 F1's. Nineteen characters which included vegetative characters and panicle components were used. There was considerable diversity in the material analysed. The 36 genotypes were grouped into 12 clusters. There was no consistent relationship between parents and their hybrids in the groupings of a cluster. It was proposed to exploit the cluster with two hybrids in it (RCR 408 x IS 84 and IS 84 x FR 169) for recombination breeding programme.
- 0196 GOMATHINAYAGAM, P., and RAJASEKHARAN, S. 1981. Biological effect of gamma rays on Sorghum bicolor (L.) Moench in the M1 generation. Madras Agricultural Journal 68(10):638-642. 4 ref.
- The biological effects of the mutagen was studied in the M1 generation by measuring reduction in germination, survival, growth inhibition and sterility. A progressive reduction in germination and survival was observed as the doses of gamma rays increased. A linear trend was observed as the doses of gamma rays increased. A linear trend was also observed in shoot and root length reduction on 10th day. The correlation and regressions on height of plant on 30th day and at maturity indicated that there was a dose-dependent reduction in height of plants. The reduction in height at maturity was not so drastic as compared to that on 30th day. A linear trend was observed in the pollen and seed fertility reduction.
- 0197 HAMILTON, N.R.S., and AL KHAWLANI, M.A. 1981. Collecting in the Y.A.R.III. Plant Genetic Resources Newsletter 45:13-16. (Summaries: Es, Fr).
- Report describes the IBPGR's collecting mission in the Yemen Arab republic. Priority was attached to collecting sorghum, forage grasses and legumes.
- 0198 ICRISAT, SORGHUM BREEDING PROGRAM. 1981. Sorghum elite progeny observation nursery (SEPON) 1981: adapted x mold resistant crosses. Patancheru, Andhra Pradesh, India: ICRISAT. 9 pp.
- 0199 ICRISAT, UPPER VOLTA COOPERATIVE PROGRAM. 1981. Annual report: sorghum breeding 1981. 15 pp. (Preliminary draft).
- The report discusses trials performed by local farmers, multilocational yield trials, trials of advanced lines at the research stations, and segregating generations.
- 0200 IMAI, T., and GOMEZ, A.A. 1981. Heterosis of sorghum F1 plants in different growing seasons. JARQ 15(1):70-73. 1 ref.
- A male-sterile line (MS 143-234-123-99-61) showing high and stable fertility was used as female parent to study the effects of seasons on the expression of F1 heterosis. A total of 110 crosses including 29 varieties of CS group, 34 of IS group and 47 other varieties were studied. Agronomic characters examined were, seedling height, days to heading, culm length, panicle length, primary rachis branches, 1000 grain weight, and grain yield. Results showed that the degree of heterosis was similar in wet and dry seasons. Heterosis in culm length was very great, while it was hardly observed for days to heading. Panicle length, no. of primary rachis branches and 1000 grain weight expressed small degree of heterosis. Still grain yield expressed very large heterosis particularly in dry season.

0201 INDI, S.K., and GOTO, J.V. 1981. Gene effects in sorghum. Indian Journal of Genetics and Plant Breeding 41(1):25-29. 9 ref.

In a study of five generation set (P1, P2, F1, F2 and F3) of three crosses, gene action for eleven quantitative characters were worked out following five parameter model of Hayman (1958). The predominance of additive ( $d^1$ ) gene action was noticed for days to 50 per cent flowering and leaf length in IS-3691 x 148 and 148 x A1 crosses, for plant height, number of leaves and ear length in IS-3691 x 148 and IS-3691 x A1 crosses, for leaf breadth in IS-3691 x 148 cross, for number of whorls in IS-3691 x A1 cross and for ear breadth in IS-3691 x A1 and 148 x A1 crosses. Preponderance of dominance (h) gene action was noticed for all the remaining characters in all the crosses. None of the crosses showed predominance of additive ( $d^1$ ) gene action for number of primaries, ear weight and grain yield. In addition, epistatic gene effect was also of considerable importance. Since grain yield and its components were predominantly under the control of dominance gene effect exploitation of hybrid vigour seems to be fruitful.

0202 INDI, S.K., and GOUD, J.V. 1981. Inheritance of tan colour in sorghum. Indian Journal of Genetics and Plant Breeding 41(1):34-46. 8 ref.

Inheritance of red purple vs. tan plant (leaf sheath) colour was studied in six intervarietal crosses of Sorghum bicolor 'LSR 1 x CS 3541', 'RCR 408 x CS 3541', '148 x LSR 1' 'CS 3541 x IS 84', 'IS 3691 x CS 3541 and 'IS 84 x 148'. F2 segregation showed a 3:1 ratio for red purple: tan colour, indicating operation of single gene in the inheritance of this character in all the six cross combinations. The monogenic recessive tan plant colour was observed.

0203 INDI, S.K., and GOTO, J.V. 1981. Genetic analysis of

quantitative characters in an intervarietal cross of sorghum. Mysore Journal of Agricultural Sciences 15(1):6-11. 18 ref.

Estimates of additive dominance and epistatic gene effects and per cent heterosis, inbreeding depression and potency ratio for eleven quantitative characters have been obtained in grain sorghum. The material studied included the parental lines and the F1, F2, B1 and B2 derivatives of the cross Swarna x A1. It appeared that additive gene action was of prime importance in the inheritance of plant height, number of leaves and number of whorls and for the remaining characters dominance gene action played an important role. Among three types of epistatic effects, it appeared that dominance + dominance (1) type was more important for majority of the characters compared to other two types. Heterosis over mid parent and inbreeding depression were highly significant for all the characters and were the highest for grain yield. Overdominance of higher parent for leaf length, leaf breadth, ear breadth, number of primaries, ear weight and grain yield was noticed.

0204 ISAKOV, IA.I 1981. Some results and prospects of breeding sorghum crops. (Ru). Seleksiya i Semenovodstvo 10:8-10.

0205 JAISIL, P. 1981. Effects of recurrent selection in two sorghum populations. M.Sc. thesis, Andhra Pradesh Agricultural University, Hyderabad, Andhra Pradesh, India. 94 pp. 71 ref.

To examine the effects of recurrent selection on two random mating populations of sorghum, population bulk trials and S1 progeny trials were conducted. It was found that recurrent selection following progeny selection (S1 and S2) is very successful in increasing the mean of the population in the desired direction without losing much variability and selection advance of

about 14% per cycle can be expected to be maintained in further cycles.

0206 KARUNARATNE, S.M., and SCOTT, K.J. 1981. Mitotic activity in protoplasts isolated from Sorghum bicolor leaves. Plant Science Letters 23(1):11-16. 7 ref.

Protoplasts were isolated from leaves of 7-day-old seedlings which had been kept in continuous darkness for 3 days prior to enzymatic digestion. Subsequent incubation of these protoplasts in a medium conditioned by prior growth of sorghum shoot callus resulted in over 90% of the original population remaining viable after 1 day and 5.2% undergoing nuclear division after 17 days. Nuclear division was inconsistent and frequent and was never more than 0.2% of the original population after incubation of protoplasts in 'non-conditioned' medium. Protoplasts isolated from seedlings grown under a 16-h-day showed a complete loss of viability 1 day after isolation when incubated either in 'conditioned' or 'non-conditioned' medium. It is concluded that dark treatment of seedlings prior to protoplast isolation and prior conditioning of the incubation medium are necessary for high viability and nuclear division in sorghum mesophyll protoplasts.

0207 KHIDSE, S.R., BHALE, N.L., and BORIKAR, S.T. 1981. Heterosis for chlorophyll stability index in sorghum. Research Bulletin of Marathwada Agricultural University 5:7-10. 5 ref.

Chlorophyll stability index (CSI)- a rapid method for estimating drought resistance, was studied at three stages in sorghum. Results revealed that the magnitude of heterosis for CSI increased after stress upto panicle emergence stage. The mean heterosis during most of the stages was in negative direction. Hybrids were found more tolerant to drought than parental varieties.

0208 KULKARNI, N., NARAYANA, D., and MURTY, K.N. 1981. Directional selection in advance generation progenies of sorghum. Indian Journal of Genetics and Plant Breeding 41(1):97-102. 4 ref.

Twenty-four advanced generation F5 and F6 progenies were studied for grain yield and yield components along with their parents. Considerable variability was present between F5 progenies on which selection can operate. The F6 progenies were superior to F5 progenies, their parents and improved varieties for grain yield and yield components except number of primary branches. Particularly the progeny 643 of IS 6928 x CSV-5 cross was early, dwarf, and highest yielding. Regression of F6 and F5 suggested that F5 itself was good indicator of F6 performance for plant height, 50% flowering, number of primary branches and 1000 grain weight. Based on within and between family variations and regression analysis, it is concluded that while between family selection would be effective for plant height, 50% flowering and number of primary branches, individual plant selection within family should be followed for grain yield and number of secondary branches in sorghum.

0209 KULLAISWAMY, B.Y., and GOUD, J.V. 1981. Linkage relationships of factors governing nature of pedicel led spikelets, glume covering and ear smoothness in sorghum. SABRAO Journal 13(2):156-163. 11 ref.

The mode of inheritance of five morphological characters was determined and the number of factors involved and their interrelationships are discussed. Three factors, S'g, Pr A1 and Es were tentatively assigned to the tenth linkage group.

0210 LENZ, M.C., and ATKINS, R.E. 1981. Comparisons of agronomic and morphologic characters in sorghums having different cytoplasms. Crop Science 21(6): 946-950. 14 ref.

Sorghum bicolor crosses differing



- in source of their cytoplasms were compared for agronomic performance in two environments. None of the male-sterility-inducing cytoplasms possessed by the lines KS34 through KS39 differed significantly from the milo sterility-inducing cytoplasm for their effects on grain yield, the primary components of yield, and most other plant characteristics. The cytoplasms possessed by the KS lines seem to provide suitable alternatives to the milo cytoplasm for use in hybrid seed production. Comparisons of the performance of entries produced by using seven male-sterility-inducing cytoplasms with that of entries with nonsterility-inducing cytoplasms often were significant ( $P^{1/4}0.05$ ). Greater emphasis for research on alternative methods of hybrid seed production in sorghum is suggested.
- 0211 LIANG, G.H., and BARNETT, F.L. 1981. Cytological effect associated with trisomies "light green" of Sorghum bicolor. *Journal of Heredity* 72(1):59-60. 9 ref.
- Some plants from trisomic light green of Sorghum bicolor produced additional and lagging chromosomes, whereas other trisomies appeared normal cytologically. Percentage of pollen abortion was highest for trisomic light green plants. Apparently trisome light green carries a gene or genes affecting the meiotic process in such a way that additional cycles of chromosome division occur or chromosomes duplicate while cytokinesis fails to take place. Maternal effects may accompany the cytological effects in the progeny of trisomies.
- 0212 LIANG, Z., and ZHOU, Y.C. 1981. The preliminary studies of isoenzymes of millet sorghum. (Ch). *Acta Botanica Sinica* 23(5):421-422. 7 ref.
- 0213 LUO, Y.W., QIAO, Z.Q., YAN, X.Z., CHEN, S.L., WANG, Y., and ZHANG, L.S. 1981. A preliminary study on induction of autotetraploid from diploid in sorghum. (Ch). *Hereditas* 3(4):29-31. 1 ref.
- 0214 MENGESHA, M.H., RAO, K.E.P., and RAO, S.A. 1981. Sorghum and millet genetic resources at ICRISAT. Patancheru, Andhra Pradesh, India: ICRISAT. 15 pp. (ICRISAT Genetic Resources Progress Report, 36).
- Outlines the objectives and activities of Genetic Resources Unit of ICRISAT and describes the strategies followed in collecting germplasm. Brings out the priority areas for future collection of sorghum and millet germplasm. Germplasm collection status at ICRISAT (Sept. 1981) is also presented indicating the area of origin of race.
- 0215 MERWINE, N.C., GOURLEY, L.M., and BLACKWELL, K.H. 1981. Inheritance of papery glume and cleistogamy in sorghum. *Crop Science* 21(6):953-956. 7 ref.
- Cleistogamous spikelets in Sorghum bicolor form when the inner glume is rolled, clasping the internal flower structures and preventing normal opening of the glumes. Cleistogamy is controlled by two independently inherited genes. Indurate (hard) glume is dominant to papery glume. The rolled glume condition is dominant to unrolled. Indurate glume is epistatic to rolling, and only papery glumes can exhibit rolling. The F<sub>2</sub> ratios from the cross (indurate glume x cleistogamous) show a good fit to a 12:3:1 ratio of indurate:cleistogamous (paperly-rolled): papery-unrolled. This cleistogamy cannot be used to breed hybrids resistant to sorghum midge because one parent would be cleistogamous and prevent production of hybrid seed.
- 0216 MILLER, F.R., and KEBEDE, Y. 1981. Genetic contributions to yield gains in sorghum over the past 30 years. *Agronomy Abstracts* 73:67-68.
- Changes in yield of sorghum have occurred with the introduction of hybrids in 1956. Yields increased substantially with heterosis and recognition of sorghum as a major

crop. This increased yield potential caused farmers to shift more inputs to the crop-better land, increased fertilizer, irrigation (where available) and pest control. In 1964, yellow endosperm germplasm was introduced which combined well with existing materials; heterosis was increased. The Sorghum Conversion Program was initiated in 1963, and released its first materials in 1970. New and previously unuseful germplasm was made available to breeding programs. Present hybrids differ by later maturity; nonsenescence; increased number of seeds/panicle, height, leaf areas; and insect and disease resistance.

0217 MISHRA, S.P., SINHA, S.K., and RAO, N.G.P. 1981. Genetic analysis of nitrate reductase activity in relation to yield heterosis in sorghum. Zeitschrift fuer Pflanzenzuchtung 86(1):11-19. 15 ref. (Summary: De).

Fourteen out of the 21 hybrids studied were heterotic for NR activity. NR activity was confined to low x low and low x medium combinations, but not observed in low x high combinations. Differences for NR activity were highly significant for males, crosses, parents Vs crosses and females Vs males. The differences among females were not significant. It is suggested that use of a high NR parent in a cross could possibly ensure a more than average NR activity in F1 hybrids. The genetic basis of NR activity studied in a line x tester mating system revealed that the nature of gene action for NR activity is non-additive.

0218 MU'ALLEM, AB.S. 1981. Sorghum germplasm in PDR Yemen. Plant Genetic Resources Newsletter 47:9-13. 4 ref. (Summaries: Es, Fr).

Collection of sorghum germplasm in PDR Yemen was started in 1969 with the establishment of Cereal Crops Unit within the Agronomy and Plant Breeding Section at El-Kod Agricultural Research Centre. Attempts have been

made to evaluate and register the entire collection.

0219 MUKURU, S.Z. 1981. Scope and breeding strategies to increase and maintain genetic diversity in the ICRISAT Sorghum Breeding Program. Patancheru, Andhra Pradesh, India: ICRISAT, Sorghum Improvement Program. 36 pp. 34 ref.

Discusses genetic diversity in sorghum, and highlights the value and necessity of developing diverse source breeding material to support and strengthen sorghum breeding programs at national and regional levels in the semi-arid tropics. Outlines the future breeding strategies to increase genetic diversity in breeding material and breeding for multiple desirable traits utilizing the best varieties from the various breeding projects.

0220 MURTHI, A.N., AYAD, W.G., and TOLL, J. 1981. Directory of germplasm collections. 3. Cereals. IV. Sorghum and millets. Rome, Italy: IBPGR. 37 pp. (AGP:IBPGR/81/55).

Information relating to the worldwide collection of sorghum and millets germplasm i.e. what genetic material is held where, is compiled. Lists of sorghum races and millet species are also appended.

0221 MURTHI, A.N., and PERRET, P.M. 1981. The IBPGR in relation to African crop genetic resources. Plant Genetic Resources Newsletter 46:31-36. (Summaries: Es, Fr).

Summarizes the activities of International Board for Plant Genetic Resources (IBPGR) on collection of germplasm of the crops originated or domesticated in Africa including sorghum and millets.

0222 MURTY, U.R., RAO, N.G.P., KIRTI, P.B., and BHARATHI, M. 1981. Breeding vybrids from facultative apomicts: a new concept in sorghum breeding. Cereal Research Communications 9(4):239-247. 19 ref. The F1 hybrids between the

synthesized lines behaved in a manner different from that of normal sexual F1's. Each time the F2 progeny contained a mixture of F1 looking heterotic plants and sexual segregates, the former occurring in a greater frequency. This resulted in formulating a new concept in sorghum breeding viz., breeding vybrids. Vybrids were defined as the progenies obtained from crossing two facultative apomicts, which reproduce through facultative apomixis. Yield level of these vybrids is expected to be intermediate between pure line varieties and hybrids. Vybrids could be perpetuated through seed harvested from F1 looking plants in each generation.

0223 MURTY, U.R., RAO, N.G.P., KIRTI, P.B., and BHARATHI, M. 1981. How to use apomixis in sorghum breeding? Presented at the All India Coordinated Sorghum Improvement Project Workshop 11-14 May 1981, Navsari, Gujarat, India. 3 pp.

Facultative apomixis has been found useful in (i) isolation of good agronomic lines from crosses of apomictic and natural sexual lines, and (ii) synthesis of vybrids which were found superior in performance to the parent varieties. Production of dihaploids which was unsuccessful through anther culture was found possible using apomixis. Procedural details to produce facultative apomicts and vybrids are also outlined.

0224 MURTY, U.R., RAO, N.G.P., KIRTI, P.B., and BHARATHI, M. 1981. In vivo production of dihaploid Sorghum bicolor (L.) Moench. Current Science 50(3): 142-143. 12 ref.

An apomictic line R-473 was crossed as a male to three other sorghum lines, IS-84, kafir-B and white seed, to find out the possibility of obtaining dihaploid individuals. It was found that the reproductive behaviour of R-473 was transferred to F2's. These F2's were heterozygotes and reproduced partly

through apospory and partly through synkaryogenesis. Individuals derived from latter were homozygous and have been termed as dihaploids.

0225 PARAMESWARAPPA, R., SHIVANNA, H., and GOWDA, B.T.S. 1981. Development of new male sterile lines with durra cytoplasm. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 2 pp. 2 ref.

Experiments were carried out on the kharif, and kharif x rabi derived lines at Dharwar, Karnataka, India. Twenty-two genotypes were used to pollinate M31-2A (dorra cytoplasm) and seeds were obtained in 19 crosses. Out of 19 crosses, 10 showed fertility in first back crossing and 5 showed fertility in ratoon cropping. Only two lines viz., 316B, and 358B were found sterile after 4th crossing.

0226 PATIDAR, H., and DABHOLKAR, A.R. 1981. Gene effects for grain size and yield in sorghum. Indian Journal of Genetics and Plant Breeding 41(2):259-263. 7 ref.

Observations were recorded on 5 randomly chosen competitive plants in each replication on (i) grain yield per plant, (ii) 1000 grain weight and (iii) volume of grains. Number of grains in a marked test tube were calculated to represent volume of grains. Analysis of generation means in three crosses showed additive gene action to be predominant for all the three characters.

0227 PAVA, H.M., and WEIBEL, D.E. 1981. Performance and heterosis of hybrid grain sorghum. CMU Journal of Agriculture, Food and Nutrition 3(2):128-143. 21 ref.

Eight parents ranging from high and low protein content and from very large, large, medium and small kernels were crossed to produce twenty eight hybrids. The parents and their hybrids were evaluated for heading date, plant height, head weight, grain yield, kernel weight, kernel number,

threshing percentage, percentage protein and protein yield. Heterosis in terms of deviations from mid parents and high parents were calculated for grain yield, kernel weight, kernel number, percentage protein and protein yield. From a comparison of F1 and parental data, significant ( $P^{1/4}.01$ ) heterosis was noticed for grain yield. Heterosis values for kernel weight and percentage protein were mostly negative, although some hybrids gave significant ( $P^{1/4}.01$ ) heterosis for both characters. It was observed that all hybrids exceeded their low parents for kernel weight.

0228 PREST, T.J. 1981. Heritability of lodging resistance and its association with other agronomic traits in a diverse sorghum population. Ph.D. thesis, Purdue University, West Lafayette, Indiana, USA. 63 pp.

0229 QUINBY, J.R. 1981. Interaction of genes and cytoplasm in male sterility in sorghum. Pages 175-184 In Proceedings, Thirty-fifth Annual Corn and Sorghum Industry Research Conference, 9-11 December 1980, Chicago, Illinois, USA. Washington, DC, USA: American Seed Trade Association. 17 ref.

Since it was known that CKP, a kafir of genotype 2 exists in its own B cytoplasm and in 3 additional cytoplasm, all of which make it male sterile, attempts were made to grow plants that can be used to determine hormone levels of one genotype in four different cytoplasm.

0230 RANA, B.S., RAO, V.J.M., REDDY, B.B., RAO, A.S., and RAO, N.G.P. 1981. Evaluation of different mating systems in sorghum. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 4 pp.

F1 and F2 generations of single (SC), back (BC), three way (TWC) and double crosses (DC) were examined to

propose a suitable breeding methodology for yield improvement in sorghum. Six parents selected on the basis of gca effects from a 15 x 15 diallel were used to generate BC, TWC and DCs. Dwarf varieties (D) CSV-4 and SPV-58 and tall variety (T) Gija 114 were found best general combiners. SCs and BCs were higher yielders as compared to parents. When crosses were classified on the basis of plant height, probability of obtaining high yielding plants was higher in DxT SC, (DxT) x D BC and (DxT)xD TWC.

0231 RANA, B.S., REDDY, C.S., RAO, V.J.M., and RAO, N.G.P. 1981. Apomixis in grain sorghums: analysis of seed set and effects of selection. Indian Journal of Genetics and Plant Breeding 41(1):118-123. 14 ref.

Seed set pattern in reciprocal crosses in two apomictic grain sorghum lines, 'R 473' and '302', was investigated. The seed set in 'R 473' was very limited in crosses. Plant to plant variation for seed set in crosses was present in 'R 473' indicating possible existence of different strains. 'R 473' carried the fertility reducer (-) cytoplasm and fertility promoter (+) nuclear genes, whereas '302' carried fertility promoter (+) cytoplasm and fertility reducer (-) nuclear genes. Therefore, 'R 473' as pollinator resulted in higher seed set in '302' cytoplasm while seed set in 'R 473 x 302' was the least. '302' was also cross-sterile like 'R 473'. There was evidence of some seed set under emasculation without pollination.

0232 RAO, K.E.P., and MENGESHA, M.H. 1981. A pointed collection of zera-zera sorghums in the Gambella area of Ethiopia. Patancheru, Andhra Pradesh, India: ICRISAT. 36 pp. 12 ref. (ICRISAT Genetic Resources Progress Report, 33).

A pointed collection was organized in the Gambella region of Ethiopia where zera-zera sorghums are extensively grown after receding of floods. Out of 150 samples collected,

146 samples were of sorghum. The collected samples belong to caudatum-guinea (zera-zera) (64), caudatum-guinea (others) (78) caudatum (3), and caudatum-bicolor (2). Almost all the samples were found agronomically superior, and it was felt that some of the lines could be a good source material in the breeding programs for broader genetic base.

0233 RAO, K.E.P., OBILANA, A.T., and MENGESHA, M.H. 1981. A pointed collection of Kaura, Fara-fara and Guineense sorghums in northern Nigeria. Patancheru, Andhra Pradesh, India: ICRISAT. 31 pp. 9 ref. (ICRISAT Genetic Resources Progress Report, 40).

The pointed collection of land races of sorghum was launched by ICRISAT in collaboration with the Institute of Agricultural Research, Samaru-Zaria, Nigeria. These land races are grown as rainfed crops in all ecological zones of northern Nigeria, and are well adapted to local conditions. Since it was not known how environment affects phenotype at ICRISAT Center, Patancheru, plant aspect scores were recorded for each accession at the time of collection, to form a basis on which to select parents for breeding programs. Field observations suggest resistance to pests and diseases, and drought tolerant genotypes among these collections.

0234 RAO, K.V., RAO, S.S., and RAO, N.G.P. 1981. Genotype x input-management interactions in sorghum. Indian Journal of Genetics and Plant Breeding 41(1):54-58. 3 ref.

Experiments involving hybrids and varieties were conducted each under high and low input-managements at six locations over a three-year period. The top ranking hybrids and varieties maintained their relative ranks under both types of inputs and managements. The rank correlations were highly significant. The genotype x input management interaction was significant

only in a few cases. Even here, the magnitude of the m.s. for this interaction was the lowest compared to m.s. for genotype or management. Estimates of heritability (relative to the test environment), and expected gain also revealed the advantages of selection under optimal environments.

0235 RAO, S.K., GUPTA, A.K., BAGHEL, S.S., and SINGH, S.P. 1981. Line x tester analysis of some quantitative characters in grain sorghum. JNKVV Research Journal 15(3):114-119. 16 ref. (Summary: Hindi).

The nature of gene action was studied using line x tester mating design for quantitative characters. Additive gene action was important for all characters studied as revealed by combining ability analysis. For days to maturity, both additive and non-additive gene actions were equally important. 61-9-1 was the best general combiner having negative g.c.a. effect for maturity and significant positive g.c.a. effect for cob length. Among female parents, 3677A appeared to be the best parent since it had a significant negative g.c.a. effect for flowering, maturity and plant height and positive g.c.a. effect for cob length. The desirable crosses were 648A x 61-1-1, 1036A x 61-9-1 and 3677A x 61-9-1 and 3677A x 61-1-1.

0236 RAO, V.J.M., REDDY, B.B., RANA, B.S., and RAO, N.G.P. 1981. Breeding for nutritional quality in sorghum. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 5 pp.

Studies were made on choice of parents, direction of the cross, the character associations, nature of gene action and mating systems to develop varieties with higher nutritional quality and yield. Crosses N-93 x P-721, N-49 x P-721 and N-55 x P-721 were found best, combining high levels of protein and lysine with plump seed.

0237 RAO, V.R. 1981. Germplasm

collection mission to Mozambique April-May 1981. Patancheru, Andhra Pradesh, India: ICRISAT. 31 pp. (ICRISAT Genetic Resources Progress Report, 35).

Describes a germplasm collection mission in Mozambique organized by the University of Eduardo Mondlane, National Institute of Research in Agronomy, Maputo, International Board for Plant Genetic Resources, and ICRISAT. A total of 199 samples were collected including 25 of sorghum.

0238 REDDY, B.B., RAO, M.J.V., RANA, B.S., RAO, V.J.M., and RAO, N.G.P. 1981. Internodal patterns and their significance in sorghum breeding. Indian Journal of Genetics and Plant Breeding 41(3):406-410. 10 ref.

Internodal patterns in exotic, Indian, hybrid and cross derivatives of sorghum have been investigated by fitting first, second and third degree polynomial curves. The behaviour of various groups and their comparison with high yielding hybrids indicate that the linear pattern may have an adaptive advantage. Besides alteration of plant type through recombination breeding for duration, dry matter production and distribution, the temperate-tropical crosses of sorghum also enable manipulation of internodal patterns.

0239 REDDY, B.B., RAO, V.J.M., RANA, B.S., and RAO, N.G.P. 1981. Basic genetic studies on growth and internodal patterns in sorghum. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 2 pp. 1 ref.

Three internodal patterns viz linear, quadratic and cubic were observed on hybrids and varieties from tropical x temperate crosses. Hybrids and high yielding varieties viz SPV-99, SPV-100 and SPV-314 had linear pattern. Four hybrids and 16 varieties from tropical x temperate crosses were compared for plant height, number of leaves, total dry matter, grain yield, harvest index,

days to 50% flowering and stem girth. Overall varietal yield levels were 20% less to hybrids but many varieties had comparable characters to hybrids. Yield increase was believed to come from increased production of biomass without changes in harvest index.

0240 REDDY, C.S., MURTHY, D.K., and RAO, N.G.P. 1981. Seedling growth stimulation and chromosome aberrations induced by solar eclipse in sorghum 8nd onion. Indian Journal of Experimental Biology 19(8):757-759. 17 ref.

Germinating seeds of sorghum and onion bulbs were exposed to sun during the entire period of solar eclipse on 16th February 1980 at Japal-Rangapur Observatory, Hyderabad. There was a significant increase in the growth of sorghum seedlings exposed to eclipse. Low frequency of chromosome aberrations such as bridges and/or fragments occurred in root tip cells of sorghum and onion exposed to solar eclipse. These results suggest that changes in the earth's atmosphere and fluctuations in radiations emitted during solar eclipse could be responsible for stimulation of seedling growth and induction of chromosome aberrations.

0241 REDDY, C.S., and RAO, N.G.P. 1981. Induced mutations in sorghum improvement. Proceedings of the Indian National Science Academy, Part B 47(3):427-446. 82 ref.

Reviews the different aspects of mutagen sensitivity, type of mutagen, and dose, techniques of handling and treatment procedure to maximize induction of mutations in sorghum. Describes the scope of induced mutations in solving problems of sorghum improvement viz. increasing the recombination potential of tropical x temperate crosses, improving the nutritional quality, diversification of male sterile cytoplasmic sources, better understanding of mechanism of apomixis, and augmenting levels of resistance to insects, pests and diseases.

0242 REDDY, C.S., and RAO, N.G.P. 1981. Induced seedling mutants in grain sorghum. Indian Journal of Experimental Biology 19(4):393-394. 9 ref.

Chlorophyll deficient mutants which can be used as genetic markers, were induced in an apomictic grain sorghum-R473. Virescent-14 died in about a week after the emergence of the 4th leaf, while virescent-31 and yellow-striped mutants turned completely green within a week and survived till maturity. There was proportionate reduction in the amount of chl. a and b in virescent-14 mutant compared to normal green seedlings. Whereas in virescent-31 and yellow-striped mutants, chl .b was much less than chl.a.

0243 REDDY, C.S., and SMITH, J.D. 1981. Induced systematic mutations and their significance in evolution of sorghum. Indian Journal of Genetics and Plant Breeding 41(3):334-339. 16 ref.

Systematic mutants were induced in a sorghum variety, Texas-414 by subjecting it to treatments with gamma rays, hydrazine, ethyl methanesulphonate, methyl methanesulphonate, singly and in combinations along with cysteine as pre-and post-treatment modifier. Caudatum spikelet type mutants occurred at higher frequency followed by guinea, kafir, bicolor and wild type, while Texas-414 possessed durra type spikelets. Also a number of intermediate races were obtained. The occurrence of these mutants resembling races of Sorghum bicolor spp. bicolor other than that used in the present study suggest that racial differentiation in cultivated sorghums proceeded through a series of independent mutations affecting grain and spikelet characteristics brought together under the influence of disruptive selection.

0244 REDDY, C.S., and SMITH, J.D. 1981. Mutagenic effects of

combination treatments of hydrazine, ethyl methanesulphonate and gamma rays in Sorghum bicolor (L.) Moench. Indian Journal of Botany 4(1):5-14. 17 ref.

The effect of gamma rays, hydrazine (HZ), and ethyl methanesulphonate (EMS) and their combinations on seed germination, seedling growth and seed set in M1 and frequency of chlorophyll and morphological mutations in M2 generation was studied in a cultivated grain sorghum variety, Texas-414. The combined treatments reduced seed germination more than additively while less than additive effects were observed in reducing the length of primary root, coleoptile and seedling height in M1 generation. Fertility reduction and survival was more than additive in combination treatments of HZ and EMS while it was less than additive in gamma + HZ treatments. In M2, chlorophyll mutations were less than additive in all combination treatments. The recovery of morphological mutations was more than additive in gamma + HZ treatments while it was less than additive in combination treatments of HZ and EMS.

0245 REDDY, C.S., and SMITH, J.D. 1981. Increased mutagenic efficiency of hydrazine following cysteine pre- and post-treatments in sorghum, Sorghum bicolor (L.) Moench. Indian Journal of Botany 4(1):103-110. 23 ref.

A method to increase the mutagenic efficiency of hydrazine (HZ) was investigated by using cysteine (CS) as modifier of mutagen while treating the seeds of sorghum. CS pre- and post-treatments of HZ treated material reduced the toxic effects of HZ in the M1 generation and a significant increase in the recovery of viable mutations was observed in the M2 generation, although only a slight increase in the recovery of chlorophyll mutations was observed, compared to HZ alone. At 0.01M HZ the mutagenic efficiency based on seedling injury was enhanced by four times,

while the efficiency estimates based on sterility were increased by 165%, with CS post-treatments. It has been postulated that CS pre- and post-treatments reduce the effects of diplontic selection by scavenging the free radicals produced by HZ which causes cellular injury, thereby increasing the possibility of transmission of mutations and their subsequent recovery in succeeding generations.

0246 REDDY, V.R.B., and YORK, J.O. 1981. Inheritance of pericarp and testa colors in certain of the Caudatum sorghums. *Agronomy Abstracts* 73:54.

In this study four strains of Caudatum (feterita) sorghums, 2266, 2403, 2801 and 3063 and four tester lines AK 3001R, AK 3003, Tam 617, and OK Dwf.Redlan were used. Yellow pericarp color resulted only when the factor Y was present in the dominant condition and the factor R was in the homozygous recessive condition. Red color was expressed when factors R, Y, and I were present in the dominant condition. When the intensifier factor I was homozygous recessive with R and Y being dominant a pink pericarp was found. White pericarp was produced only when Y, or both R and Y, were homozygous recessive. Brown pigment was found in the pericarps of kernels having red, pink, yellow, and white pericarps when factors B1, B2 and S were present in the dominant condition. It was confirmed that two complementary factors, B1 and B2, are responsible for the presence of a testa.

0247 REDDY, Y.R.N. 1981. Line x tester analysis to identify potential seed parents among non-restorer lines in sorghum (*Sorghum bicolor* (L.) Moench). M.Sc. thesis, Andhra Pradesh Agricultural University, Hyderabad, Andhra Pradesh, India. 55 pp.

A line x tester experiment using 20-non-restorer lines as pollen parents and 5 cytoplasmic genetic

male-sterile lines as seed parents (testers) was undertaken. Resulting 100 male sterile hybrids and 25 parents were planted in the kharif season at ICRISAT, Patancheru, India, as two separate experiments along with pollinator bulk to provide the pollen for F1 hybrids. Observations were recorded on days to bloom, plant height, grain yield and head yield per plant, head length, 500 grain weight, plot grain yield and head yield. The seed set on hybrids and male-sterile lines was normal and grain yield was satisfactory. L1, L8 and L12 were found to be good non-restorer lines followed by L15 and L19 and were recommended for conversion to A-B lines by the substitution backcross program for use as female parents in developing hybrids.

0248 ROMERO HERRERA, I., 1981. The harvest index as selection criteria for yield in two sorghum populations, using three methods of familial selection. (Es). M.S. thesis, Escuela Nacional de Agricultura, Chapingo, Mexico. 200 pp.

0249 ROSS, W.M., KOFOID, K.D., MARANVILLE, J.W., and VOIGT, R.L. 1981. Selecting for grain protein and yield in sorghum random-mating populations. *Crop Science* 21(5):774-777. 12 ref.

Grain protein and grain yield relationships were studied in six Sorghum bicolor populations. Means, variance components, heritabilities, genetic and environmental correlations, and expected correlated responses were determined. Change from the first selection cycle to the second cycle was significant by mass selection for both high and low grain protein percentage in NP7BR. Populations selected for grain yield produced more protein per ha than did populations selected for protein. In all populations, the expected correlated response of protein or of yield was negative when the other trait was selected. Selection for protein yield would be expected to



result in yield advances equal to selection for yield per se without drastic decreases in grain protein, but high environmental correlations between grain yield and protein yield would exist.

0250 SCHERTZ, K.F., PRING, D.R., and ROSS, W.M. 1981. Sorghum cytoplasmic sterility. *Agronomy Abstracts* 73:72.

To determine, that cytoplasm from diverse sources differ in sterility induction and in organelle DNA characteristics, observations were made of previously developed cytoplasmic male steriles and male steriles derived by intercrossing lines from the Sorghum Conversion Program. Sterility was determined of test-cross progenies grown at two locations in each of two year6. DNA characteristics were determined by use of restriction endonuclease and gel electrophoresis. Some cytoplasm studied probably differ in sterility induction and many of these cytoplasm also differ in mitochondrial and chloroplast DNA characteristics.

0251 SHARMA, D. 1981. Sorghum. Pages 26-57 In Plant breeding report 1981. Tamale, Ghana: Ghanaian German Crops Research Project.

0252 SHEWRY, P.R., MIFLIN, B.J., FORDE, B.G., and BRIGHT, S.W.J. 1981. Conventional and novel approaches to the improvement of the nutritional quality of cereal and legume seeds. *Science Progress* 67(268):575-600. 57 ref.

0253 SHINDE, V.K. 1981. Genetic variability interrelationships and path analysis of yield and its components in sorghum (*Sorghum bicolor* L.). *Journal of Maharashtra Agricultural Universities* 6(1):30-32. 8 ref.

Twenty advanced generation progenies derived from two exotic x Indian crosses, viz., M 35-1 x I.S.84 and M 35-1 x I.S.3691 were evaluated during rabi, 1977. Significant positive genotypic correlation was

observed between test weight and yield, weight of panicle and yield, plant height and test weight, and number of leaves and test weight. Path analysis revealed that the plant height influenced grain yield through test weight.

0254 SHINDE, V.K., and SUDEWAD, S.M. 1981. Line x tester analysis of combining ability in sorghum (*Sorghum bicolor* L. Moench). *Journal of Maharashtra Agricultural Universities* 6(3):215-218. 3 ref.

Combining ability analysis was performed for four quantitative characters in a set of line x tester mating system, using five male steriles viz., 2219-A, 1036-A, 36-A, 1202-A and 296-A as females and five restorers viz., PVK-1, PVK-2, PVK-3, PVK-9 and PVK-16-1 as males. PVK-16-1 was found to be a good general combiner for length of panicle, while PVK-3 and PVK-9 for test weight. Amongst females, 296-A was the general combiner for grain yield. The crosses 296-A x PVK 9 and 296-A x PVK-16-1 recorded high positive and significant g.c.a effects for grain yield per plant. Non-additive gene action was involved in grain yield per plant, while other characters were governed mainly by additive type of gene action.

0255 THANKY, H.H., DESAI, K.B., and TIKKA, S.B.S. 1981. Heterosis and combining ability in grain sorghum (*Sorghum bicolor* (L.) Moench). *Gujarat Agricultural University Research Journal* 6(2):65-71. 6 ref.

The maximum heterosis was expressed by the plant height and earhead length. The next in descending order were seed size, days to maturity, panicle width, grain yield and days to 50% bloom. Hybrids involving locals were higher yielding and early in maturity. For grain yield and its associated characters additive genetic variance was found in preponderance. In certain cross combinations and for yield contributing components, non-additive

genetic variance was also observed in predominance indicating the utility of conventional and heterosis breeding for sorghum improvement work. The local varieties B.P.53, Sona-108 and Surat-1 emerged as good general combiners but they were tall and late in maturity. Hence these varieties are recommended to be converted into suitable types to be used in hybrid production.

0256 TRIPATHI, D.P., MEHTA, S.L., and RAO, N.G.P. 1981. Soluble protein and isoenzymes from anthers of diverse male steriles in sorghum. Indian Journal of Genetics and Plant Breeding 41(1):170-177. 6 ref.

Soluble protein, esterase and peroxidase isoenzyme pattern were studied in anthers of diverse sorghum male steriles and their maintainers. Soluble protein pattern of sterile and corresponding maintainer line showed qualitative and quantitative differences. Based on esterase isoenzyme pattern the diverse male steriles and maintainers could be classified in three groups. Peroxidase pattern also showed characteristics but not so clearcut differences.

0257 XU, R.Y., and ZHAO, S.T. 1981. Combining pattern of characters kinship and fertility of parental material in sorghum. (Ch). Shanxi Nongye Kexue 6:4-7.

0258 ZHANG, W.J. ZHANG, C.S., TANG, X.Q., LI, X.Q., and SU, Y.M. 1981. Heterosis and isozyme in sorghum. (Ch). Acta Botanica Sinica 23(6):507-510. 7 ref.

0259 ZHOU, G., ZEN, Y., and YANG, W. 1981. The molecular basis of remote hybridization: an evidence for the possible integration of sorghum DNA into rice genome. Scientia Sinica 24(5):701-709. 29 ref.

The stabilized F13-14 offsprings of rice x sorghum hybrid retain the entire set of unaltered chromosomes from their maternal rice plant but

exhibit a great variety of distinct phenotypes. Isozyme analysis showed that a new esterase band which exists only in sorghum has been found in the stabilized rice x sorghum offsprings. Integration of a small portion of the sorghum (Hegari) DNA into the rice (yinfang) genome was indicated by DNA reassociation kinetic experiments. These results suggest that DNA segment integration could occur in this kind of hybridization between remotely related subjects.

## Hybrids, Varieties, and Performance Trials

0260 ANONYMOUS. 1981. Sorghum in brief. (Fr). Memorisation et Technique Agricole 28:77-84.

0261 ANONYMOUS. 1981. Sorghum varieties. (Fr). Cultivars 136:59.

0262 ABUELGASIM, E.H.H. 1981. Obeid Research Station. Pages 173-178 In Gezira Research Station and Sub-stations annual report 1974/75. Gezira, Sudan: Ministry of Agriculture, Food and Natural Resources.

Experiments were conducted at Kaba and Goz Ashgar Central Reserved Forest under Obeid Sub-station which included variety trials on sesame, sorghum, groundnuts and pearl millet. Sixteen varieties including one local variety (Safra Habasheya) were grown in a randomized complete block trial with 3 replications. Data are presented on grain yield, plant population, grain weight, threshing, no. of heads per plant, days to 50% flowering and plant height. Results indicate that yield ranged from 133-479 kg/feddan. Dwarf white milo gave the highest mean yield with largest grain size and earliest to flower.

0263 ANTOHE, I., COSMIN, O., ILICEVICI, S., VLAS, I., BARBULESCU, A., GRECU, E., SCURTU, M., COSEREA,

- V., RIZEA, A., SAVULESCU, V., and DASCALU, D. 1981. Experimental data on the development of grain sorghum hybrids. (Ro). Analele Institutului de Cercetari Pentru Cereale si Plante Tehnice 47:43-53. 7 ref. (Summaries: En, Ru).
- 0264 ARGENTINA: SECRETARIA DE ESTADO DE AGRICULTURA Y GANADERIA, SERVICIO NACIONAL DE SEMILLAS. 1981. Sorghum: the 1981 planting advices. Sorghum hybrids and varieties indicated for the producing sub-regions. (Es). Informacion Agropecuaria 4(21):10-13.
- 0265 ATKINS, R.E., MOELLER, L.W., LOTHROP, J.E., and KWOLEK, T.F. 1981. Grain sorghum performance tests 1979-81. Ames, Iowa, USA: Iowa State University. 6 pp.
- Thirty-two hybrids from commercial seed companies and 17 hybrids released by 6 state experiment stations were planted at 4 different locations in Iowa State for performance tests during 1981. Data are presented relating to brand, entry no., days to midbloom, plant height and grain yield in bushels/acre.
- 0266 BRACY, R., MASON, L., and ALLEN, M. 1981. Performance of grain sorghum hybrids for grain and silage production 1981. Pages 13-18 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.
- Fifteen grain sorghum hybrids were evaluated for grain and silage production. Data were recorded for grain yield, height and head type. Yields ranged from 4107 lb/acre for Funk's G-516 BR to 3209 lb/acre for Funk's G-622 GBR. Height of the plants varied from 4.0 to 5.3 ft. Most of the varieties were semi-open to open-head types. Pennington BR and Funk's G-516 BR were the highest yielding varieties over the 3 years, 1979-81. Forage yields and related data on grain sorghums harvested for silage were also recorded. Green yield ranged from 10.0 to 14.8 t/acre while dry yield varied from 3.4-4.9 t/acre. Dekalb BR-64 had the highest dry matter content at harvest with 42.5%.
- 0267 CLARK, L.E., and PIETSCH, D. 1981. Grain sorghum yield performance Chillicothe 1980. Progress Report, Texas Agricultural Experiment Station no.3730. 15 pp. 2 ref.
- Thirty-three hybrids were grown to evaluate their field performance and utilization as food and feed. Seed of hybrids were planted in 40 inch rows in 2 row, 25-foot plots and replicated 4 times. The test was planted in a randomized block with restricted randomization. Data were collected on days to 50% flower, plant height, head exertion, moisture percent, test weight, lodging, maturity classes, threshing percent, yield, and statistical significance. The mean yield of the test was 1,645 lb/acre and the yield of medium maturity hybrids was approximately 400 lb/acre greater.
- 0268 DE SOUZA MEDEIROS, A.C. 1981. Performance of genotypes of saccharine sorghum and grain sorghum in the "Cerrado" area. (Pt). Pesquisa em Andamento 9:1-5.
- 0269 DENMAN, C.E., MORRISON, R.D., MCNEW, R.W., PECK, R.A., REEVES, H.E., and JORDAN, J.D. 1981. Performance tests of hybrid sorghums and corn in Oklahoma 1980. Research Report, Oklahoma Agricultural Experiment Station no.P804. 35 pp.
- Performance trials of 121 grain, 30 forage, and 40 sudangrass type sorghum hybrids were conducted at 7, 5, and 4 locations respectively. Total rainfall was below normal and summer temperatures were above normal with prolonged period of drought at all locations. The grain and forage tests were abandoned at all dryland locations except Boise city location in Panhandle area (for grains) and Perkins Agronomy Research Station (for forage). Yields of grain were above

- average at Boise city while forage yields were very low at Perkins Agronomy Research Station. Yields were obtained for sudangrass at all locations where tested but dryland results were very poor.
- 0270 DESIDERIO, E. 1981. On maize and grain sorghum: synthesis of results for the first trial year. (It). *Agricoltura Ricerca* 4(1):19-33. 20 ref.
- 0271 DREIER, A.F., NORDQUIST, P.T., GRABOUSKI, P.H., and NELSON, L.A. 1981. Nebraska grain sorghum performance tests 1980. University of Nebraska Cooperative Extension Service no.81-106. 31 pp.
- 0272 EL SUNNI, M. 1981. Sorghum: cultivating friends. *Sudanow* 6(9):11.
- 0273 FEYT, H. 1981. Grain sorghum varieties: results of 1980 trials. (Fr). *Perspectives Agricoles* 46:16-18.
- 0274 FINKNER, R.E., ARLEDGE, J.S., BARNES, C.E., GREGORY, E.J., ARNOLD, R.N., HOOKS, R.F., and LUGG, D.G. 1981. Test yields of sorghum and corn 1980, Research Report, New Mexico Agricultural Experiment Station no.443. 47 pp.
- Hybrids and varieties of sorghum (grain and forage), sorghum-sudangrass hybrids and corn were evaluated for adaptability and performance at Artesia, Clovis, Farmington, Cruces, and Los Lunas (USA). Results showed that the average grain yields of all hybrids tested at Clovis and Farmington were less than the previous year i.e. 1979 except hybrid Ranchero which produced over 10,000 lb/acre at Clovis. The highest forage yields were recorded at Los Cruces where seven hybrids produced 10 tons or more of dry forage per acre. Yields of sorghum-sudangrass hybrids at Artesia were the highest of the five locations averaging 52.4 tons of green or 14.4 tons of dry forage per acre.
- 0275 FRANCE: INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE. 1981. Grain maize, grain sorghum. (Fr). Versailles, France: Institut National de la Recherche Agronomique. 161 pp.
- 0276 FRANCE: INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE. 1981. Varieties bulletin 1981, grain-maize, grain-sorghum: provisional descriptive notices of varieties registered in 1981. (Fr). Versailles, France: Institut National de la Recherche Agronomique. 203 pp.
- 0277 GERIK, T.J., and PIETSCH, D. 1981. Grain sorghum hybrid performance, Temple, Texas 1980. Progress Report, Texas Agricultural Experiment Station no.3729. 15 pp. 2 ref.
- Hybrids to be evaluated were grown in two rows spaced 27 inches apart and 30 feet in length. Data were collected on days to 50% flowering, plant height, head exertion, moisture percent lodging, midge and bird damage, maturity classes, threshing percent, yield, and statistical significance. The yields attained by hybrids in 1980 performance test were greater than those obtained by producers in the area. Yields averaged 3857, 4134, 3595 lb/acre for early, medium and medium late maturity class hybrids respectively.
- 0278 GOURLEY, L.M., EDWARDS, N.C., SANDERS, T.G., BUEHRING, N.W., and HARMAN, R.D. 1981. Mississippi grain sorghum performance trials 1980. Information Sheet, Mississippi Agricultural and Forestry Experiment Station no.1310. 4 pp.
- 0279 GRAVES, C.R. 1981. Performance of field crop varieties 1980. Bulletin, Tennessee Agricultural Experiment Station no.600. 84 pp.
- 0280 HEGAB, A.E. 1981. Evaluation of grain and forage sorghum varieties for the Virgin Islands. *Agronomy Abstracts* 73:49.

An experiment was initiated in November 1980 to evaluate 16 commercial varieties of grain and forage sorghum at the Virgin Islands, Agricultural Experiment Station. Yield and quality of grain and forage sorghum were affected by soil, pests, and climatic conditions of St. Croix. Pioneer varieties were the best adapted with Pioneer 8815 (grain sorghum) yielding 3300 kg/ha. The sweet Sioux (forage sorghum) had the highest yield of all forage varieties with 11 tons/acre. Preliminary data showed that the second cut of all the forage varieties was higher yielding than the first. Pioneer W 921 was the best pest and disease resistant variety.

One sorghum hybrid trial and two advanced sorghum varietal trials were conducted to study the yield in relation to days of maturity. Hybrid MSH-37, and varieties CSV-4 and SPV-372 were found superior to others and more suited to the command area. Conclusions could not be drawn in an experiment to evaluate the efficacy of insecticides for control of sorghum shoot fly due to low pest incidence during the period under study. Experiment to know the effect of different dates of sowing on grain yield revealed that early planting gives highest returns. Among different kharif crops soybean yields were highest followed by sorghum and pigeonpea.

0281 INDIA: MINISTRY OF AGRICULTURE, DIRECTORATE OF MILLETS DEVELOPMENT. 1981. A note on the performance of jowar hybrids and varieties in the minikit demonstrations. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 7 pp.

Minikit demonstrations were conducted during kharif 1980 to review the yield performance of CSH-5, CSH-6 and CSH-9 along with a few promising varieties in major sorghum growing Indian states. Results revealed that the hybrid CSH-5 is best and well adapted to most of the states for kharif followed by CSH-9 which was found better suited to Maharashtra and Karnataka and gave higher fodder output. In lower rainfall areas CSH-6 proved to be better than the other two hybrids. The varieties gave much lower yield than hybrids. Out of the varieties tested, SB-905, SPV-102 and K-5 were found better in Karnataka, Maharashtra and Tamil Nadu respectively.

0282 INDIA: RAJASTHAN COMMAND AREA DEVELOPMENT. 1981. Sorghum. Pages 1-5 In Technical report: other crops 1981. Kota, Rajasthan, India: Agriculture Adaptive Trials and Field Verification Centre.

0283 LOPEZ, J.V. 1981. Statistics and behavior of grain sorghum hybrid cultivars during the period 1980/81. (Es). Informativo de Tecnologia Agropecuaria para la Region Semiarida Pampeana 77:8-13.

0284 MASSINO, I.V. 1981. Sorghum cv. Uzbekskoe 5. (Ru). Kukuruz 1:30.

0285 MENA T., H. 1981. Regional trial on sorghum 1981. (Es). Maracay, Venezuela: Fondo Nacional de Investigaciones Agropecuarias. 23 pp.

0286 OBILANA, A.T. 1981. New sorghum varieties for three Nigerian Savanna ecological zones. Pages 54-64 In Proceedings, Fifth NAFFP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University.

Six new pure line varieties, K.S.V.11, K.S.V.12, K.S.V.7, K.S.V.8, and S.S.V.9, S.S.V.10, adapted to the northern Sudan savanna (and Sahel), Sudan savanna, and the northern guinea savanna, respectively, were developed by the Sorghum Breeding Unit of the Institute for Agricultural Research, Samaru. The synthesis and characteristics of these varieties are described and their performance in relation to corresponding elite lines

- and check varieties are discussed. The varieties have been selected based on a combination of desirable factors of adaptability, acceptable plant height, seed colour and quality, resistance/tolerance to Striga and high yield.
- 0287 OBILANA, A.T. 1981. Sorghum hybrids for Nigeria: a step forward towards increasing crop protection. Pages 65-74 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 3 ref.
- Three high yielding F1 hybrids, S.S.H.3, S.S.H.4 and S.S.H.5, have been developed from the sorghum breeding research activities of the Institute for Agricultural Research. The synthesis and characteristics of the hybrids are described and their performance relative to other experimental hybrids and elite pure line varieties are discussed. These F1 hybrids significantly outyield the existing best pure line varieties by 10% to 43%, under unfavourable drought conditions in the growing season, and at a population density of 37,000 plant/ha.
- 0288 PAVA, H.M. 1981. CMU-Var 2: new grain sorghum variety. CMU Journal of Agriculture, Food and Nutrition 3(3):272-273.
- Describes the agronomic characters of a new grain sorghum variety CMU-VAR 2 developed from a cross between Redland and (A-Wheatland x Collubi) x (ROKY 7). This variety with tall and robust stalk is able to withstand lodging or strong winds and resistant to insect pests and diseases, with a yield of 5-7 t/ha of grains under fertilizer rate of 90-45-45 kg NPK/ha.
- 0289 PEREZ, F., and AREVALO, C. 1981. Comparative trials with commercial sorghum grain cultivars. (Es). Revista Industrial y Agricola de Tucuman 58(1):1-13. 4 ref.
- 0290 RAO, N.G.P., RANA, B.S., RAO, V.J.M., and REDDY, B.B. 1981. New hybrids and varieties of sorghum and their performance. Indian Journal of Genetics and Plant Breeding 41(2):213-219. 4 ref.
- The performance of some of the newly developed hybrids and varieties during the kharif season in India over a three year period has been examined. The hybrid SPH-61 (CSH-9) was consistently superior and most stable in yield performance. Hybrids were generally superior in performance and stability compared to improved varieties, but the latter did reflect significant improvement over local cultivars and could supplement hybrids to accomplish greater coverage.
- 0291 ROMANIA: INSTITUTUL DE CEKETARI PENTRU CEREALE SI PLANTE TEHNICE. 1981. Single grain sorghum hybrid bred at the Research Institute for Cereals and Industrial Crops, Fundulea. (Ro). Productia Vegetala, Cereale si Plante Tehnice 33(5):49.
- 0292 ROSENOW, D.T., JOHNSON, J.W., and PLETSCHE, D. 1981. Grain sorghum hybrid performance Lubbock, Texas 1980. Progress Report, Texas Agricultural Experiment Station no.3731. 21 pp. 2 ref.
- Eighty-eight hybrids were tested for their performance under irrigated condition while 61 were evaluated under non-irrigated condition. Data were collected on days to 50% flower, plant height, head exertion, leaf and plant death rating, bird damage, test weight, moisture percent, threshing percent, and yield for irrigated and non-irrigated te6ts. Hybrids were placed into three maturity groups viz. medium, medium late, and late. Mean yield of irrigated hybrids was more than non-irrigated hybrids.
- 0293 SCANTAMBURLO, J.L., BUCAR, A.C., DOMANSKI, C.E., and GAMBA, R.D. 1981. Evaluation of a sorghum collection at the INTA Agricultural Experiment Station in Manfredi 1948-1980: expanded and updated. (En, Es).

Manfredi, Argentina: Instituto Nacional de Tecnologia Agropecuaria. 158 pp.

A breeding plan was proposed to initiate the formation, study, maintenance and gradual increase of a collection of species and annual varieties of sorghum. Records are kept of phenological data, characteristics of the plant and grain, climatic adversities and plant reactions to pests. Evaluations are coded with symbols and observations are recorded for a minimum of three seasons. Seeds from this collection are supplied to companies, universities and research institutes.

0294 SPAIN: INSTITUTO NACIONAL DE SEMILLAS Y PLANTAS DE VIVERO. 1981. Varieties register, assays on the agronomic value: sorghum 1978-79/1979-80 campaigns. (Es). Madrid, Spain: Instituto Nacional de Semillas y Plantas de Vivero. 87 pp.

0295 UBI, E.O. 1981. Farmers' observations on two sorghum varieties. AERLS Newsletter 7(1):21-23.

Two sorghum varieties, viz. Ex-bauchi, and L187, have been evaluated from the views of farmers in Sudan and Sahel ecological zones. Grain size and total yield of both varieties were higher than their local varieties and grains were threshed easily. The flour expanded greatly making more stuff than local variety. Overnight storing of already prepared stuff (Tuwo) was easier and its previous day's quality was also retained.

0296 UBI, E.O. 1981. Review of 1980 NAFPP activities on sorghum/millet. Pages 28-43 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University.

Out of 747 trials conducted on the farmers' plots, 434 trials were on sorghum which included sorghum minikit trials, production trials, variety trials, and fertilizers trials. Yield

data from the states are summarized. Yield from pre-minikit trial on sowing data showed that earlier planting gave relatively higher yield.

0297 UNDERSANDER, D.J., REGIER, C., and PIETSCH, D. 1981. Grain sorghum hybrid performance Etter, Texas 1980. Progress Report, Texas Agricultural Experiment Station no.3728. 17 pp. 2 ref.

Ninety-three sorghum hybrids were tested for their performance. Good management and a timely irrigation schedule resulted in above normal grain yields. The test mean yield was 5985 lb/acre, while two hybrids in each of the medium-late, and the late maturity classes produced over 7000 lb/acre. Green bugs were observed in the test but populations were minimal and did not warrant chemical control. Bird or midge damage was not observed.

0298 UNGENFUKHT, V.F., and LARINA, V.V. 1981. Highly yielding sorghum hybrid. (Ru). Seleksiya i Semenovodstvo 5:33-34.

0299 UNITED STATES: UNIVERSITY OF GEORGIA, COLLEGE OF AGRICULTURE EXPERIMENT STATIONS. 1981. Corn and grain sorghum performance tests 1980. Research Report, Georgia Agriculture Experiment Stations no.370. 54 pp.

0300 VIATOR, H.P., BOQUET, D.J., HUTCHINSON, R.L., MARSHALL, J.G., and RABB, J.L. 1981. Performance of grain sorghum hybrids in Louisiana 1980. Agronomy Research Report, Louisiana Agricultural Experiment Station no.66. 14 pp.

Presents information on grain yields and performance under environmental and disease conditions of commercially available hybrids.

0301 VLAS, I., and STEPANESCU, E. 1981. Cultivation of hybrid grain sorghum under the conditions of the Socodor drained solonetz soils. (Ro). Analele Institutului de Cercetari Pentru Cereale si Plante Tehnice 47:55-59. 5 ref. (Summaries: En, Ru).

0302 YASSIN, T.E.S. 1981. Crop breeding. Pages 222-230 In Gezira Research Station and Sub-stations annual report 1974-75. Gezira, Sudan: Ministry of Agriculture, Food and Natural Resources.

Sorghum variety trial (local material), FAO sorghum yield nursery, and sorghum sowing date and seed rate experiments were conducted at Kadugli (Sudan) during 1974-75. Out of local varieties, four kulum strains gave the highest yields and were tall and late, and their grain color was red and of reasonable size. Out of 23 varieties from six countries and received from FAO Near East Regional Office, variety CE 90 16-3 from Senegal was the best. No significant differences in yield were found due to seed rate. However, early sowing gave high yields.

0303 YORK, J.O. 1981. Arkansas grain sorghum performance tests for 1980. Mimeograph Series, Arkansas Agricultural Experiment Station no.286. 15 pp.

Grain sorghum hybrids entered by commercial, state, and local agencies were tested to compare hybrids under the existing environment. Tests were conducted at 7 different locations. Results are presented locationwise and data are presented regarding yield of bushels/acre, average yield for 3 and 5 years, plant height, plant uniformity, head exertion, head compactness, days to flowering, bird damage, and test weight.

## AGROCLIMATOLOGY

0304 COMMONWEALTH BUREAU OF PASTURES AND FIELD CROPS. 1981. Sorghum and millets: solar radiation effects 1948-72. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 8 pp. 51 ref. (Annotated Bibliography G537).

0305 COMMONWEALTH BUREAU OF PASTURES

AND FIELD CROPS. 1981. Sorghum and millets: solar radiation effects 1973-80. Maidenhead, Berks, UK: Commonwealth Bureau of Pastures and Field Crops. 34 pp. 118 ref. (Annotated Bibliography G537A).

0306 DANJO, T., and MAEDA, Y. 1981. Effects of meteorological condition on the development of rachis branches and spikelets of grain sorghum. (Ja). Kinki Chugoku Agricultural Research 61:15-18. 6 ref.

0307 GARDNER, B.R., BLAD, B.L., GARRITY, D.P., and WATTS, D.G. 1981. Relationships between crop temperature, grain yield, evapotranspiration and phenological development in two hybrids of moisture stressed sorghum. Irrigation Science 2(4):213-224. 19 ref.

This study was conducted on a Typic Ustipsamment (Valentine fine sand) soil to establish relationship between crop temperature and the grain yields, phenological development, evapotranspiration rates (ET) and leaf water potential of two hybrids of Sorghum bicolor subjected to varying levels of plant water stress. The sorghum hybrids used were RS 626 and NB 505. Four irrigation treatments were applied to the crops for varying levels of water stress during each of three major growth stages. Soil moisture was monitored with a neutron probe. ET was estimated with the water balance technique. Crop temperature was measured with an IR thermometer and leaf water potential was measured with a Scholander pressure bomb. Grain yields were reduced by water stress occurring at anytime during the growing season.

0308 JAMES, R.C., and EDDY, R.L. 1981. The effects of precipitation enhancement as viewed through crop growth models. 1. A grain sorghum model. Bulletin of the American Meteorological Society 62(5):726.

0309 KARIM, N.H., and RUELKE, O.C. 1981. Influence of time and crop



canopy on the diurnal changes in soil, air and leaf temperatures. Bangladesh Journal of Botany 10(1):82-85. 5 ref.

The temperature of bare land, sorghum field and leaf were taken from a field at the University of Florida in October 1975. There was a clear and drastic change of temperature at different times of the day both in bare and canopy land covered by plants. There was a slight difference in leaf and air temperature at the same heights.

0310 RODELLA, R.A., and ANDRADE, V.M.M. 1981. Phenological characteristics of four sorghums (*Sorghum bicolor* (L.) Moench). (Pt). Cientifica 9(1):121-128. 11 ref.

Four cultivars ("Huerin Inta", "Granador Inta", "Contibrasil 101" and "Te-Total") were studied comparatively in relation to crop phenology. Two experiments were carried out on different planting dates: March 19, 1976 (late) and December 20, 1976 (normal). As to the stages of plant development, the crop cycle was longer at the later planting date. The most precocious cultivars in both plantings were "Huerin Inta" and "Granador Inta".

0311 SCHAFFER, J.A. 1981. The effect of planting data and environment on the phenology and modeling of grain sorghum, *Sorghum bicolor* (L.) Moench. Ph.D. thesis, Kansas State University, Manhattan, Kansas, USA. 117 pp.

0312 SWINDALE, L.D., VIRMANI, S.M., and SIVAKUMAR, M.V.K. 1981. Climatic variability and crop yields in the semi-arid tropics. Pages 139-166 In Food-climate interactions (eds. W.Bach, J.Pankrath, and S.H.Schneider). Dordrecht, Netherlands: D.Reidel Publishing Company. 38 ref.

Rainfed farming is risky in semi-arid tropics and farmers are reluctant to invest in crop production. Traditional agriculture means low but stable yields, low

inputs, mixed cropping, large families, low incomes and living standards and outmigration of family members, both seasonal and permanent. Only about 4% of the arable land of the semi-arid tropics is irrigated. New technologies that reduce the risks of farming in the rainfed semi-arid tropics include improved soil and water management on watershed-based land units, the use of fertilizers and improved seeds, improved cropping systems and supplementary irrigation. The productivity of traditional agriculture is declining and the threat of serious food shortages is rising but the potential for the semi-arid tropics to feed itself in all but the driest years does exist. Institutional and infrastructural improvements will be necessary for this potential to be reached.

0313 TAYLOR, T.W., and RAVET, F. 1981. A meteorologically driven grain sorghum stress indicator model. Houston, Texas, USA: Lyndon B.Johnson Space Center. 11, 4 pp.

## SOIL SCIENCE

0314 BALIGAR, V.C., NASH, V.E., WHISLER, F.D., and MYHRE, D.L. 1981. Sorghum and soybean growth as influenced by synthetic pans. Communications in Soil Science and Plant Analysis 12(1):97-107. 25 ref.

Observations were made on the root growth of sorghum and soybeans grown in containers of soil in which one layer was varied in bulk density, thickness and depth from surface. The physical properties of pans were related to the growth of sorghum and soybeans under controlled conditions. With an increase in the bulk density of the compacted layer the root growth was reduced. A bulk density of the compacted layer greater than 1.85 g.cm<sup>-3</sup> affected the root weight. Above the high density layer, roots grew laterally rather than

longitudinally. Root growth below the compacted layer was entirely dependent on the root growth in the compacted layer. Root growth was affected not only by the resistance of the compacted layer but also by its depth and thickness.

0315 CHEW, W.Y., JOSEPH, K.T., and RAMLI, K. 1981. Influence of liming and soil pH on sorghum (*S.bicolor*) and groundnut (*Arachis hypogaea*) in acid tropical Malaysian peat. *Experimental Agriculture* 17(2):163-169. 6 ref.

Groundnut and sorghum seed yield and crop residue showed parabolic responses to peat pH and liming, but groundnut seed yield correlated poorly with soil pH ( $r^2=0.38$ ,  $P=0.05$ ), compared with its crop residue as well as with sorghum seed and residue ( $r^2=0.75$ ,  $0.76$ , and  $0.79$ , respectively,  $P=0.01$ ). Groundnut was more tolerant of peat acidity than sorghum, giving higher plant survival in unlimed plots, optimum seed and residue at pH 4.60 compared with 5.70 for sorghum, and reduced responsiveness to pH increase. Seed and residue to both crops decreased with continuous cropping, probably because of increasing pest and disease incidence and depletion of available soil nutrients.

0316 HAVLIN, J.L., and SOLTANPOUR, P.N. 1981. Evaluation of the  $NH_4HC0_3$ -DTPA soil test for iron and zinc. *Soil Science Society of America Journal* 45(1): 70-75. 26 ref.

Greenhouse studies were carried out to evaluate the ability of the  $NH_4HC0_3$ -DTPA soil test to separate Fe and Zn deficient from nondeficient soils. Forty Colorado soils, including 11 benchmark soils, having wide ranges in extractable levels of Fe and Zn were chosen. The soil test was found effective. The critical Fe level for sorghum was established at 4.8 ppm, whereas the critical Zn level for corn was 0.9 ppm.

0317 INUYAMA, S. 1981. Effectiveness of straw mulch for

alleviating drought stress of grain sorghum. (Ja). *Japanese Journal of Crop Science* 50(2):217-222. 11 ref. (Summary: En).

F1 hybrid variety, E59, was planted in four treatments: irrigation-straw mulch, irrigation-no mulch, no irrigation-straw mulch, and no irrigation-no mulch treatments with three replications. The growth of grain sorghum was not accelerated by mulch under irrigated conditions. However, the growth in mulch treatment was more vigorous under unirrigated conditions. Grain yields harvested on August 20 were high in mulch treatment, even if only slightly high under irrigated conditions. From these results, it was concluded that mulch is effective to reduce the adverse effect of water stress by the depression of evapotranspiration and the maintenance of relative high leaf water potential in limited water conditions.

0318 MELENDEZ, M.J.A. 1981. Characteristics of some tropical soils. (Es). Maracay, Venezuela: Universidad Central de Venezuela. 170 pp.

0319 MITCHELL, C.C., Jr., and BLUE, W.G. 1981. The sulfur fertility status of Florida soils. II. An evaluation of subsoil sulfur on plant nutrition. *Soil and Crop Science Society of Florida Proceedings* 40:77-82.

0320 NONOYAMA, Y. 1981. Soil fertility with respect to non-tillage cultivation in upland field (sorghum) under paddy-upland rotation system. 2. On the physical and chemical properties of surface soil. (Ja). *Kinki Chugoku Agricultural Research* 62:63-67. 10 ref.

0321 PICHOT, J., SEDOGO, M.P., POULAIN, J.F., and ARRIVETS, J. 1981. Fertility evolution in a tropical ferruginous soil under the effect of organic manure and inorganic fertilizer applications. (Fr).

Agronomie Tropicale 36(2):122-133. 24 ref. (Summaries: En, Es).

The trial was conducted in Upper Volta on a tropical clay sandy ferruginous soil. Inorganic fertilizers increased yields for some years but made soils impoverished in exchangeable base cations and caused acidification. They produced a potassium deficiency and aluminium toxicity which had noxious effects on the establishment of sorghum seedlings. Applications of organic matter in the form of ploughed in green manure and crop residues or applied farmyard manure made it possible to reduce or suppress the unfavourable effects of inorganic fertilizers.

0322 RAO, M.S.R.M., and RAO, V.R. 1981. Pushing up yields in rabi black soils. Intensive Agriculture 19(2-3):22-29.

Describes the poor soil and water conservation measures adopted in Deccan Plateau (India) and rabi crops suffering from moisture stress condition due to the absence of rains after planting and precarious soil moisture status. The work done in this regard after establishment of Soil Conservation Research Centre in Bellary in 1954, and Dryland Research Centre under All India Coordinated Research Project for Dryland Agriculture at Bellary, Bijapur, and Solapur, is outlined.

0323 RUSSEL, J.S. 1981. Models of long term soil organic nitrogen change. Pages 222-232 In Simulation of nitrogen behaviour of soil-plant systems (eds. M.J.Frissel, and J.A.van Veen). Wageningen, Netherlands: Centre for Agricultural Publishing and Documentation. 22 ref.

Effect of crop-pasture sequence was evaluated using soil and plant data from a long-term experiment at the Waite Institute (Australia). From the estimated parameters it was found possible to project soil nitrogen changes with time and to indicate various combinations of sequences

which should maintain soil nitrogen status. The effect of cropping to sorghum and the feedback effects of crop yield on soil nitrogen levels at were studied using soil and plant yield data at Narayen Research Station (Australia). The analysis suggests that soil nitrogen will continue to decline with cropping to lower levels even though crop yields are maintained by applying nitrogen fertilizer. Areas for further research are suggested.

0324 UNGER, P.W., and JONES, O.R. 1981. Effect of soil water content and a growing season straw mulch on grain sorghum. Soil Science Society of America Journal 45(1):129-134. 14 ref.

The contribution of a growing season straw mulch to growth, yield, grain quality, water use, and water-use efficiency of grain sorghum was evaluated in 1977, 1978, and 1979. Before planting, areas of Pullman clay loam (fine, mixed, thermic Torrertic Paleustolls) were irrigated twice, once, or not irrigated to simulate high, medium, and low levels of water storage in soil during fallow. After emergence, wheat straw was placed on the surface at rates of 0 (check), 2, 4, or 8 metric tons/ha. Sorghum with the high and medium water levels grew taller, yielded more, and used water more efficiently. In general, sorghum responded more to soil water content at planting than to mulch rate during the growing season. When significant responses to mulch rate were obtained, they resulted mainly from mulch on the low water level plots. For the 3 years, the growing season mulch at 8 metric tons/ha increased water-use efficiency 19% over the no-mulch treatment.

0325 WATSON, J., and PEPPER, I.L. 1981. Yields and leaf metal concentrations of cotton, sorghum, and soybeans grown on sludge-amended soil. Agronomy Abstracts 73:37.

Cotton, Sorghum bicolor and soybeans were grown on Pima clay loam

field plots that were amended annually for three years with four rates (0, 20, 40, 80 metric tons/ha) of anaerobically-digested, air-dried Tucson sewage sludge. Fertilizer guide N and P plots were also established. One field was amended with sludge and allowed to remain fallow the first two years. The highest sorghum yields were obtained from the high rate sludge treatment. DTPA extractable soil Cu, Zn, Ni and Cd increased with an increase in total sludge applied. Soil N03- N and C02 extractable P increased with an increase in total sludge applied, in most cases. The Cu, Zn, Ni and Cd concentrations in midseason leaves tended to increase with increased sludge rate. Overall, metal contents were not hazardous.

## SOIL MICROBIOLOGY

0326 ALBRECHT, S.L., MITCHELL, M.E., and GASKINS, M.H. 1981. Influence of soil moisture and organic substances on N<sub>2</sub>(C<sub>2</sub>H<sub>2</sub>)- fixation by sorghum and millet. Plant Physiology 67(4, suppl):77. (Abstract).

Several factors affecting nitrogenase activity and growth of nitrogen-fixing soil bacteria in association with sorghum and millet roots were examined. Plants were grown in a greenhouse and nitrogenase activity was determined by acetylene reduction. Organic material released by the roots was determined by <sup>14</sup>C labelling studies. Rates of nitrogenase activity and numbers of soil bacteria were positively correlated to soil moisture. In monoxenis systems, the numbers of the *Azospirillum brasilense* were found to be positively correlated to soil organic matter content. General trends suggest that low soil moisture and organic matter will severely limit associative nitrogen fixation and growth of soil nitrogen-fixing bacteria.

0327 BAGYARAJ, D.J., HEGDE, S.V., and CHALAPATHY, K. 1981. Effect of fertilization and ratooning on the microflora of soil and rhizosphere of sorghum. Pages 17-24 In Progress in soil biology and ecology in India (ed. G.K.Veeresh). Bangalore, Karnataka, India: University of Agricultural Sciences. 8 ref.

Application of N, P and K at the rate of 75, 30 and 15 kg per acre respectively to main and ratoon sorghum crops considerably altered the soil microbial population. In general application of fertilizers markedly increased the rhizosphere microbial population at vegetative, flowering and grain maturation stages of plant growth, compared to the unfertilized plants. The increase was highest at the flowering stage of the plant. Bacteria were found to occur in highest number followed by actinomycetes, fungi and azotobacters, both in the rhizosphere and nonrhizosphere soils. Ratooning of sorghum did not alter the soil microbial population over the main crop.

0328 BARRAQUIO, W.L., and WATANABE, I. 1981. Occurrence of aerobic nitrogen fixing bacteria in wetland and dryland plants. Soil Science and Plant Nutrition 27(1):121-125. 3 ref.

Occurrence of aerobic nitrogen fixing bacteria was studied in wetland and dryland plants. Latisail, IR26 and Khao-Lo were grown during wet season while *Oryza australiensis*, *O. punctata* and *Monochoria vaginalis* were sampled during dry season. The dryland plants used in experiment included a legume, maize, sorghum (IS-2940 and KU-301) grasses and rice. Results revealed that all the root tissues of wetland plants yielded high percentage of nitrogen-fixing bacteria ranging from 20-90% of the total aerobic heterotrophs and pseudomonas like bacteria were found in abundance. In the dryland plants the total aerobic heterotrophs ranged from ten thousand to ten million per g fresh weight of sample. No pseudomonas like

bacteria were isolated from any of the dryland plants.

0329 DE FREITAS, J.L.M., PEREIRA, P.A.A., and DOBEREINER, J. 1981. Effect of organic matter and *Azospirillum* spp. strains in the metabolism of nitrogen in *Sorghum vulgare*. Pages 155-163 In *Associative N<sub>2</sub>-fixation* (eds. P.B.Vose, and A.P.Ruschel). v.1. Boca Raton, Florida, USA: CRC Press. 14 ref.

Strains of *Azospirillum lipoferum* and *Azospirillum brasilense* isolated from sterilized roots of sorghum and rice respectively were used to study the interaction of inoculation with organic fertilizers and mineral N. Results showed varied nitrogenase activity during plant growth cycle and different behavior due to treatments. Nitrate reductase activity increased with nitrate addition. Inoculation with *Azospirillum* spp. resistant to streptomycin increased the population of this bacteria both in the inner part and the rhizosphere of sorghum. Total production of dry weight increased with the addition of organic matter from 5100 to 7700 k/ha but content of total N decreased with organic matter addition. It was also shown that organic matter can make the plant resistant to adverse climatic conditions and city garbage compost can be used as an excellent organic matter.

0330 GIOVANNETTI, M., BAGNOLI, G., and LEPORINI, C. 1981. Effect of increasing N concentrations on sporocarp production by *Glomus mosseae*. (It). *Micologia Italiana* 10(3):25-28. 15 ref. (Summary: En).

Additions of inorganic nitrogen inhibited vesicular-arbuscular mycorrhizal infections at the concentrations of 114 mg/l of N, in sorghum plants grown in sterile sand. Extramatrical mycelium development and sporocarp formation were totally inhibited. The highest vesicular-arbuscular mycorrhizal infection, as well as the best sporocarp and external mycelium

production, were obtained using 23 mg/l of N. The results are discussed in relation to the importance of the maintenance and increment of microbiological soil fertility in marginal soils.

0331 GROVER, R. 1981. Studies on associative nitrogen fixing bacteria of sorghum and barley. M.Sc. thesis, Haryana Agricultural University, Hissar, Haryana, India. 59 pp.

0332 HESS, D., and KIEFER, S. 1981. Induction of bacterial nitrogenase activity in vitro associations: a comparison of the inducing capabilities of *Triticum aestivum* and *Sorghum nigricans*. *Zeitschrift fuer Pflanzenphysiologie* 101(1): 15-24. 13 ref.

0333 JADHAV, S.W., PATIL, P.L., and PATIL, B.C. 1981. The effect of *Azotobacter* on yield of jowar (*Sorghum vulgare* Pers.). *Maharashtra Vidnyan Mandir Patrika* 16(1-2):29-32. 8 ref.

The study revealed that the vigour, the growth, straw and grain yield of sorghum were improved due to the seed inoculation with *Azotobacter*. The grain yield was significantly increased due to different strains of *Azotobacter* in all the three years. The strain variation in *Azotobacter* was also confirmed.

0334 KAPULNIK, Y., KIGEL, J., OKON, Y., NUR, I., and HENIS, Y. 1981. Effect of *Azospirillum* inoculation on some growth parameters and N-content of wheat, sorghum and panicum. *Plant and Soil* 61(1-2):65-70. 17 ref.

The potential of the nitrogen fixing bacterium *Azospirillum brasilense* to enhance development and increase growth of several gramineae was investigated. In both sterilized and non-sterilized systems heading and flowering occurred earlier in the inoculated plants as compared to the noninoculated ones. Total shoot and root weights, total-N content, plant height and leaf length were significantly increased by

inoculation.

0335 KAPULNIK, Y., SARIG, S., NUR, I., OKON, Y., KIGEL, J., and HENIS, Y. 1981. Yield increases in summer cereal crops in Israeli fields inoculated with *Azospirillum*. *Experimental Agriculture* 17(2):179-187. 15 ref.

Inoculating *Sorghum bicolor*, *Zea mays*, *Panicum miliaceum*, and *Setaria italica* with nitrogen fixing bacteria of the genus *Azospirillum* in northern Negev and Bet Shean Valley field experiments resulted in significant increase in yield of grain and foliage of commercial value. It was concluded that inoculating summer cereal crops in Israel saved valuable nitrogen fertilizer.

0336 KAVIMANDAN, S.K., PATIL, V.D., and APTE, R. 1981. Nitrogen fixation by rhizoplane microflora. *Indian Journal of Microbiology* 21(2) : -165-166 . 9 ref.

To study the nitrogen fixing ability of bacteria associated with roots of weed plants, *Azotobacter* spp. were isolated from root surfaces of *Sorghum vulgare*, *Arachis hypogea* and *Glycine max*, and *Azospirillum* spp. were isolated from stems of wheat. Results revealed that the nitrogen fixed by *Azotobacter* strains isolated from root surfaces of *Sorghum vulgare* ranged from 0.45 to 15.17 mg N/g carbon source.

0337 KLUCAS, R.V., and DOBEREINER, J. 1981. Grasses, wheat, maize and sorghum: position paper. Pages 243-245 In *Associative N<sub>2</sub>-fixation* (eds. P.B.Vose, and A.P.Ruschel). v.2. Boca Raton, Florida, USA: CRC Press.

Research on diazotrophic biocoenosis in grasses, wheat, maize, and sorghum and its importance to the plant is stressed. Recommendations for its further study are also made.

0338 KLUCAS, R.V., PEDERSEN, W., SHEARMAN, R.C., and WOOD, L.V. 1981. Nitrogen fixation associated with

winter wheat, sorghum, and kentucky bluegrass. Pages 119-129 In *Associative N<sub>2</sub>-fixation* (eds. P.B.Vose, and A.P.Ruschel). v.1. Boca Raton, Florida, USA: CRC Press. 18 ref.

Experiments were conducted to determine the extent of associative symbiotic relationships in temperate regions of the United States. Winter wheat, sorghum, and perennial bluegrass were used in the study. Roots were collected and assayed for acetylene reduction. Nitrogen fixers were isolated and identified from the roots exhibiting nitrogenase activity, and seeds and plants were inoculated with various nitrogen fixing isolates. Results revealed that nitrogenase activity was much greater in grain sorghum than in wheat and forage sorghums.

0339 KRISHNA, K.R., and BAGYARAJ, D.J. 1981. Note on the effect of VA mycorrhiza and soluble phosphate fertilizer on sorghum. *Indian Journal of Agricultural Sciences* 51(9):688-690. 14 ref.

The effect of different levels of soluble phosphorus (P) on the symbiosis of vesicular-arbuscular (VA) mycorrhiza and sorghum was studied in CSH-5 hybrids grown in pots having red sand loam soil with and without mycorrhizal inoculation. Plants were supplied with 4 levels of soluble P viz. 0%, 50%, 100%, and 200% of the recommended dose. It was found that the lower P fertilizer dosages along with mycorrhizal inoculation had effects similar to application of complete recommended P fertilizer.

0340 MONZON DE ASCONEGUI, M.A., and MARTINS, C.O. 1981. Performance of various strains of *Azospirillum* on wheat and sorghum. (Es). *Revista de la Facultad de Agronomia, Universidad de Buenos Aires* 2(1):39-45. 14 ref. (Summary: En).

0341 PAL, U.R., and MALIK, H.S. 1981. Contribution of *Azospirillum brasilense* to the nitrogen needs of

- grain sorghum (*Sorghum bicolor* (L.) Moench) in humid sub-tropics. *Plant and Soil* 63(3):501-504. 7 ref.
- Field experiments were conducted to assess the contribution of *Azospirillum brasilense* to the N needs of grain sorghum cv. CSH-5 during monsoon seasons of 1978 and 1979. A *brasilense* contributed to the N uptake by crop in the range from 5.8 to 19.6 kg N/ha. However, the contribution of *A. brasilense* to the N needs of sorghum was more when sorghum was manured with farmyard manure at the rate of 10 tons/ha.
- 0342 RANGASAMY, A., and MORACHAN, Y.B. 1981. Role of phosphobacterin in the uptake of nitrogen in rainfed sorghum. *Madras Agricultural Journal* 68(7):488-490. 5 ref.
- Reports experiments to study the nitrogen uptake in rainfed sorghum inoculated with phosphobacterin with and without nitrogen and phosphorus applications. Data revealed that nitrogen uptake was significantly high in the presence of phosphobacterin, which was due to higher levels of phosphorus uptake associated with phosphobacterin inoculation. It is concluded that phosphobacterin indirectly helps nitrogen uptake in sorghum.
- 0343 RAO, N.S.S. 1981. Contribution of bio-fertilisers in supplementing nitrogen requirements. *Indian Farming* 31(7):13-16, 68.
- Experiments were conducted to determine the nitrogen fixing capability of *Azotobacter*, *Azospirillum*, blue green algae and *Azolla* in sorghum, pearl millet and rice crops in carrier-based cultures. *Azospirillum* in sorghum and pearl millet fixed nitrogen and produced growth substances. Use of this micro-organism as a seed inoculant saved 20-30 kg N/ha.
- 0344 RAO, R.V.S, and DART, P.J. 1981. Nitrogen fixation associated with sorghum and millet. Pages 169-177 In *Associative N<sub>2</sub>-fixation* (eds. P.B.Vose, and A.P.Ruschel). v.1. Boca Raton, Florida, USA: CRC Press. 6 ref.
- Research on nitrogen fixation ability of pearl millet, sorghum, minor millets, and some tropical grasses at ICRISAT is reported. Germplasm of these crops, grown under low fertility with 0 or 20 kg N/ha fertilizer addition, have been evaluated to see whether there are differences in ability to stimulate the nitrogen-fixing activity among genotypes.
- 0345 REYES, J., and CASTILLO, J. 1981. Micromycetes of the rhizosphere of sorghum. (Es). *Boletin de la Sociedad Mexicana de Micologia* 15:5-8.
- 0346 SARIG, S., KAPULNIK, Y., NUR, I., and OKON, Y. 1981. Response of non-irrigated sorghum to *Azospirillum* inoculation. (He). *Hassadeh* 62(3): 412-414. 4 ref. (Summary: En).
- 0347 SIEVERDING, E. 1981. Influence of soil water regimes on VA mycorrhiza. 1. Effect on plant growth, water utilization and development of mycorrhiza. *Zeitschrift fuer Acker und Pflanzenbau* 150(5):400-411. 18 ref. (Summary: De).
- Sorghum bicolor* and *Eupatorium odoratum* were grown in wet, normal and dry soil moisture regimes with and without VA mycorrhiza in two soils-one (A) with strong P fixation and other (B) with fair P availability. The favourable effect of mycorrhiza on plant growth was more pronounced in *E. odoratum* than in sorghum, in soil A than in soil B, and in insoluble P fertilizer than in soluble P. Mycorrhizal plants were less sensitive to temporary water shortage than non-mycorrhizal. It was concluded that under conditions of inadequate soil moisture mycorrhiza can improve the water relations of crops.

## WATER MANAGEMENT

0348 ANONYMOUS. 1981. An experiment of irrigation using the pounds of Paraguana Peninsula: the case of pearl millet (*Pennisetum typhoides*) and sorghum (*Sorghum vulgare*) under three frequencies of irrigation. (Es). Pages 3.3.102 to 3.3.132 In Reports, Fourth Latin-American Seminar on Drop and Located Irrigation, 21-27 June 1981, Barquisimeto, Venezuela. Caracas, Venezuela: Instituto Interamericano de Ciencias Agrícolas. 22 ref.

0349 AGUIAR, P.A.A. 1981. Annual yield potential of grain sorghum under irrigated conditions. (Pt). Pesquisa Agropecuaria Brasileira 16(1):117-120. 3 ref. (Summary: En).

The annual Sorghum bicolor grain production potential of eight commercial hybrids and two varieties was evaluated under irrigated conditions in the Sao Francisco Valley. A double row system spaced 40 cm apart in beds of 70 cm width, with approximately 15 plants/m in each row. The hybrids tested were much more productive than the varieties. A gradual decrease in the average yield was obtained from the first harvest to the first and second ratoon cropping, with 9,313, 6,476 and 3,602 kg/ha, respectively. The total average yield from the three harvests reached 19,391 kg/ha, which indicates the technical viability of exploring grain sorghum under irrigated conditions.

0350 DESHMUKH, R.C., RAMAIAH, R., and CHANNAL, H.T. 1981. Effect of sprinkler and surface (check basin) method of irrigation on the yield of sorghum. Research Bulletin of Marathwada Agricultural University 5:25-26. 6 ref.

The grain yield was found significantly higher in sprinkler irrigation plots (55.70 q/ha) compared to check basin plots (48.04 q/ha).

0351 GIRI, A.N., and BAINADE, S.S.

1981. Performance of different rabi crops under limited irrigation in Dudhana command area of Marathwada region. Indian Journal of Agronomy 26(3):297-301. 1 ref.

Experiments were conducted during rabi season of 1977-78, 1978-79 and 1979-80 at Parbhani to study the comparative performance of different rabi crops under limited irrigation. Sorghum gave significantly higher grain yield than wheat, bengal gram, safflower, linseed and pea respectively. Linseed crop gave significantly the highest monetary returns compared to cereals (sorghum and wheat) as well as pulses. It was observed that one protective irrigation was adequate for raising these crops.

0352 HATFIELD, J.L. 1981. Irrigation scheduling with thermal infrared and spectral remote sensing inputs. Pages 10-17 In Irrigation scheduling for water and energy conservation in the 80's. St. Joseph, Michigan, USA: American Society of Agricultural Engineers. 9 ref.

0353 HOBBS, E.H. 1981. Water requirements of grain sorghum. Pages 20-21 IN Research highlights 1980, Research Station, Lethbridge, Alberta. Lethbridge, Alberta, Canada: Agriculture Canada. 2 ref.

0354 KEEFER, G.D. 1981. Irrigated sorghum at Emerald. Queensland Agricultural Journal 107(3):155-161.

Information on the potential of sorghum as an irrigated crop at Emerald and recommendations for its production under irrigation are given. The possibilities of ratooning the plant crop for a second cycle grain yield are discussed.

0355 LEAL DIAZ, J. 1981. Water demand and efficiency of some important agricultural crops. (Es). Pages 3.3.16 to 3.3.28 In Reports, Fourth Latin-American Seminar on Drop and Located Irrigation, 21-27 June 1981, Barquisimeto, Venezuela.



Caracas, Venezuela: Instituto Interamericano de Ciencias Agrícolas. 8 ref.

0356 STEWART, B.A., DUSEK, D.A., and MUSICK, J.T. 1981. A management system for the conjunctive use of rainfall and limited irrigation of graded furrows. Soil Science Society of America Journal 45(2):413-419. 9 ref.

For efficient use of irrigation and rainfall for furrow irrigation of sorghum, a 600-m long field was divided into three water management sections. The upper half was managed as fully irrigated. The next one-fourth was a "tail-water-runoff" section that utilized furrow runoff from the fully irrigated section. The lower one-fourth was designated a "dryland" section, retaining and utilizing any runoff generated either by irrigation or rainfall from the wetter, fully irrigated, or tailwater-runoff sections. Furrow dams were placed about every 3 to 4 m throughout the length of the field after planting. Seedling rates were reduced down the field from 6 kg/ha on the fully irrigated section to 3 kg/ha on the tailwater section, to 1.5 kg/ha on the dryland section. Nitrogen applications were also reduced on the tailwater and dryland sections to correspond with anticipated yield levels. The three irrigation treatments were 5-cm water applied to every furrow; 3.75 -cm water applied to alternate furrows; and 2.5-cm water applied to every third furrow between crop rows in a two-row planted, and one row left out, skip-row system. These treatments were compared with conventional furrow irrigation without dams involving tail-water runoff. Five irrigations were applied at 14-day intervals, regardless of seasonal rainfall. The extent that the field was irrigated depended on the rainfall. The fixed 14-day irrigation schedule and 12-hour sets reduced management requirements and facilitated the potential for automation of graded furrow water application.

0357 SULLIVAN, C.Y., WATTS, D.G., GARRITY, D.P., and MAURER, R.E. 1981. Responses of sorghum and corn to limited irrigation. Pages 205-218 In Proceedings, Thirty-fifth Annual Corn and Sorghum Industry Research Conference, 9-11 December 1980, Chicago, Illinois, USA. Washington, DC, USA: American Seed Trade Association. 13 ref.

Reviews the research performed on fine sandy soil near Tryon in West Central Nebraska in which corn and sorghum were grown at close proximity with different irrigation levels and timings of application. A modified form of the line source irrigation system was used. Yields were maximum when sufficient soil water was available to permit maximum evapotranspiration (ET). Sorghum yields were higher than corn at less than 50 cm ET. The most favorable irrigation scheduling for sorghum was one in which water stress gradually increased throughout the season.

0358 VEGA G., J.D., and PERALES R., S.O. 1981. Yield prediction and irrigation needed for the crops sunflower, maize, Phaseolus vulgaris, sorghum and wheat utilizing the water balance method near Apodaca, N.L. (Es). Pages 114-115 In XVII informe de investigacion, 1979-80. Monterrey, Nuevo Leon, Mexico: Instituto Tecnológico de Monterrey, Division de Ciencias Agropecuarias y Maritimas.

## AGRONOMY AND CULTIVATION

### General

0359 ANONYMOUS. 1981. Crop technique: sorghum in Sardinia. (It). Agricoltura Ricerca 4(3):8.

0360 ANONYMOUS. 1981. South Queensland guide to grain sorghum characteristics 1981-82. Queensland Agricultural Journal 107(6):338-339.

Information relating to seed company, hybrid, time of flowering, height, head, grain color, reaction to diseases and pests, and resistance to lodging is tabulated.

0361 AGEEB, C.A. 1981. Agronomy and crop physiology. Pages 1-18 In Hudeiba Research Station annual report 1976-77. Hudeiba, Sudan: Ministry of Agriculture, Agricultural Research Corporation.

0362 ALI, A.H., RAHMAN, N.H.A., HAKIM, M.N., and EL SHOURBAGI, F.A. 1981. Reduction in yield as affected by leaves stripping in grain sorghum. Annals of Agricultural Science 15:75-84. 10 ref. (Summary: Ar).

0363 BAPAT, D.R. 1981. Sorghum in Maharashtra: a technical bulletin on sorghum cultivation. Rahuri, Maharashtra, India: Mahatma Phule Agricultural University. 44 pp. 8 ref.

Presents information on high-yielding varieties and hybrids for kharif and rabi seasons, growth stages, agro-climatic regions, production technology, diseases, pests and weeds of sorghum and their control, grain storage, and economics of hybrid sorghum cultivation in the state of Maharashtra.

0364 BHATIA, C.R., MITRA, R., and RABSON, R. 1981. Bioenergetic and energy constraints in increasing cereal productivity. Agricultural Systems 7(2):105-111. 18 ref.

Alterations in the harvest index (grain yield/biological yield) were analysed from the point of view of intrinsic energy and nitrogen, phosphorus and potassium requirements. A higher harvest index, without any reduction in biological yield, increased the harvest of energy in the above ground parts of the crop, and nitrogen and phosphorus in the grain. It enhanced the fertilizer requirement of the crop. From bioenergetic considerations, higher grain yields, obtained by improving the harvest

index, represent a path which demands least increments in photosynthate and nutrient inputs. The other alternatives available for increasing cereal productivity, were costlier in terms of photosynthate and fertiliser requirements (energy inputs).

0365 BIJAPUR, U.K., GOWDA, B.T.S., and GOUD, J.V. 1981. Grain yield stability of experimental rabi sorghum (*Sorghum bicolor* L. Moench) hybrids. Mysore Journal of Agricultural Sciences 15(1):12-15. 5 ref.

The stability analysis has given indications on the hybrids adopted to poor and high fertility conditions. The hybrids 323A x P20 and 323A x P2 showed low 'b' values and low deviation from regression indicating their suitability to low fertility conditions while 1258A x P18, 1258A x P7 and 36A x P10 recorded high 'b' value and low deviation from regression showing their suitability for high fertility conditions.

0366 BOURNE, J. (comp). 1981. South Queensland grain sorghum planting guide 1981-82 season. Queensland Agricultural Journal 107(6):340-343.

Appropriate planting time, and region and shires for the recommended grain hybrids are given.

0367 CERVATO, G. 1981. Grain sorghum cultivation. (It). Terra e Vita 22(42):47-48.

0368 CRAFTFORD, D.J., and NOTT, R.W. 1981. Yield formulas for summer crops of the Highveld region. Pretoria, South Africa: Department of Agriculture and Fisheries. 22 pp. 9 ref. (Summaries: Af, Fr). (Technical Communication, 169).

Based on the assumption that the yield of a crop is a function of the rainfall, effective soil depth, the air/moisture regime within the effective depth, the transpiration and grainchaff ratios and the crop's ability to resist drought, formulas have been developed to calculate the

average yield for maize, maize silage, grain sorghum, sunflower, groundnut, dry beans and potatoes. Tests have shown good agreement between calculated and actual yield.

0369 DESAI, K.B., and DABHOLKAR, A.R. 1981. Constraints for increasing productivity of grain yield of sorghum in Gujarat state. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 5 pp.

Major constraints limiting sorghum yield in Gujarat include, low genetic potential for yield of locally grown varieties, farmers' lack of interest in the crop due to poor economic return, incidence of diseases and pests, and inadequate supply of hybrid seeds in rabi season. Suggest the evolution of varieties/hybrids suitable for the region, and adoption of better agro- management practices to improve yield.

0370 DIGHE, R.S., and PATIL, V.N. 1981. Effect of seed size on germination, vigour and yield in sorghum (Jowar). PKV Research Journal 5(1):17-20. 5 ref.

Effect of seed size was studied in two sorghum hybrids CSH-1 and CSH-5. The composite seed was divided in three groups in CSH-1 and four groups in CSH-5 and those seed size groups were compared with the unprocessed bulk seed. The results indicate that in both CSH-1 and CSH-5 the lowest seed size inferior to other seed size groups in terms of seed vigour, laboratory germination and field emergence. However, the yield per plant and yield components were not affected by seed size. It was concluded that even if the yield per plant is unaffected, the inclusion of lower sized seeds results in a poor stand and this will adversely affect yield if the smaller sized seeds are included for sowing purpose.

0371 EL RAYAH, A.H. 1981. Agronomy of dura and other crops. Pages 12-16

In Gezira Research Station and Sub-stations annual report 1974/75. Gezira, Sudan: Ministry of Agriculture, Food and Natural Resources.

Experiments were conducted to test the suitability of dura varieties to the irrigated conditions of the Gezira, Sudan. Sowing was done in early July at a spacing of 15 cm with two plants per hole on ridges 80 cm apart and 2 N was given at sowing. Results showed that Feterita maatug, Feterita 7028 and dwarf hegari were best for grain yield. Dabars were best for straw yield. Grain and straw yields were reduced with wider spacing. Grain and straw yields were significantly increased with nitrogen. Though prewatering and waterstop had no effect on yield, longer watering interval from 7 to 14 days increased the grain yield significantly.

0372 FOREMAN, J.W., and ROMANO, I. (comp). 1981. Grain sorghum planting guide for Central Queensland in 1981-82. Queensland Agricultural Journal 107(6):335-337.

Characteristics such as flowering, height, head, grain colour, resistance to SCM virus, Puccinia purpurea, leaf blight, and lodging, and yield of a wide range of hybrids are listed.

0373 GALLINA, M. 1981. Sorghum: ideal crop for our hills. (It). Terra e Vita 22(13):46-47.

0374 GOMEZ M., N., and CERVANTES S., T. 1981. Delimitation of cropping areas of grain sorghum in Mexico. (Es). Agrociencia 44:103-110. 11 ref. (Summary: En).

Sorghum growing areas were classified by numerical taxonomy techniques. The information used was the phenotypic values and the effects of the genotype-environment interaction for grain yield from 151 hybrids grown in 21 environments. The dendrogram from phenotypic values and the average Euclidean distance allowed to define 3 areas characterized by

their environmental yield, and 6 areas were delineated from the dendrogram based on the complement of the correlation coefficient of interaction effects of genotype by environment.

- 0375 GRETZMACHER, R. 1981. The production of sorghum (*Sorghum bicolor* (L.) Moench) in the Sudan. (De). *Bodenkultur* 32(1):13-34. 38 ref. (Summary: En).

Besides improvements in respect to crop rotation, seed quality, weed control, harvesting and storage procedures, a splitting of the big rental-farms were found necessary to increase the yield.

- 0376 HARAKI, T., and HORINO, T. 1981. Effect of leaf removal on yield and its components in grain sorghum. (Ja). *Japanese Journal of Crop Science* 50(2): 241-242. 3 ref.

- 0377 HEINRICH, G.M. 1981. Morphological and physiological mechanisms of yield stability in grain sorghum (*Sorghum bicolor* (L.) Moench) across diverse environments. Thesis, University of Nebraska, Lincoln, Nebraska, USA. 93 pp. 99 ref.

Yields of 3 stable and 3 unstable sorghum genotypes were evaluated across 14 environments using a modified Finlay and Wilkinson stability analysis. Results revealed that stability was more related to stress tolerance than to greater capacity for yield component compensation. Tolerance to high temperatures in GS2 was important to yield stability, and seed weight maintenance under stress made an important contribution to yield stability.

- 0378 HENZELL, R.G., FLETCHER, D.S., and GALLAGHER, E.C. (comps). 1981. South Queensland grain sorghum yields. *Queensland Agricultural Journal* 107(6):328-329.

Summary of data collected from the Department of Primary Industries' Grain Sorghum Hybrid Testing Program in southern Queensland is tabulated.

The yield of a particular hybrid has been expressed as a percentage of the mean yield of three hybrids viz. Texas 610SR, Pride, and E57.

- 0379 HITAKA, N. 1981. The effects of defoliation on grain sorghum yield. (Ja). *Kinki Chugoku Agricultural Research* 61:19-22. 16 ref.

- 0380 HOBBS, E.H., and KROGMAN, K.K. 1981. Sorghum and barley in southern Alberta: grain yield response to irrigation and fertilizer. *Canadian Journal of Plant Science* 61(4):837-842. 9 ref. (Summary: Fr).

The seasonal water requirements of irrigated grain sorghum, the interaction between water use and applied N fertilizer, and the comparative water use efficiencies of sorghum and barley were determined in southern Alberta over a 3-yr period. Peak daily water use of 6 mm for sorghum was 1 mm lower than that determined previously for barley. Seasonal water use (500 mm) was 20% greater than for barley because of sorghum's longer growing season. Under adequate irrigation, both sorghum and barley responded linearly to applied N up to 80 kg/ha, but when water was restricted, sorghum showed less response than barley. Water-use efficiency (kg of grain/m<sup>3</sup> of water used) decreased for both crops with increasing water availability but maximum yields were achieved under irrigation. When sorghum was favored with a long, warm growing season, it produced as much grain (6900 kg/ha) and used water as efficiently (1.25 kg/m<sup>3</sup>) as did barley.

- 0381 HOSMANI, S.A. 1981. Present status of agronomic research on sorghum in Karnataka. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 3 pp. 3 ref.

Agronomic investigations were carried out in different parts of the state for increasing the yield of

sorghum. Results are reported in respect of time of sowing, plant population, planting method, seed treatment, nitrogen application, weed control and cropping systems.

0382 HUNDAL, S.S., and DE DATTA, S.K. 1981. Tillage and soil moisture effects on rainfed sorghum and mungbean grown after lowland rice. I. Root distribution, soil water extraction and crop yields. Los Banos, Laguna, Philippines: IRRI. 49 pp. 24 ref. (IRRI Saturday Seminar, 10 October 1981).

Upland crops of sorghum and mungbean were grown after lowland rice during the post-rainy season on a clay soil at the IRRI farm. Two levels of tillage were compared at three water table levels. Measurements were made on rooting depth and distribution, soil water content and pressure changes as a function of depth and time, crop water extraction, and grain and dry matter yields. Under dry conditions, sorghum yields were much below its yielding potential. Grain yield was more at deeper than at shallow water table levels when complete seedbed tillage was practiced. On the other hand, no-till sorghum yields were greater at shallow than at deeper water table levels. The results suggest practical implications of crop selection and soil management during the post-rainy season for upland crops grown in the presence of a ground water table.

0383 ICRISAT, MALI COOPERATIVE PROGRAM. 1981. Sorghum agronomy. Pages B49-B52 In ICRISAT Mali preliminary report for the 1981 season. Bamako, Mali: ICRISAT. (Summary: Fr).

0384 INDIA: ALL INDIA COORDINATED RESEARCH PROJECT FOR DRYLAND AGRICULTURE. 1981. Improved agronomic practices for dryland crops in India. Hyderabad, Andhra Pradesh, India: All India Coordinated Research Project for Dryland Agriculture. 93 pp.

The major agronomic findings of scientists working at the 23 research centres of the All India Coordinated Research Project for Dryland Agriculture and 24 Integrated Dryland Agricultural Development Pilot Projects are presented region-wise.

0385 JACQUIN, C. 1981. Sorghum: the points on production techniques. (Fr). Producteur Agricole Francais 57(287):10-12.

0386 KALIUZHNYI, A.I., LITVINENKI, E.L., and GLADYSH, V.P. 1981. Seed germination and the productivity of sorghum. (Ru). Selektsiya i Semenovodstvo 4:40-42.

0387 LANCA, J.C.E., and PARREIRA, J.DA S. 1981. Sorghum, a profitable crop. (Pt). Divulgacao, Direccao-Geral de Extensao Rural no.10. 22 pp.

0388 LANDI, R., MATTEI SCARPACCINI, F., MUGNAI, E., and TALLURI, P. 1981. Crop technique for grain sorghum: trials of investment. (It). Agricoltura Toscana 5(1-2):29-32.

0389 MAJOR, D.J., and HAMMAN, W.M. 1981. Comparison of sorghum with wheat and barley grown on dryland. Canadian Journal of Plant Science 61(1):37-43. 21 ref. (Summary: Fr). Sorghum bicolor ('Pride P130'), wheat, and barley were harvested at 1-wk intervals on dryland at Lethbridge, Alberta, in 1976 than in 1977 and separated into leaves, stems, heads, and seed. Whole-plant yields were higher in 1976 than in 1977 and sorghum whole-plant yields were higher than barley or wheat in both years. Sorghum grain yields were similar to those of barley, but were greater than those of wheat. Although sorghum is about 40 days later maturing than barley or wheat, its whole-plant and filling-period durations were not very different from the other two crops. Sorghum used water more efficiently than wheat or barley under drought conditions. The biggest disadvantage

- of sorghum hybrids was their slow growth in spring.
- 0390 MURPHY, W.J., BUCHHOLZ, D., SEWELL, H., PALM, E.W., and THOMAS, G.W. 1981. Grain sorghum production in Missouri. Science and Technology Guide no.4347. 6 pp.  
Information on average yields, production practices, disease, pests, weed control, and harvesting and drying of sorghum is presented.
- 0391 OGUNLELA, V.B., and EGHAREVBA, P.N. 1981. Acceleration of sorghum and millet production in Nigeria through timely operations. Pages 128-141 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 15 ref.  
The significance of timeliness of various operations viz. seedbed preparation, sowing, weeding, fertilizer application, pest control, and harvesting, as a means of boosting sorghum and millet production in Nigeria is highlighted.
- 0392 RAO, C.H., SANGHI, N.K., and RAO, U.W.B. 1981. Sorghum yield in relation to physiological maturity. Indian Journal of Agricultural Sciences 51(4):233-235. 4 ref.  
Harvesting short-duration Sorghum bicolor at physiological maturity (92 days) did not reduce either its grain yield and quality, or its fodder yield, and helped in better regeneration of ratoons. The germination of the grain was 85%.
- 0393 SIGNORINI, O. 1981. High yields of grain sorghum. (Es). Journal of Biochemistry 15(90):32, 34.
- 0394 SINGH, S.P., PAL, U.R., UMRANI, N.K., and UPADHYAY, U.C. 1981. Agronomic researches on grain sorghum: a review. Pages 130-159 In Proceedings, National Symposium on Crop Management to Meet the New Challenges, 14-16 March 1981, Hissar, Haryana, India (eds. R.Prasad, K.S.Prashar, and R.P.Singh). New Delhi, India: Indian Society of Agronomy. 243 ref.
- 0395 VANCE, P.N. 1981. Agronomic studies on grain sorghum in Papua New Guinea. Port Moresby, Papua New Guinea: Department of Primary Industry. 121 pp. 70 ref. (Research Bulletin, 30).  
Results of variety evaluation programme, nutrition studies on the alluvial soils, plant population studies, and herbicide studies at the Markham valley, and nutrition studies at the Central Province are given.
- 0396 VECCHIETTINI, M. 1981. Technical notes for sorghum farmers. (It). Terra e Vita 22(13):49-53.
- 0397 WHITEMAN, P. 1981. Sorghum and millet agronomy investigations in eastern province, results and discussion of trials: 1980 long and short rains and 1981 long rains. Katumani, Kenya: Sorghum and Millet Development Project. 163 pp. 129 ref. (Technical Report, AG:DP/KEN/78/016).  
Results of investigations carried out over a nineteen month period, involving three cropping seasons at Katumani and Kampi Ya Mawe are presented in four chapters- climate, population studies, soil moisture management, and sundry trials.
- 0398 WIEGAND, C.L., RICHARDSON, A.J., GERBERMANN, A.H., and CUELLAR, J.A. 1981. Use of spectral vegetation information to estimate grain sorghum yields. Agronomy Abstracts 73:15.  
A data set of grain sorghum ground truth [LAI and percent ground cover (PC)], grain production (YIELD), and LANDSAT MSS observations during grain filling for the 1973, 1975 and 1976 growing seasons for fields in Hidalgo County, TX. was used. The data shows that the relations between LAI, YIELD (kg/ha), and vegetation indexes- perpendicular vegetation index (PVI), Kauth greenness (GVI), and Ashburn vegetation index (AVI). Pooled data across years gave linear

correlation coefficients as high as 0.85 between the vegetation indexes and YIELD, and 0.82 between the vegetation indexes and LAI. When PVI was 7, corresponding to an LAI of 2.2 for headed sorghum, light interception was essentially complete. Vegetation indexes' sensitivity to field-to-field variations in growing conditions make them valuable complements to physiological process models of crop growth and yield that are being developed.

## Land Preparation and Cultivation

0399 BENATTI, R., FRANCA, G.V., and FREIRE, O. 1981. Effects of depth, plowing schedule and equipment on the yield of annual crops grown in a red yellow podzolic soil, Ortho. (Pt). Engenharia Agricola 5(2):15-20. 10 ref. (Summary: En).

0400 BOTSWANA: DRYLAND FARMING RESEARCH SCHEME. 1981. Sorghum spacing studies: agronomic trials. Pages 44-79 In Second annual report phase III 1981. Gaborone, Botswana: Ministry of Agriculture.

Segaolane sorghum was grown in 9 different population and row-spacing combinations (population ranges 10,000-200,000 plants/ha) at Mahalapye, Goodhope, Motopi and an additional site at Sebele in Botswana. At Sebele a variety comparison was included as an additional variable. Yield level and yield dependence on plant population differed greatly between sites. Analysis of DLFRS sorghum yields at Goodhope, Mahalapye and Motopi showed little response to differences in row spacing, that is similar populations performed equally well in wide (1.5m), standard (0.75 m) and narrow (0.38 m) rows. At Sebele both Segaolane and 8D sorghum showed greater yield for any population with narrower row spacing. Suggests standard rows as best compromise when the late rains are abundant and wide

rows as safer where late season rains are limited.

0401 BOTSWANA: DRYLAND FARMING RESEARCH SCHEME. 1981. Sorghum spacing studies: microenvironment and crop physiology. Pages 80-123 In Second annual report phase III 1981. Gaborone, Botswana: Ministry of Agriculture.

Crop physiological investigations were carried out on two sites at Sebele, Botswana. Standard agronomic measurements and measurements of soil moisture and crop water status were made at both sites. Leaf area development, radiation balance and windspeed measurements were restricted to one site. Detailed measurements of radiation balance, windspeed, air temperatures, water vapour pressures, crop water status, and various parameters of crop growth confirmed the existence of substantial differences in water use by different populations of sorghum. Values for transpiration showed that a dense crop stand in narrow rows uses more water than a sparse stand in wide rows. Crop water status data indicated that although sorghum controlled its water potential by stomatal closure and reduced leaf area development, its water requirement increased with increasing population.

0402 BOTSWANA: DRYLAND FARMING RESEARCH SCHEME. 1981. Maize/sorghum/millet comparison trial. Pages 199-203 In Second annual report phase III 1981. Gaborone, Botswana: Ministry of Agriculture.

A comparison was made of the three crops grown side by side over a range of populations and row spacing. To study the effect of plant population on uptake of nitrogen and phosphorus by sorghum, data obtained were analysed in terms of row spacing and plant population. Dry matter production increased with decreasing row width. Plant tissue nitrogen and phosphorus percentage contents showed no significant row-width effects. Results also revealed that total uptake of nitrogen and phosphorus was

closely dependent on total dry matter production.

0403 DESHPANDE, S.B., GAIKWAD, C.B., and JADHAV, S.B. 1981. Effects of tillage and manuring on growth and yield of cotton and rabi jowar under rainfed conditions of Pune region. Madras Agricultural Journal 68(6):385-391. 17 ref.

A long range experiment was started at Pune (India) during 1932-33 to investigate the effect of tillage and manuring on growth and yield of rainfed cotton and rabi sorghum, in rotation. The same experiment was carried out during 1973-74 and 1974-75 in two sets of plots. The results revealed that the grain and fodder yields of rabi sorghum during 1974-75 were significantly higher with deep tillage as compared to shallow tillage. The significant increase in yield components viz. grain weight/earhead, 1000 grain weight and grain and fodder yields of rabi sorghum was recorded by manuring the crop at the rate of 5.6 tonnes of FYM/ha every year when compared with no manure.

0404 DORAN, J.W., and WILHELM, W.W. 1981. Influence of crop residue removal on yields of corn, sorghum, and soybeans with no tillage. Agronomy Abstracts 73:211.

For 3 years, yields were significantly influenced by amount of crop residues on the soil surface. Where surface crop residues were completely removed, average yields of corn, sorghum, and soybeans were 24, 6, and 27% lower than where residues were not removed. Removal of 50% surface crop residues had little or no effect on yields. Yield reductions were directly related to higher soil and plant canopy temperatures and lower soil water contents where surface crop residues were removed.

0405 JONES, O.R. 1981. Land forming effects on dryland sorghum production in the southern great plains. Soil Science Society of America Journal 45(3):606-611. 10 ref.

The effectiveness of selected low-cost, water-conserving land forming systems in preventing runoff and increasing dryland Sorghum bicolor yields on Pullman clay loam was evaluated during 1975-1978 at Bushland, Texas. Systems investigated were mini-bench terraces (5 m wide), conservation mini-bench terraces (9 m wide), and three configurations of contour furrows. Grain yield and water-use efficiency were significantly greater with mini-bench terraces than with any other treatment. Mean annual grain yield on mini-bench terraces was 2,380 kg/ha, compared to 1,210 kg/ha on conventional graded furrows. Mini-benches, conservation mini-benches, and large contour furrows controlled erosion and retained all precipitation from a storm of 75-year expected frequency, while conventional furrows overtopped and failed to retain runoff.

0406 KAORE, S.V., and BATHKAL, B.G. 1981. Effect of soil depth on sorghum under rainfed condition. PKV Research Journal 5(2):129-134. 2 ref.

Trials were undertaken to study the response of Sorghum (variety CSH-5) to ten pre-determined soil depths varying from 15 cm to 150 cm at an interval of 15 cm under normal precipitation distribution during the kharif seasons of 1979 and 1980 at Akola (India). There was considerable reduction in the dry matter weight and grain yield as the profile depth of soil decreased. Reduction in the dry matter was of the order of 61.9, 44.8, 32.6 and 12.4 per cent on upto 30, 30-60, 60-90 and 90-120 cm soil depth, respectively as compared to dry matter produced at 120-150 cm soil depth. Similarly, reduction in grain yield on profile depths of upto 30 cm, 30-60, 60-90 and 90-120 cm was 77.1, 57.8, 34.7 and 10.6 per cent, respectively in relation to grain yield produced on soil depth of 120-150 cm. It was concluded that for obtaining potential yield of sorghum under rainfed conditions with the precipitation



distribution available at the station, minimum depth of soil profile should be 90-120 cm.

significantly more where mulch was applied during early stage of crop growth.

0407 LOPES, L.R., GALBIATTI, J.A., BENINCASA, M.M.P., BENINCASA, M., and BANZATTO, D.A. 1981. Effect of the seedling line orientation on the performance of Sorghum bicolor (L.) Moench. (Pt). Cientifica 9(1):129-136. 17 ref. (Summary: En).

Effects of different orientation lines on the micro-climate and biological productivity of sorghum under field conditions were studied. Soil humidity and temperature were determined for the micro-climate characterization. Biological productivity was evaluated in terms of aerial parts dry matter accumulation, total leaf area and specific leaf area during the crop growth. It is concluded that the cropping orientation lines has no effect on biological productivity of sorghum.

0408 MANE, V.S., and UMRANI, N.K. 1981. Application of organic mulch at various state of crop growth under dryland conditions. 1. Effect on growth and yield of winter sorghum. Indian Journal of Agronomy 26(1):1-6. 11 ref.

An experiment was conducted on winter sorghum at Solapur, Maharashtra during 1973-76 to study the relationship between the crop production and the stage of crop growth at which the mulch is to be applied. During 1975-76, due to excessive rainfall (60% above normal) mulching did not show any beneficial effect. In the remaining two years, mulch improved the growth as well as production from 20 to 120 per cent under different mulching treatments. The maximum advantage of mulch was noticed when it was applied immediately after emergence. A continuous decline in production was noticed with the delayed application of mulch. Height of the crop, number of functional leaves at primodial stage and panicle weight were

0409 MYERS, R.J.K., and FOALE, M.A. 1981. Row spacing and population density in grain sorghum: a simple analysis. Field Crops Research 4(2):147-154. 20 ref.

A simple analysis is described by which yields of grain sorghum at different row spacings may be compared over a range of yield levels. Yield at one row spacing is plotted against yield at alternative row spacings. Regression analysis is used to compare row spacing effects and to determine the best row spacing at any given yield level. Under conditions producing yields exceeding 3700 kg/ha, the optimum row spacing is 25 cm, for yields of 3100-3700 kg/ha the optimum is 50 cm; for yields of 1000-3100 kg/ha the optimum is 75 cm; while for yields of  $\frac{1}{4}$ 1100 kg/ha the optimum is 200 cm.

0410 PERLYATHAMBI, C., and PALANIAPPAN, S.P. 1981. Effect of pre-monsoon sowing, depth of seed placement and seed hardening on total drymatter production, growth and yield components of rainfed sorghum. Madras Agricultural Journal 68(2):100-104. 5 ref.

A field experiment was carried out at Tamil Nadu Agricultural University during the south-west and north-east monsoon seasons of 1979-80. Premonsoon sowing, depth of seed placement at 5.0 cm and 10% KH<sub>2</sub>P<sub>04</sub> seed treatment recorded maximum dry matter production and also favourably influenced the maximum production.

0411 SALINAS, J., MATOCHA, J.E., and ANDERSON, W.B. 1981. Tillage effects on some soil physical properties, and sorghum yields. Agronomy Abstracts 73:219.

The effect of tillage on bulk density depended upon organic matter distribution in the 0 to 15 cm depth, whereas, in the 15 to 30 cm depth bulk density depended more on mechanical

manipulation of the soil by the tillage systems. Aggregate stability of surface soil seemed to be affected both by the mechanical manipulation and by plant residue left on the surface by the tillage systems. In general, moldboard and chisel systems created a cloddy surface condition, disturbed the clay formations and produced the highest infiltration rates. Although differences in profile stored water occurred after tillage, at seedling time they were negligible. Yield data indicate that when moisture stress was not a limiting factor, no treatment differences were observed. However, when moisture stress was a limiting factor, yield depressions were associated with moldboard and chisel systems.

0412 THOMAS, G.A., MYERS, R.J.K., FOALE, M.A., FRENCH, A.V., HALL, B., LADEWIG, J.H., DOVE, A.A., TAYLOR, G.K., LEFROY, E., WYLLE, P., and STIRLING, G.D. 1981. Evaluation of row spacing and population density effects on grain sorghum over a range of northern Australian environments. *Australian Journal of Experimental Agriculture and Animal Husbandry* 21(109):210-217. 9 ref.

Experiments were conducted to determine the response of grain sorghum to row spacing and population density over a range of soil types, planting dates and seasonal conditions. Narrow and standard single rows (0.33 m to 1.07 m spacings) yielded equal or better than more widely spaced (1.50 to 4.27 m) single or twin rows (0.33 or 0.36 m apart) at equivalent population densities over a wide range of yield levels. Only at yield levels below 900 kg/ha there was a trend for 2.00 or 2.13 m twin rows to outyield the 0.33 or 0.36 m single row spacing. Significant yield reductions resulted in a number of trials, at yield levels above 1600 kg/ha, from the use of wide row spacings. Where there was severe water stress, grain yields were also reduced by high population densities

( $1/2$ 150,000 plants/ha), particularly at the 0.33 or 0.36 m row spacing. There was no evidence that response to row spacing differed between cultivars.

0413 UMEKI, Y., MURAKOSO, K., SAKAMOTO, S., and ETO, H. 1981. Sorghum broadcasting in the stand of early season rice. (Ja). *Kyushu Agricultural Research* 43:27.

0414 VIATOR, H.?, end MARSHALL, J.G. 1981. No-till grain sorghum production following wheat. *Louisiana Agriculture* 25(1):16-17.

Experiments were carried out to compare the yield of grain sorghum with and without tillage, and to determine the effect of plant rows, and burning of residues on grain yield and weed control in a double cropping system using wheat and grain sorghum. Conventional tillage produced higher yields during years of adequate rainfall, no-tillage yields were much greater during dry year. Burning wheat residues before planting sorghum, resulted in higher weed populations and negated the protection that the stubble mulch afford. Twenty-inch wide rows produced higher yields and more effective weed control than 40-inch rows in both tillage systems.

## Fertilizers and Plant Nutrients

0415 AJAKAIYE, C.O. 1981. Influence of soil applications of nitrogen on nitrate reductase activity, leaf and grain protein content in sorghum. *Plant and Soil* 60(3):423-434. 18 ref.

Three sorghum genotypes, L.187, SK5912 and RCFA x L.187 (the latter being a hybrid) were field grown under four nitrogen application rates and replicated four times. Nitrate reductase activity (NRA) was measured at 5, 7, 9, 11, 13, and 15 weeks and at 18, 19, 20 and 21 weeks after planting in 4th vegetative leaf and flag leaf respectively. Flag leaf,

4th leaf and grain protein contents were also measured. Nitrogen application generally increased NRA in both 4th leaf and flag leaf in the 3 genotypes at all the sampling dates. NRA of 4th leaf was negatively correlated with leaf protein but flag leaf protein tended to increase with applied nitrogen. Flag leaf NRA was positively and significantly correlated with grain protein indicating an important part played by the flag leaf relative to protein accumulation of the developing grain.

0416 BABARIA, C.J., and PATEL, C.L. 1981. Response and uptake of iron by sorghum to application of iron, farmyard manure and sulphur in calcareous soil. Gujarat Agricultural University Research Journal 6(2):121-124. 7 ref.

Ten treatment combinations were used in a field experiment to study the response of hybrid sorghum CSH- 5 to application of different levels of iron, sulphur, and farmyard manure. Iron was applied @ 10, 20 and 30 ppm in the form of  $FeSO_4 \cdot 7H_2O$  farmyard manure (FYM) was applied @ 5 and 10 t/ha and elemental sulphur was applied @ 20 and 40 ppm. Combinations of FYM+S and Fe + FYM + S were also used. Dose of 20 ppm Fe raised the grain (31%) and fodder yield significantly. Concentration of Fe in root, shoot and grain was also increased. The highest grain and fodder yields of 3708 and 9006 kg/ha respectively were obtained by addition of FYM @ 5 t/ha. It also increased the iron content in root, shoot and grain. Application of S @ 20 ppm could only increase the concentration of iron in root and shoot.

0417 BRAGA, J.M., and NEVES, M.J.B. 1981. Alteration of the solubility of Patos phosphate. 1. Effect of particle size and heat treatment. (Pt). Revista Ceres 28(160):546-554. 5 ref. (Summary: En).

The effects of particle size, temperature and duration of time at several temperatures on the solubility

of Patos phosphate and phosphorus uptake by Sorghum bicolor were studied in the greenhouse. In experiment I, eight particle sizes (10, 20, 40, 60, 80, 100, 150 and 200 mesh), three levels of phosphate and five soils were used; in experiment II, four particle sizes (50, 100, 150 and 200 mesh) were tested at 25, 500, 700 and 900 deg C, and in experiment III, the Patos phosphate was treated at 100, 200, 300, 400, 500, 600 and 700 deg C for 6, 12, 18 and 24 hours. Results revealed that the smaller particle size increased the availability of Patos phosphate to sorghum. The phosphorus was more available in soils with less exchangeable aluminium content. At high temperature the solubility of Patos phosphate decreased irrespective of time periods of treatments.

0418 BURESH, R.J., and VLEK, P.L.G. 1981. Greenhouse evaluation of nitrogen fertilizer sources for wheat and sorghum in arid and semiarid agriculture. Agronomy Abstracts 73:173.

The experiments were conducted with deep soil profiles subjected to several different moisture regimes. The efficiency of fertilizer N uptake by sorghum grown under three moisture regimes ranged from 46% to 70%. It was greater with sodium nitrate and urea supergranules than with urea plus PPDA, broadcast granular urea, and incorporated granular urea. The findings were found in agreement with field data from the semiarid tropics collected in an IFDC/ICRISAT collaborative program.

0419 CLARK, R.B., PIER, P.A., KNUDSEN, D., and MARANVILLE, J.W. 1981. Effect of trace element deficiencies and excesses on mineral nutrients in sorghum. Journal of Plant Nutrition 3(1-4):357-374. 28 ref.

The effects of Mn, Fe, Zn, Cu and B deficiencies and Mn, Fe, Zn, Cu, B, Mo, Al, Cr, Co, Ni, Se, Sr, Hg, Pb, Cd, and Ba excesses on visual symptoms

and mineral concentrations in Sorghum bicolor plants grown in nutrient solutions were determined. Plant growth was inhibited by each mineral element treatment. Symptoms of excess Mo and Se resembled those of P deficiency and symptoms of excess Al, Cu, Co, and Ni resembled those of Fe deficiency. Concentrations of many of the essential mineral nutrients taken up by the plants were affected by the stresses imposed by deficiencies or excesses. Concentrations of the nutrients were affected more extensively in roots than in leaves.

0420 DEFELIPO, B.V., DE SOUZA, J., BRAGA, J.M., and VENEGAS, V.H.A. 1981. Effect of incubation period with natural soil phosphate on the availability of phosphorus to plants. (Pt). Revista Ceres 28(159):515-520. 10 ref. (Summary: En).

Greenhouse experiments were conducted to compare the efficiency of four rock phosphates (Patos, Araxa, Catalao, and Tapira) to concentrated superphosphate as sources of phosphorus to plants. Four levels of P and three incubation periods were employed and Sorghum bicolor variety 'DK-E57' was used as the test plant. For the soil with higher levels of pH, Ca and P, and lower levels of exchangeable Al, the rock phosphates did not release P to the plants, even with the longer periods of incubation (45 and 90 days). For the soil with the lower fertility states, a longer period of incubation resulted in better efficiency of 'Araxa' and 'Patos' rock phosphates as sources of P to the plants.

0421 DESHMUKH, V.A., and PADOLE, V.R. 1981. Effect of carbofuran on yield and uptake of NPK by hybrid sorghum CSH-1. Journal of Maharashtra Agricultural Universities 6(1):25-27. 6 ref.

NPK, NPK + carbofuran, 1/2 NPK + carbofuran significantly increased grain and straw yield of sorghum as compared to control in both the years viz., 1976-77 and 1977-78. Carbofuran

in association with NPK treatments increased uptake of N, P and K than the respective NPK treatment alone. Carbofuran in association with NPK gave maximum net profit followed by its association with 1/2 NPK.

0422 DUNCAN, R.R. 1981. Variability among sorghum genotypes for uptake of elements under acid soil field conditions. Journal of Plant Nutrition 4(1):21-32. 18 ref.

Sorghum grain genotypes are compared for their individual patterns of leaf nutrient accumulation when grown under acid soil field conditions (pH<sup>1/4</sup> 4.8) over a three-year period. Significant differences among years for leaf concentrations of Ca, Mg, K, Mn, P, Fe, Al, and Zn were detected. Year x genotype interactions occurred for Ca, Mg, and Mn leaf concentrations. All genotypes differed in their ability to absorb elements, but some general patterns of nutrient accumulation were noted. Comparison of SC0283, an acid soil tolerant genotype, and BSD106, a susceptible genotype, revealed differences in mean concentrations of Al, Fe, Mn, and Cu. For breeding purposes, these four elements need to be monitored when determining the nutritional profile of various genotypes which are grown under acid soil stress conditions.

0423 ESCASINAS, R.O., ESCALADA, R.G., and TRENUELA, R.M. 1981. Effect of different population densities and nitrogen levels on the yield and yield components of sorghum. Annals of Tropical Research 3(4):258-265. 8 ref.

Increasing the population density decreased the panicle length, number of grains per panicle, and weight of grains per panicle although it increased the leaf area index. Population density of 200,000 plants/ha gave the highest grain yield of 2.07 t/ha, followed by 300,000 plants/ha at 2.01 t/ha, and 100,000 plants/ha at 1.72 t/ha. Application of N fertilizer increased plant

- height, leaf area index, panicle length, number of grains per panicle, weight of grains per panicle, and stover and grain yields. Plots treated with the highest level of N (200 kg/ha) gave the highest grain yield of 2.32 t/ha.
- 0424 FORTUN, C., and HERNANDO, V. 1981. Use of the straw as organic manure in a sorghum cultivation. (Es). *Anales de Edafologia y Agrobiologia* 40(7-8): 1227-1234. 9 ref. (Summary: En).
- 0425 FURLANI, A.M. 1981. Differences in phosphorus uptake, distribution and use by sorghum genotypes grown with low phosphorus. Ph.D. thesis, University of Nebraska, Lincoln, Nebraska, USA. 113 pp.
- 0426 FURLANI, P.R. 1981. Effects of aluminum on growth and mineral nutrition of sorghum genotypes. Ph.D. thesis, University of Nebraska, Lincoln, Nebraska, USA. 147 pp.
- 0427 FURLANI, P.R., and CLARK, R.B. 1981. Screening sorghum for aluminum tolerance in nutrient solutions. *Agronomy Journal* 73(4):587-594. 28 ref.
- A rapid method for screening genotypes for Al tolerance was developed by growing over 100 plants in the container of small volume (50 ml/plant). Mineral element conditions that gave good differential responses for Al tolerance were 148 micro mol/liter Al, 74 micro mo l/liter P, 7.4 mmol/liter Ca, 1.6 mmol/liter Mg, 3.9 mmol/liter K, 24.7 mmol/liter N (8 N03-:1 NH4+), light (17 hours)/dark (7 hours) temperatures of 28/23 C, and solution pH values below 4.0. Mineral element levels or temperatures higher or lower than these resulted in poorer differential responses of genotypes to Al. A mixture of N03- or NH4+ gave better genotypic separation than N03- or NH4+ alone. Visual Al toxicity symptoms on roots were noted within 10 days, and seminal root lengths could be used to assess Al tolerance of sorghum genotypes.
- 0428 GALAN, J.M., PAVA, H.M., and FONOLLERA, V.C. 1981. The effect of nitrogen fertilization and seed deterioration on grain yield and other agronomic parameters of grain sorghum, *Sorghum bicolor* (L.) Moench. *CMU Journal of Agriculture, Food and Nutrition* 3(4):318-339. 18 ref.
- 0429 GOSHAEV, G. 1981. Factors increasing sorghum yield and green mass quality at fertilizers application and irrigation. (Ru). *Zemledelie* 11:22-23.
- 0430 GRUNDON, N.J., and BEST, E.K. 1981. Tolerance of some winter and summer crops to copper deficiency. Page 360 In *Copper in soils and plants: proceedings of the Golden Jubilee International Symposium on Copper in Soils and Plants*, 7-9 May 1981, Perth, Australia (eds. L.F.Loneragan, A.D.Robson, and R.D.Graham). Sydney, Australia: Academic Press. (Abstract).
- 0431 HELKIAH, J., MANICKAM, T.S., and NAGALAKSHMI, K. 1981. Influence of organic manures alone and in combination with inorganics on properties of a black soil and jowar yield. *Madras Agricultural Journal* 68(6):360-365. 8 ref.
- Studies to evaluate the efficacy of organic sources of manures as compared to chemical fertilizers in a black soil revealed that the application of organic sources at different levels in combination with inorganic fertilizers had significantly increased the grain and straw yield of CSH 5 sorghum. The physical properties of the soil viz. bulk density, hydraulic conductivity and total porosity and also the nutrient contents had improved. The uptake of the nutrients by the crop had increased due to the addition of organic manures with fertilizers as compared to control and inorganic fertilizers alone.
- 0432 HIBBERD, C.A., HINTZ, R.L.,

WEIBEL, D.E., and WAGNER, D.G. 1981. The effect of nitrogen fertilization on the nutritional quality of grain sorghum. Presented at the Meeting of the American Society of Animal Science, Southern Region, 1-4 February 1981, Atlanta, Georgia, USA. (Abstract).

Five grain sorghum varieties were grown under dryland conditions at two different levels of nitrogen fertilization. Normal fertilization rates characterized one level while additional 50 lb.N/acre characterized second level. Average crude protein content increased ( $P^{1/4}.005$ ) from 13.5% to 13.9% for normal vs. high fertilization level. Tannin content decreased only for Darset variety with additional fertilizer. The Darset (bird resistant) was found better as regards to relative digestibility and starch availability by increased fertilization. The results suggest that increased nitrogen fertilization of grain sorghum can increase crude protein and decrease tannin levels and may increase the nutritive quality of the grain.

0433 HIBBERD, C.A., WEIBEL, D.E., WAGNER, D.G., and HINTZ, R.L. 1981. The effect of additional nitrogen fertilization on the nutritive value of grain sorghum. Pages 158-161 In Animal science research report: beef and dairy cattle, swine, sheep and their products 1981. Stillwater, Oklahoma, USA: Oklahoma State University.

Five varieties of grain sorghum were grown under dryland conditions to investigate the effect of additional nitrogen fertilizer on chemical composition and relative digestibility of the sorghum. Addition of 50 lb N/acre increased berry size markedly and crude protein content slightly. Tannin content was decreased for the high tannin Darset variety. Although in vitro digestibility was not consistently increased by fertilizer addition, detrimental effects were not observed. Notably, these results were observed during a dry season when the

benefits of additional fertilizer may not be as apparent as during a normal growing season.

0434 HIROCE, R., SAWAZAKI, E., POMMER, C.V., and DE MIRANDA, L.T. 1981. The influence of NPK fertilization on the yield and leaf mineral contents of different grain sorghum and maize cultivars. (Pt). Revista Brasileira de Ciencia do solo 5:67-71. 9 ref. (Summary: En).

0435 IBRAHIM, I.K., and ELLIS, R., Jr. 1981. Correlation of iron activities in calcareous soils with control of iron chlorosis in grain sorghum. Agronomy Abstracts 73:149.

Ten iron products were added to three western Kansas soils at rates of 0, 10, and 20 ppm Fe. The soil samples were incubated at 25 C and field capacity moisture. Determinations of pH, total iron and iron activities in a water extract were made at time intervals of 10, 100, 1,000 and 3,000 hours. Total iron and activities of iron in solution decreased with time. Six of the iron materials were used in a greenhouse experiment with a Ulysses silt loam soil using grain sorghum (KS56 KAEIR) as the test crop. The first crop was harvested at five weeks and the second crop at four weeks. Geigy 138 chelate was the only product which prevented chlorosis from developing on the plants at the 10 ppm rate of application. Geigy 138 chelate resulted in greater uptake of iron by the first crop and more dry weight of plant material in the second crop. In general, control of chlorosis on the sorghum plants was correlated with maintenance of more iron and greater iron activities in solution found in laboratory studies.

0436 JHA, D., RAHEJA, S.K., SARIN, R., and MEHROTRA, P.C. 1981. Fertilizer use in semi-arid tropical India: the case of high-yielding varieties of sorghum and pearl millet. Patancheru, Andhra Pradesh, India: ICRISAT. 47 pp. 21 ref. (ICRISAT

Presents information on the status of fertilizer use on HYV of sorghum and pearl millet, and identifies factors which influence farmers' decisions regarding fertilizer use. Data from 21 SAT districts for sorghum was taken from the study conducted by Indian Agricultural Statistics Research Institute, New Delhi during 1973-74. Results of analysis suggest that the traditional reluctance was due to poor economic returns and instability of response to fertilizer application for most of the local varieties of unirrigated food crops. Concludes that the development of regionally-adapted fertilizer responsive varieties should be given top priority. Change in extension system to a highly flexible one, and provision of credit and improvement in retail trade are also suggested to promote fertilizer use and productivity of unirrigated crops.

0437 JHA, D., and SARIN, R. 1981. An analysis of levels, patterns, and determinants of fertilizer use on farms in selected regions of semi-arid tropical India. Patancheru, Andhra Pradesh, India: ICRISAT. 63 pp. 22 ref. (ICRISAT Economics Program Progress Report, 25).

Various aspects of fertilizer use on farms, data source and brief background of study areas are discussed in the first part of this paper. The second part presents an analysis of determinants of fertilizer use. This is a regression-based analysis which hypothesizes that fertilizer use decisions are influenced by a set of personnel, resource endowment, institutional and agroclimatic factors. Data for this analysis were collected from six villages of Peninsular India through ICRISAT village level studies. Data on adoption, average level, allocation, rates of application, agronomic management of fertilizers and use of organic manures are presented for sorghum, paddy, wheat, cotton, groundnuts etc.

0438 JOSHI, P.K., UPADHYAY, U.C., SONDGE, V.D., and BORULKAR, D.N. 1981. Response and economics of nitrogen application to sorghum (*Sorghum bicolor* L. Moench). Journal of Maharashtra Agricultural Universities 6(3):194-196. 7 ref.

Sorghum variety 302 responded linearly, while sorghum hybrids (CSH-1 and CSH-4) responded quadratically to nitrogen application. The magnitude of response of CSH-4 to nitrogen was higher than the response of CSH-1. The maximum economic doses for CSH-1 and CSH-4 were 96 and 120 kg N/ha respectively.

0439 KANNAN, S. 1981. Differences in Fe-stress response in sorghum hybrids and their parental line: evidence for heterosis. Zeitschrift fuer Pflanzenphysiologie 103(4):285-290. 22 ref.

Fe-stress tolerance and susceptibility were examined in two Sorghum bicolor hybrids CSH-7 and CSH-8 and compared with those of their parents, 36-A, 168 and PD-3-1-11. The capacity to reduce the pH of the root medium and recovery from chlorosis were significantly greater in the two hybrids which manifested heterosis in their Fe-stress response. Further, it is suggested that the chlorotic leaf of a Fe-stress tolerant variety transmits a 'signal' to the root and this 'signal' is probably hormonal in nature.

0440 KANNAN, S. 1981. The reduction of pH and recovery from chlorosis in Fe-stressed sorghum seedlings: the principal role of adventitious roots. Journal of Plant Nutrition 4(1):73-78. 11 ref.

*Sorghum bicolor* cv. CSH-5 seedlings were grown in complete nutrient medium and Fe-stress was induced by transferring to minus Fe medium, so that the seminal and adventitious roots were separately placed in two containers. It was found that the pH of the medium was reduced to 3.5 by the adventitious

roots, and not by the seminal roots. It is suggested that the 'signal' from the chlorotic leaves was transmitted to the adventitious roots and not to the seminal roots. Further, the adventitious roots have the capacity to produce the 'reductants'.

0441 KENE D.R., and DESHPANDE, T.L. 1981. Uptake of micronutrients by hybrid jowar (CHS-1) in calcareous black soils of Vidarbha. PKV Research Journal 5(1):103-107. 16 ref.

The results revealed that application of micronutrients (Zn, Mn, and Fe) increased their content and uptake, and had good effects on the content and uptake of N and K but adverse effect on content and uptake of P205. The relative yield and nutrient uptake performance under different treatments indicated that the deficiency of any nutrient element depends upon its availability in soil as well as its ratio with available content of other nutrients.

0442 KNUDSEN, D., CLARK, B.B., DENNING, J.L., and PIER, P.L. 1981. Plant analysis of trace elements by X-ray. Journal of Plant Nutrition 3(1-4):61-75. 8 ref.

Energy dispersive X-ray fluorescence (EDXRF) technique has been used for multielement analyses of plant tissues. Elements can be assayed above the atomic number of Na (11) including S, Cl, Br, and trace elements, except B. Overall optimal pellet weights of 500 mg (32 mm diameter) and 100 mg (13 mm diameter) were chosen. It was found that weights could vary + 25% without significant change in intensities. Samples ground to 1 mm, 20-mesh, and 8-mesh did not show significant intensity differences. When 1 g of boric acid was used to back pellets, intensities for light elements (Mg, Al, Si, P, S) were increased, but for higher atomic number elements intensities decreased from 60% to less than 20% those of non-backed pellets.

0443 KUO, S., and MIKKELSEN, D.S.

1981. Effect of P and Mn on growth response and uptake of Fe, Mn and F by sorghum. Plant and Soil 62(1):15-22. 12 ref.

High P and Mn concentrations in solution (greater than 40 and 1 mg for P and Mn, respectively) markedly reduced plant height and shoot and root dry weight of 4-week-old sorghum plants. High Mn concentrations in solution increased the concentrations of Mn and P in shoot tissue and uptake of Mn, but depressed the uptake of P. High levels of P enhanced Mn uptake by sorghum and accentuated Mn toxicity at low Mn levels. The tissue Fe and total uptake of Fe were both reduced markedly by the high levels of P and Mn concentrations in solution. The increase of P, Mn and Fe concentrations in root tissue with a concomitant decrease of Fe in shoots suggests that the translocation of Fe from roots to shoots was hindered under high P and Mn conditions.

0444 LIN, C.F. 1981. Fertility status and response of sorghum to P K fertilizers in the soils of Pescadores Islands. (Ch). Journal of Agricultural Research of China 30(3):261-269. 6 ref.

0445 MALAVOLTA, E., NOGUEIRA, F.D., OLIVEIRA, I.P., NAKAYAMA, L., and EIMORI, I. 1981. Aluminium tolerance in sorghum and bean: methods and results. Journal of Plant Nutrition 3(1-4):687-694. 13 ref.

0446 MALI: MINISTERE DE L'AGRICULTURE, SECTION DE RECHERCHE SUR LES CULTURES VIVRIERES ET OLEAGINEUSES. 1981. Campaign report 1980: the effects of tilemsi phosphates on maize, millets, sorghums, and groundnuts. (Fr). Bamako, Mali: Ministere de l'Agriculture, Section de Recherche sur les Cultures Vivrieres et Oleagineuses. 44 pp.

0447 MARTINS, C.E., AMARAL, F.A.L.DO, MONNERAT, P.H., CONDE, A.R., and FONTES, L.A.N. 1981. Efficiency of



utilization of potassium, calcium and magnesium by 16 sorghum hybrids. (Pt). Revista Ceres 28(158):323-332. 9 ref.

0448 MICHAEL, R., and BADIGER, M.K. 1981. Transformations in plant-available forms of iron and manganese as influenced by manuring and cropping under irrigation. Plant and Soil 62(2):323-325. 8 ref.

Vertisols from field plots fertilized continuously with P, K, FYM alone and in combination at the rate of 60 kg P205, 30 kg K20 and 1.5 ton FYM per ha were tested for different forms of Fe and Mn as a consequence of continuous cropping with sorghum and wheat. The transformations that occurred in different forms of plant-available iron were greater than those of Mn. Exchangeable and easily reducible Fe contents were markedly influenced by treatments. In manganese, transformations of easily reducible to exchangeable forms were conspicuous.

0449 MIRHADI, M.J., and KOBAYASHI, Y. 1981. Studies on the productivity of grain sorghum. V. Effect of nitrogen fertilization and water stress on the grain yield, nitrogen uptake and translocation. Japanese Journal of Crop Science 50(2):131-142. 25 ref. (Summary: Ja).

A pot experiment was carried out to determine the optimum level of nitrogen application to obtain higher grain yield and protein content, and to investigate nitrogen uptake and translocation under different degrees of water stress. With increasing nitrogen application, there was an increase in percent crude protein and decrease in grain yield. From the data of the percent nitrogen content in grain to nitrogen content in whole plant, it is revealed that, with higher application of nitrogen, the absorbed nitrogen accumulated more in the vegetative parts and less translocated into the grains. No relationship was found between increasing concentration of nitrogen

in the soil and increasing grain and protein yields during drought. Imposition of a short period of drought (approximately 10 days) at 6th leaf emergence stage and rewatering before wilting resulted in an increase in grain and protein yields due to enhancement of nitrogen uptake and/or nitrogen translocation even under higher nitrogen application.

0450 NAGRE, K.T. 1981. Response of kharif jowar (sorghum) varieties to varying levels of NPK under rainfed conditions. Indian Journal of Agricultural Research 15(3):166-170. 5 ref.

An experiment conducted at Akola, Maharashtra, revealed that hybrids CSH-1 and CSH-2 were at par and recorded significantly more (55.3% and 41.8% respectively) yield than local improved variety NJ 164. During deficit rainfall and droughty year CSH-1 was better than CSH-2. Local variety NJ 164 responded to nitrogen only upto 60 Kg N/ha whereas CSH-1 and CSH-2 responded upto 120 Kg N/ha. At both these levels hybrids gave more response than local variety. CSH-1 gave 23.0 and 19.28 kg response to per kg of nitrogen at 60 and 120 kg N/ha level as against 8.68 and 5.53 kg obtained from NJ 164. Phosphate application was found effective at 60 kg P205/ha during 1969-70 only while Potash application was not found beneficial.

0451 NAGRE, K.T., and BAPORIKAR, V.R. 1981. Response of hybrid sorghum CSH-1 to plant densities and NPK fertilizers. PKV Research Journal 5(1):47-49. 9 ref.

Results of experiment conducted at Akola (India) during 1968-69 and 1969-70 indicated that yield of CSH-1 was significantly influenced due to various plant densities. Close spacing (45 x 75 cm) with high plant population of 2.96 lakh/ha was at par with moderate spacing (45 x 15 cm) with plant population of 1.48 lakh/ha and both recorded significantly more yield than wider spacing (45 x 22.5

cm) with 0.99 lakh plants/ha. Increasing doses of nitrogen upto 120 kg N/ha significantly increased the grain yield of CSH-1. The mean response per kg of nitrogen was 21.1 and 14.6 kg at 60 and 120 kg N/ha level. Quadratic function fitted to the data indicated that the optimum levels of nitrogen computed for 1968-69 and 1969-70 were 169.87 and 142.27 kg N/ha with the expected yields of 28.17 and 45.98 q/ha during respective years. Phosphate and potash application was not found beneficial.

0452 NAGRE, K.T., RAHATE, V.T., and KHEDEKAR, P.K. 1981. Studies on the effects of nitrogen and phosphate fertilization on yields of hybrids and high yielding varieties of sorghum. PKV Research Journal 5(1):31-34. 4 ref.

Results of two years indicated that hybrid CSH-5 gave maximum and significantly more yield than sorghum varieties No.302, No.148, CS-3541 and hybrid CSH-1. These new varieties had less yield potential as compared to hybrids. At 0 and 60 kg N/ha levels CSH-5 and CSH-1 were at par, however, at 120 kg N/ha level CSH-5 gave maximum and significantly more yield than CSH-1 and other varieties. Response of CSH-5 at 120 kg N/ha was 19.0 and 24.5 q/ha during 1975-76 and 1976-77 respectively. Phosphate application significantly increased sorghum grain yield at 60 kg P2O5/ha level. Straw yields of CSH-5 and CSH-1 were at par and the same were significantly more than other varieties.

0453 NONOYAMA, Y. 1981. Soil fertility with respect to non-tillage cultivation in upland field (sorghum) under paddy-upland rotation system. 1. Absorbing pattern of the soil nitrogen by grain sorghum. (Ja). Kinki chugoku Agricultural Research 62:58-62. 12 ref.

0454 PARKPIAN, P., and ANDERSON, W.B. 1981. Iron dust availability as

influenced by acidification. Agronomy Abstracts 73:187.

A fine Fe dust waste product was evaluated to determine its ability to alleviate Fe chlorosis of sorghum grown on a calcareous Fe deficient soil. It was mixed with the soil at two different particle sizes (dust and pellet) prior to seeding. These were each applied both without and with acidification to increase Fe solubility. The ratio of Fe to H<sub>2</sub>SO<sub>4</sub> was 1:2. Three rates of Fe application used were 0.2, 0.8, and 3.2 g/kg. Iron-deficiency symptoms in sorghum were very severe on both control and Fe pellet treatments at all rates. However, Fe dust at the rate of 3.2 g/kg was as effective as the acidified Fe materials, either dust or pellet, at the rate of 0.8 g/kg in alleviating chlorosis. Results indicated that acidification increased the solubility of the Fe material and the availability of soil Fe to the Fe deficient sorghum plants. This material also supplied some plant available manganese and zinc.

0455 PATIL, J.D., and PATIL, N.D. 1981. Effect of calcium carbonate and organic matter on the growth and concentration of iron and manganese in sorghum (*Sorghum bicolor*). Plant and Soil 60(2):295-300. 18 ref.

Addition of CaCO<sub>3</sub> caused significant decrease in dry matter and grain yield. But yields tended to increase with the addition of organic matter at the rate of 15 t/ha. The iron concentration decreased with the addition of CaCO<sub>3</sub> at all the stages of crop growth. Like iron, concentration of manganese also decreased with the increase in added CaCO<sub>3</sub>. Organic matter increased the iron concentration both at seedling and flowering stage. The concentration of manganese was, however, dependent on the stage of the crop.

0456 PAWAR, H.K., and NARKHEDE, B.N. 1981. Response of sorghum (*Sorghum bicolor* L. Moench) hybrid CSH-1 and variety M.35-1 to different levels of

N, P and K in rabi under irrigation. 3. Dry matter accumulation pattern. Journal of Maharashtra Agricultural Universities 6(1):41-45. 9 ref.

The response of Sorghum bicolor hybrid CSH-1 and variety M.35-1 to different levels of N (50, 100 and 150 kg/ha), P (25, 50 and 75 kg/ha) and K(25, 50 and 75 kg/ha) was studied in 1968-69 and 1969-70 at Pune (India). Increased levels of N fertilization showed beneficial effect on dry matter production at all the stages of crop growth. Dry matter production at maturity was considerably increased due to P application upto 50 kg/ha. In leaves the dry matter production was increased with increased levels of P. In earhead and grain the dry matter production was increased with application of P upto 50 kg/ha. In general, K application was not found to be useful in increasing the dry matter, however, 50 kg K/ha was found to be beneficial in increasing dry matter per plant in grains. Dry matter per plant was more in M.35-1 than in CSH-1 at all the stages of crop growth. The harvest index was found to be 39.2 and 30.6% in CSH-1 and M.35-1 respectively.

0457 PAWAR, H.K., and NARKHEDE, B.N. 1981. Response of sorghum (Sorghum bicolor L. Moench) hybrid CSH-1 and variety M.35-1 to different levels of N, P and K in rabi under irrigation. 4. Content and uptake of nitrogen. Journal of Maharashtra Agricultural Universities 6(2):117-123. 21 ref.

The uptake of N, P and K by Sorghum bicolor hybrid CSH-1 and variety M.35-1 as affected by different levels of N, P and K was studied in 1968-69 and 1969-70 at Pune (India). Sorghum contained the highest N (2.574%) at 25 days of growth, and at maturity it was 0.958%. At maturity grain showed the highest (1.489%) N content followed by the leaves (0.894%) and stem (0.491%). On an average, the sorghum crop removed 164.5 kg N/ha at maturity. Increased levels of N fertilization increased the content and uptake of N.

Application of P also increased the content and uptake of N in sorghum. In general, K application was not found to be useful in increasing the N content, however, 50 kg K/ha was found to be beneficial in increasing the N content in leaves and grains at maturity.

0458 PRASAD, M.M., SINHA, M.N., and RAI, R.K. 1981. Studies on phosphorus use efficiency in wheat and residual effect on kharif crops. Journal of Nuclear Agriculture and Biology 10(3):81-83. 13 ref.

Field experiments were carried out to study the utilization of fertilizer P by wheat in rotation with maize, sorghum, cowpea and moong. The grain and straw yield of wheat increased with increase in the level of P from 0 to 51 kg P/ha. The residual and cumulative residual effect of applied P on following kharif crops resulted in increased yield of each crop with the application of P upto 34 kg/ha. However, 51 kg P/ha, showed the residual effect on sorghum and moong only.

0459 QUILANG, R.R. 1981. Effect of rate and date of incorporation of ipil-ipil leaves on grain sorghum. M.S. thesis, University of Philippines at Los Banos, Los Banos, Laguna, Philippines. 58 pp. 35 ref.

0460 RALPH, W. 1981. Nitrogen losses from irrigated crops. Rural Research 112:11-13. 2 ref.

Decrease in the yields of irrigated sorghum, maize, and cotton due to loss of nitrogen from the soil is reviewed. The advantages of mixing anhydrous ammonia in irrigation water and the problems due to ammonia adsorption into soil particles and volatilization resulting in uneven nitrogen distribution are discussed. Use of acid or urea to overcome some of these problems is suggested.

0461 RAMANI, S., KANNAN, S., and NIRALE, A.S. 1981. Differential zinc

uptake and transport in sorghum varieties suited for different moisture regimes. *Journal of Plant Nutrition* 4(4):337-351. 16 ref.

Zinc absorption and transport were examined in M.35-1, a drought resistant, and M.47, a drought susceptible *Sorghum bicolor* varieties. Excised roots were employed to study the mechanism of uptake at cellular level. The absorption over 0 to 130 micro M ZnCl<sub>2</sub> followed a biphasic pattern with a second rise at 90 micro M. While there were no differences in the pattern of absorption in the two cultivars, transport of Zn to shoot followed a higher rate in M.47 than in M.35. Phosphates decreased the uptake and transport of Zn in both the varieties. However, Zn inhibited phosphate absorption and transport in intact seedlings differentially among the varieties. The inhibition of Zn uptake by phosphate was much less in M.35 than M.47, which will facilitate survival of M.35 under water stress.

0462 RLCAMONTE, E.M., and ALFEREZ, A.C. 1981. The influence of nitrogen fertilization and population on density on yield and yield components of three sorghum varieties. *CLSU Scientific Journal* 2(1):59-70. 16 ref.

A field experiment was conducted to evaluate the response of Cosor 3, BPI Sor 1 and UPLB SG 5 to varying levels of nitrogen and plant population densities under Central Luzon (Philippines) conditions. The levels of nitrogen were 60, 100 and 150 kg per hectare. The population densities used were 200,000, 250,000 and 300,000 plants per hectare. The computed grain yield per hectare of the three varieties was highest at 150 kg N per hectare (14.1 tons) and lowest at 50 kg N per hectare (9.0 tons). Grain yield also increased as plant population was increased from 200,000 (9.7 tons) to 250,000 (2.0 tons) plants per hectare. Yield did not increase beyond 250,000 plants per hectare.

0463 ROSOLEM, C.A., BRINHOLI, O., and MARCONDES, D.A.S. 1981. Effects of time and rate of application of nitrogen and grain sorghum (*Sorghum bicolor* (L.) Moench) production. (Pt). *Cientifica* 9(1):85-89. 16 ref. (•Summary: En).

Doses of 0, 40, 80 and 120 kg/ha of nitrogen as ammonium nitrate were applied at sowing, half at sowing + half at growing differentiation, and half at sowing + half at boot stage. Results revealed that the nitrogen fertilization did not increase the grain production, but the fertilized plants had their cycles fastened in relation to unfertilized ones. Topdressing nitrogen at growing point differentiation caused the major grain production compared to applications at sowing and at boot stage.

0464 ROSOLEM, C.A., MALAVOLTA, E., MACHADO, J.R., and NAKAGAWA, J. 1981. Effects of N, P and K on protein contents and protein production of grain sorghum. (Pt). *Turrialba* 31(2):129-134. 11 ref. (Summary: En).

The experiment was conducted on 5 grain sorghum cultivars, in nutrient solution. The cultivars presented different responses to nutrient stress and the nutrient effects were more important on grain production than on protein contents of the grains.

0465 SAYEGH, A.H., JALOUD, A., and OSMAN, A.M. 1981. The effect of compound versus single fertilizers on the productivity of some crops in the middle eastern countries. *Landwirtschaftliche Forschung* 34(1-2): 60-66. 3 ref. (Summary: De, Fr).

Fertility trials were conducted in Saudi Arabi, Syria, and Jordan to compare the effect of compound versus single fertilizers, at the same level of nutrients on the yield of vegetable and field crops. Results revealed that the use of mineral fertilizers almost doubled the yield and the compound fertilizer NPK 15-15-15 was one of the most successful types.

Fertilizers traditionally preferred by government advisory services for arid soils did not show any superiority to the other forms of fertilizers. Good water supply and weed control were found essential for efficient fertilizer response.

0466 SHIBANO, K., HORINO, T., and HARAKI, T. 1981. Fertilizer application method for high-yielding culture of grain sorghum. 2. K, Ca and Mg content of grain sorghum influenced by N side-dressing. (Ja). Kinki Chugoku Agricultural Research 61:28-31. 6 ref.

0467 SINGH, L. 1981. Phosphorus and potassium requirements of sorghum in savannah soils of Nigeria. Pages 83-91 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 11 ref.

The response of sorghum grain to applied P and K under groundnut-sorghum rotation in savanna zone of Nigeria was studied. Results indicated that most of the savanna soils were low in available P and K content. Application of 16 kg P and 20 kg K per ha was found adequate. Suggests that the fertilizer applications be based on the soil test values to avoid under or over fertilization.

0468 SINGH, L., and NNADI, L.A. 1981. Residual effect of previous crops and fertilizer on wheat yield and soil properties at Kadawa, Nigeria. Pages 75-82 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 5 ref.

Effects of different crops grown in rainy season following wheat crop in dry season and their impact on soil properties are reported. Results indicate that sorghum was the most exhaustive crop followed by maize. To harvest good yields and to maintain the soil fertility at an optimum level

under sorghum-wheat rotation, higher rate of fertilizer was found necessary.

0469 SPALLACCI, P. 1981. Nitrogen uptake by crops manured with pig slurry. Pages 678-680 In Nitrogen losses and surface run-off from landspreading of manures (ed. J.C.Brogan). The Hague, Netherlands: Martinus Nijhoff.

Results are given for four year lysimeter trials carried out on different soils with various rates of pig slurry applications. The nitrogen uptake and its increase by increasing applications of slurry were the highest in forage sorghum, medium in grain maize and grain sorghum, and lowest in wheat. Uptake was maximum on sandy clay and on sandy loam soils.

0470 SUTRISNO, UTOMO, W.H., and DHARMAPUTRA, T.S. 1981. The application of Cate and Nelson's method for predicting nitrogen critical level of 6orghum. Agrivita 4(4):16-22. 11 ref.

Based on the method of Cate and Nelson (1971), the nitrate-nitrogen critical level at 5 days and 30 days after the second N application were 199.0, 99.5 and 87.0 ppm (UPCA S1); 219.0, 152.0 and 102.0 ppm (6 C); and 169.0, 369.0 and 87.0 ppm (Darso). The critical levels for total nitrogen were 0.40, 0.57 and 0.64% (UPCA S1); 0.29, 0.69 and 0.69% (6 C), and 0.45, 0.69 and 0.55% (Darso).

0471 TAMURA, K., HATAKEYAMA, S., and NAWA, N. 1981. Effects of bulk blending fertilizer on the growth of sorghum. (Ja). Kyushu Agricultural Research 43:129.

0472 TANDON, H.L.S., KUMAR, V., MEELU, O.P., PRASAD, R., PURI, D.N., RANDHAWA, N.S., SEKHON, G.S., and SINGH, R. 1981. Soil fertility and fertilizer use in India. Pages 9-25 In Quarter century of agronomic research in India (1955-80). New Delhi, India: Indian Society of Agronomy. 31 ref.

Progress in the field of soil fertility and fertiliser use during 1955-80 has been revived. Widespread deficiencies of N, P, K and Zn have given a comprehensive and dynamic meaning to 'balanced fertilizer use'. Recommended doses of fertilizers have been developed on individual crop basis but research on treating various cropping systems as the unit is growing. Among food grains, research effort on irrigated crops has been much more than on rainfed crops. A notable feature is the development of large-scale fertilizer experiments on farmers' fields. Use of isotopes and high-speed analytical system is increasing. Extensive responses to N and P have been recorded for many crops under rainfed conditions. Effect of pease-meal vs. simultaneous adoption of improved practices on the yield of rainfed sorghum has been illustrated.

0473 UMRANI, N.K., and BHOI, P.G. 1981. Response of different sorghum varieties to nitrogen under dryland conditions. Fertiliser News 26(11):18-19, 23. 4 ref.

Varietal response to nitrogen application was studied under dryland conditions of Solapur (India) for different rabi sorghum varieties. Newly developed hybrid like CSH 7R was included in these studies. It was noticed that response to N fertiliser was highly dependent on rainfall. In different years it varied from 7 kg to 32 kg grain/kg N applied. Very high response was noticed during good rainfall year. Varieties differed in production of grain in such a year. This was probably the reason for slow spread of hybrids during rabi season. Hybrid CSH 7R showed good response compared to M.35-1 at 30 kg N level. Response beyond 60 kg N/ha was not significant. Fodder production of hybrids was, however, half of the traditional variety M.35-1.

0474 WOOD, R.A. 1981. Nitrogen availability in soils as influenced by organic fertilizers having different

C/N ratios. Proceedings of the South African Sugar Technologists' Association 55:165-168. 5 ref.

Three soils representing the Fernwood, Cartref and Inanda series were treated either with fresh or decomposed filtercake, poultry litter or poultry manure having different C/N ratios to examine their effects of N availability. Over a period of four weeks, rates of N immobilization and mineralization were determined for the various treatments under incubated conditions in the laboratory. Simultaneously in the glasshouse the recovery of N by sorghum under the same fertilizer treatments was determined in a pot experiment. The total inorganic N present in the different soil treatments after four weeks incubation was closely correlated with uptake of N by sorghum from all three soils. Plant uptake of N was depressed on all soils following the addition of fresh filtercake having high C/N ratios.

## Planting Seasons and Dates

0475 ALI, M., RAWAT, C.R., and DHAR, S.N. 1981. Productivity of kharif crops as influenced by planting time under dryland conditions. Indian Journal of Agronomy 26(1):71-76. 5 ref.

Productivity and profitability of sorghum, pearl millet, redgram, soybean and blackgram on different dates of planting was determined for 3 consecutive years (1977-1979) under dryland conditions of Bundelkhand region (India). Of the two cereals, pearl millet outyielded Borghum on all dates of planting and was found to be the most remunerative crop. Early planting (June 20) led to highest production and return from sorghum, pearl millet and redgram and decreased when planting was delayed.

0476 HUME, D.J., and KEBEDE, Y. 1981. Responses to planting date and

population density by early-maturing sorghum hybrids in Ontario. Canadian Journal of Plant Science 61(2):265-273. 23 ref. (Summary: Fr).

One early-maturing, commercially available Sorghum bicolor hybrid Pride P130, and two experimental hybrids Pride X4043 and Pride X 3160 were grown at three planting dates and three plant densities in 1975 and 1976 at Elora, Ontario. Grain yield of all hybrids decreased by about 10% per week when plantings were delayed by 2 or 4 weeks. Increasing populations from 75000 to 30000 plants/ha in 1975 increased grain yield from 4.3 to 6.0 t/ha. In 1976, raising populations from 150000 to 450000 plants/ha increased average yields from 3.2 to 3.7 t/ha. P130 was the earliest and the best yielding hybrid in both years. In 1975, the best environmental treatment yielded 7.3 t grain/ha while in 1976 it yielded 5.7 t/ha.

0477 MIRHADI, M.J., and KOBAYASHI, Y. 1981. Studies on the productivity of grain Sorghum. IV. Effect of various planting dates on the growth, grain yield, and protein content of irrigated and nonirrigated grain sorghum. Japanese Journal of Crop Science 50(2):115-124. 10 ref. (Summary: Ja).

Hybrid H-726 was planted on May 1, 15, June 1, 15, July 1, 1978. Irrigated treatments received water 2 times a week during the growing season, while irrigation was stopped from 6th leaf emergence stage in the nonirrigated treatments. There was a remarkable increase in plant height, panicle length, number of leaves per plant, number of grains per panicle, grain and forage yields and their nitrogen contents in irrigated treatments compared with nonirrigated treatments at all planting dates. Compared with later planting, early planting resulted in higher grain and protein yields in both irrigated and nonirrigated treatments. It seems that long vegetative period and short

ripening period were favorable conditions for grain sorghum to produce high grain and protein yields.

0478 SRIVASTAVA, U.S.L., and SINGH, S. 1981. Effect of different sowing dates on the yield of sorghum cultivars. Indian Journal of Agronomy 26(4):444-445. 2 ref.

The investigation included two separate field experiments in which two hybrids (CSH-1 and CSH-2) in 1971 and two indigenous types (T-22 and T-4) in 1972 were tested under 4 sowing dates which were planted at an interval of 7 days commencing with first monsoon rains. Data showed that sowings on earlier dates gave significantly higher grain yield than the later dates. Fodder yield also reduced with delay in sowing. CSH-2 outyielded CSH-1 in both grain and fodder yields while T-22 and T-4 were at par in grain yield.

0479 VECCHIETTINI, M. 1981. Sowing date effects on maize (*Zea mays* L.) and grain sorghum (*Sorghum vulgare* L.). (It). Revista di Agronomia 15(3-4):225-232. 14 ref. (Summary: En).

Six trials, four on sorghum (two in West-Emilia hills, 300-350 m above sea level and two in the plain around Modena), and two on maize, only in the latter environment, were carried out. The best sowing period for grain sorghum varied from the hills to the plain. In the hills the latest sowing dates (May 13 in 1976 and May 16 in 1977) proved to be better than previous ones (April 13 and 28 in 1976 and April 27 and May 6 in 1977). The earliest sowing dates gave, in fact, the lowest yields, mainly because of the poor plant growth. In the plain, the first sowing dates (April 21 in both years) gave better results than the latest ones (May 6 in 1976 and May 21 in 1977), mainly because of better plant density. The latest maize and sorghum hybrids gave the highest yields, and the differences among them were very small. In practice, however, the late sowing of hybrid

sorghum should be discarded because of ripening harvesting problems.

## Farming Systems

0480 ACOSTA, M., and VERSOZA, J.C. 1981. Effect of different levels of nitrogen on the yield of mungbean intercropped with sorghum. TCA Research Journal 3(2): 73-76. 9 ref.

0481 BHALERAO, S.S., and UPADHYAY, U.C. 1981. Crop geometry studies in sorghum in association with pigeonpea varieties. Indian Journal of Agricultural Sciences 51(11):778-781. 5 ref.

Different row spacings and planting methods for Sorghum bicolor tested during 1975-76 and 1976-77 showed no significant difference in the yield of sorghum at an optimum plant population of 180,000. Intercropping of 'No.148' pigeonpea in sorghum rows gave an additional yield of 3.42 q/ha of pigeonpea without significant reduction in sorghum yield. The gross income was also the highest, being Rs.586/ha more than with the sole crop of sorghum.

0482 BHAN, S., and KHAN, S.A. 1981. Double cropping under rainfed conditions of central Uttar Pradesh. Indian Journal of Agronomy 26(4):371-376. 7 ref.

A field study with 20 crop rotations was conducted at the Soil Conservation Farm, Kanpur (India) for 4 consecutive years, 1975-76 to 1978-79. The study revealed that with selection of suitable crops and varieties and adoption of proper agronomic practices, it was feasible and remunerative to follow double cropping in rainfed areas of central Uttar Pradesh where at present, in general only one crop is grown in a year. The rotations, of fodder (sorghum 8B)- safflower 'T 65', fodder (sorghum 8B)- mustard 'KB2', blackgram T 9- mustard 'KB2', blackgram T 9-

Bafflower 'T 65,' greengram 'K 851'- mustard 'KB 2' and greengram 'K-851'- safflower 'T 65' appeared to be productive and remunerative as compared to the practice of leaving the land fallow during kharif.

0483 CASTILLO, A.P. 1981. Influence of intercropping perennial stylo (*Stylosanthes guyanensis*) on growth and yield of grain sorghum (*Sorghum bicolor* L. Moench). M.S. thesis, University of Philippines at Los Banos, Los Banos, Laguna, Philippines. 50 pp. 29 ref.

0484 CELESTINO, A.F. 1981. Optimization of the yield of mungbean-sorghum intercrop through manipulation of density and time of interplanting. Ph.D. thesis, University of Philippines at Los Banos, Los Banos, Laguna, Philippines. 201 pp. 43 ref.

0485 CHOWDHURY, M.S., and MISANGU, R.N. 1981. Sorghum/chickpea intercropping trial at Morogoro, Tanzania. Pages 217-221 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Sorghum was intercropped with chickpea at varied soil fertility levels in a field experiment. Chickpea was inoculated with a commercial inoculant (Nitrogerm-chickpea) under three levels of soil fertility: (a) no fertilizer (control), (b) 20 kg N/ha as ammonium sulfate, and (c) 20 kg N/ha plus 100 kg P/ha as ammonium sulfate and triple superphosphate, respectively. Results indicated the absence of indigenous rhizobia for chickpea. Inoculation significantly increased dry matter and N content of chickpea, but failed to increase grain yield. Intercropping decreased the dry-matter content and grain yield of chickpea but had no effect on yield of sorghum. Variation in the soil fertility levels had no effect no



nodulation, dry matter, N content, or grain yield of chickpea but significantly increased the grain yield of sorghum.

0486 CHOWDHURY, S.L. 1981. Recent studies in intercropping systems on the drylands of India: some thoughts, some results. Pages 299-305 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Some doubts are expressed regarding the adequacy of documentation on the benefits often claimed to accrue from intercropping systems of the "replacement series" type. The doubts are illustrated by the results presented and obtained in trials conducted at cooperating centers of the All India Coordinated Research Project for Dryland Agriculture during 1971-72 to 1977-78. The land equivalent ratio measure is found inadequate to measure total productivity or incomes. Expected money value is recommended as a better measure for trials on intercropping systems involving optimal populations of both components to establish conclusions in this area of research. Usually cereals including sorghum, grain legumes, and oil-seeds are used as components in intercropping systems in India.

0487 CONGLETON, W.F., and JOHNSON, J.T. 1981. Double cropping of corn and grain sorghum enhanced by irrigation. *Agronomy Abstracts* 73:16.

A long growing season and the availability of irrigation allows South Georgia farmers to double crop grain sorghum behind corn. Under good management, yields in excess of 9.4 metric tons/ha of number two shelled corn and 4.6 metric tons/ha of number two grain sorghum are both economical and feasible. Higher yields have been obtained by some growers. Widespread use of this double-cropping system under irrigation in the southeastern United States will largely depend upon

the availability of (1) high-yielding, early-maturing corn and grain sorghum hybrids, (2) pesticides effective in controlling problem weeds and insect pests and (3) reliable markets for grain sorghum.

0488 CRABTREE, R.J., and MAKONNEN, G.A. 1981. Double and monocropped wheat and grain sorghum under different tillage and row spacings. *Soil Science* 132(3):213-219. 8 ref.

A field study was conducted on a Wynona silt loam soil (Cumulic Haplaquolls) to analyze the effects of tillage and row spacings on soil water content and yields of monocropped (MC) and double-cropped (DC) wheat and grain sorghum under rainfed conditions. For the 3 years of successfully double-cropping grain sorghum (DC-GS), conventional tillage, double-cropped grain sorghum (CT-DCGS) in 50-cm rows yielded 4080, compared with 3810 kg/ha in 75-cm rows. No-tillage, double-cropped grain sorghum (NT-DCGS) in 50-cm rows yielded 3830 compared with 3590 kg/ha in 75-cm rows. When planted at the same time as the DC-GS, conventional tillage, monocropped grain sorghum (CT-MCGS) in 50-cm rows yielded 4150 compared to 3760 kg/ha in 75-cm rows.

0489 CURRIER, C.G., and STARLING, J.G. 1981. Two harvests from one planting. *Highlights of Agricultural Research* 28(1):5.

0490 DUNCAN, R.R. (ed). 1981. Ratoon cropping of sorghum for grain in the southeastern United States. *Research Bulletin, Georgia Agriculture Experiment Stations* no.269. 45 pp.

The possibility of producing two grain crops of sorghum from one planting during a single growing season and the advantages and disadvantages of ratoon cropping of sorghum grain hybrids are described. Better agronomic and fertility practices, methods of weed and insect control, and hybrid selection are also recommended.

0491 EDJE, O.T. 1981. Response of sorghum (*Sorghum bicolor*) and beans (*Phaseolus vulgaris* cultivar 253-1) in mono culture and in association. LUSO Journal of Science and Technology 2(1):3-13.

0492 ELMORE, R.W., and JACKOBS, J.A. 1981. Sorghum plant height effect on intercropped soybean yield and yield components. Agronomy Abstracts 73:103.

The effect of short (1 m) and tall (1.5 m) *Sorghum bicolor* on alternate-row intercropped soybeans was studied in an experiment conducted in Isabela, Puerto Rico. Soybean yields with tall sorghum were 18% less than those with short sorghum as a result of decreased pods/plant and seeds/pod. Tall sorghum cultivars were, however, more productive than the short cultivars.

0493 FRANCIS, C.A. 1981. Developing hybrids of corn and sorghum for future cropping systems. Pages 32-47 In Proceedings, Thirty-fifth Annual Corn and Sorghum Industry Research Conference, 9-11 December 1980, Chicago, Illinois, USA. Washington, DC, USA: American Seed Trade Association. 16 ref.

A survey was conducted to collect opinions from specialists on factors limiting the yield, and important problems the breeder is most likely to solve in future. Survey responses indicated that limited moisture (88%) and insect problems (82%) were the factors limiting yields in sorghum. Solutions were expected from breeding for resistance to insects (65%), to drought (44%) and diseases (29%). Availability of less water, minimum tillage, more use of herbicides, narrow rows, rotational crops and lower seeding rates were the main changes anticipated by respondents in sorghum cropping systems. Based on it, long-term changes in crops and cropping systems are predicted.

0494 GIRI, A.N., and BAINADE, S.S. 1981. Studies on intercropping system

with hybrid sorghum CSH-6. Indian Journal of Agronomy 26(3):351-352.

An experiment to study the possibility of taking two intercrops in between two paired rows of sorghum under rainfed conditions was conducted. Data revealed that the grain yield of sorghum CSH-6 was not influenced due to different crops grown in the intercropping systems. Highest grain yield was obtained from sorghum paired row + sesamum x mung intercropping system. Sesamum + mung, pigeonpea + mung/groundnut in between paired rows of sorghum, gave higher grain yields than sole crop of sorghum.

0495 HELSEL, Z.R., and WEDIN, W.F. 1981. Harvested dry matter from single and double cropping systems. Agronomy Journal 73(5):895-900. 14 ref.

Studies were conducted to investigate the potential of double cropping (DC) in central Iowa by growing grain sorghum, forage sorghum, sorghum x sudangrass (all *Sorghum bicolor* Moench) and 7 other crops in single cropping (SC) system and following either winter rye or spring oats harvested for forage in double cropping system (DC). Average drymatter (DM) yields of main crops were greater in SC system than in DC system. However, forage sorghum and sorghum x sudangrass hybrid in both SC and rye-DC systems produced the highest whole crop yields. It was concluded that there is a potential for increased harvestable DM by DC in the north central United States, if a small grain harvested early for forage is the first crop of the DC system.

0496 HONDURAS: SECRETARIA DE RECURSOS NATURALES, DIRECCION AGRICOLA REGIONAL NOR-ORIENTAL. 1981. Regional development project of the valley of Guayape: periodical report. (Es). Tegucigalpa, Honduras: Secretaria de Recursos Naturales, Direccion Agricola Regional Nor-Oriental. 25 pp.

- 0497 HONDURAS: SECRETARIA DE RECURSOS NATURALES, DIRECCION AGRICOLA REGIONAL NOR-ORIENTAL. 1981. Regional development project of the valley of Guayape: report of advance. (Es). Tegucigalpa, Honduras: Secretaria de Recursos Naturales, Direccion Agricola Regional Nor-Oriental. 81 pp.
- 0498 HSIEH, S.Y. 1981. The improvement and development of upland crops in Al-Ha6sa area, Saudi Arabia. (Ch). Tainan DAIS Scientific Meeting Report 1980:1-5. 4 rf. (Summary: En).  
Results of work on upland crop improvement between winter 1974 and spring 1979 by the Chinese Agricultural Technical Mission in Al-Hassa area, Saudi Arabia is reported. Among 12 kinds of introduced upland crops, corn and sorghum were found good for spring crop and fall crop while sunflower was good for all year round cropping. It recommends the Government to build up a complete agricultural policy including the processing factory, rotation system, economical utilization of water source, reducing the production costs by large cultivation and mechanization.
- 0499 HUNSHAL, C.S. 1981. Efficient and remunerative intercropping of sorghum, redgram, greengram, and soybean with compatible plant population. Ph.D. thesis, Haryana Agricultural University, Hissar, Haryana, India. 129 pp.
- 0500 ICRISAT. 1981. Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT. 401 pp.
- 0501 ICRISAT, MALI COOPERATIVE PROGRAM. 1981. Sorghum legume intercropping. Pages B5-B20 In ICRISAT Mali preliminary report for the 1981 season. Bamako, Mali: ICRISAT. (Summary: Fr).
- 0502 JAYARAMAN, S., and MORACHAN, Y.B. 1981. Performance of soybean varieties in sorghum based cropping systems in relation to yield. Madras Agricultural Journal 68(8):506-512. 1 ref.  
A field experiment was conducted at Coimbatore (India) in South West monsoon 1978 to identify the shade tolerant soybean varieties under the sorghum based cropping systems. Performance of sorghum (Co.21) was found better in paired row system. Maximum sorghum grain yield of 4304 kg/ha was recorded when grown with soybean. Application of 80 kg N/ha resulted in higher sorghum grain yield of 4356 kg/ha over 60 kg N/ha. Maximum net return of Rs.2939/- and Rs.2841/- per ha were realised when sorghum was grown with lab-lab and soybean Punjab-1.
- 0503 JAYARAMAN, S., and MORACHAN, Y.B. 1981. Harvest index of soybean varieties in sorghum based cropping system. Madras Agricultural Journal 68(10):690-691. 1 ref.  
Five soybean varieties were tested to identify the variety with highest harvest index in sorghum based cropping systems. It was revealed that varieties, cropping systems, and nitrogen levels influence the harvest index. Uniform row system of planting and 80 kg N/ha showed an increased harvest index number over paired row system and 60 kg N/ha application. In both the systems and nitrogen levels, Punjab-1 performed well.
- 0504 JODHA, N.S. 1981. Intercropping in traditional farming systems. Pages 282-291 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.  
Studies show that intercropping is largely a system of small and unirrigated farms. A significant implication of this finding is that any breakthrough in intercropping technology will help poor farmers more

than the rich. Increased research resource allocation to intercropping will thus serve the equity goals better. Stresses the need to develop simple system that satisfies key objectives, such as profitability and stability, without ignoring the other objectives that underlie the traditional intercropping system.

0505 KANWAR, J.S. 1981. Problems and potentials of vertisols and alfisols: the two important soils of SAT: ICRISAT experience. Presented at the International Symposium on Distribution, Characteristics and Utilization of Problem Soils, 19-26 October 1981, Tsukuba, Japan. 35 pp. 18 ref.

Evidence is presented that using small watershed concept, broad bed and furrow (BBF) system of land treatment, improved cultivars, fertilizers and good management the vertisols in Indian SAT even under rainfed farming can produce about 600 per cent more food. Estimates show that about 12 million ha of vertisols of Indian SAT which remain uncropped during the rainy season are capable of producing an additional 36 million tons of grain with improved technology. Similarly the alfisols also with an improved technology can produce many times more food. However, there are still some problems of alfisols such as crusting and crop stand establishment, which require intensive investigation. Data on yield, and response to N fertilizer of sorghum are presented with other crops.

0506 KRANTZ, B.A. 1981. Intercropping on an operational scale in an improved farming system. Pages 318-327 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Recent research has shown substantial benefits from intercropping at medium to high levels of technology; however, due to several factors, including the lack of

operational-scale research, sole-cropping technology is being promoted by national programs, and the potential benefits of improved intercropping are not being achieved. Therefore, steps should be taken to conduct research on an operational scale to uncover and solve possible problems and constraints. Farmers in the semi-arid tropics should be provided with the necessary information to capitalize on the intercropping benefits and the synergistic effects of nonmonetary-improved management to use in combination with costly monetary inputs.

0507 KUROE, H., ORITA, Y., HARADA, M., and TSUNEYOSHI, T. 1981. Studies on mixed cultivation of corn and sorghums. (Ja). Kyushu Agricultural Research 43:144.

0508 LOMBIN, L.G. 1981. Continuous cultivation and soil productivity in the semi-arid savannah: the influence of crop rotation. Agronomy Journal 73(2):357-363. 23 ref.

The effects of nine sequences of growing cotton, Sorghum bicolor and groundnuts on soil productivity and crop nutrition were evaluated on a sandy loam soil at Samaru (Nigeria). The sequence treatments were: continuous sorghum, cotton, and groundnuts; sorghum followed by groundnuts or cotton; groundnuts followed by sorghum or cotton; and cotton followed by sorghum or groundnuts. Sorghum yielded higher when preceded by groundnuts than when preceded by cotton. Continuous sorghum significantly depressed yield. On the average, groundnuts performed equally well when preceded by sorghum or cotton but yielded significantly less when continuously cropped. Cotton following sorghum outyielded cotton following groundnuts or cotton following cotton. Most of the rotational effects especially on sorghum were most attributable to residual soil N. A continuous monoculture of any of the three crops

appears inadvisable. For maximum yields, the best sequence would be groundnuts followed by sorghum and cotton in that order.

- 0509 LOMBIN, L.G., and ABDULLAHI, A. 1981. Effects of cropping sequence on the yields of three major savanna crops at Samaru, Nigeria. Samaru Journal of Agricultural Research 1(1):49-58. 28 ref.

In a study to determine the best sequence of growing sorghum, groundnuts and cotton in a rotation in Samaru (Nigeria), yields were highest when groundnut was followed by sorghum and cotton. A continuous monoculture of each of these crops on the same land tended to depress yields, this being most severe in sorghum and least severe in cotton. Sorghum appeared to be a better preceding crop for both cotton and groundnuts.

- 0510 MAFRA, R.C., LIRA, M.DE A., ARCOVERDE, A.S.S., ROBERIO, G., and FARIS, M.A. 1981. Studies on the intercropping of sorghum and corn with phaseolous beans (*Phaseolus vulgaris*) and cowpea (*Vigna unguiculata*). Pages 46-51 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

A study on the intercropping of corn and sorghum with cowpea and beans was carried out in the "Agreste" and "Sertao", two ecological zones of the state of Pernambuco, Brazil. The number of plant-units was the same in both the intercropping and the sole-crop systems, since one row of corn or sorghum was replaced by one row of cowpea or two rows of beans. The results indicate that corn can be replaced by sorghum in intercropping corn/legume systems without damage to the legume yield. This replacement should promote a yield stability because sorghum is less affected by the weather than corn.

- 0511 MATEO, N., DIAZ, A., and NOLASCO, R. 1981. The maize-sorghum

crop production system in Honduras. (E8). Turrialba, Costa Rica: Centro Agronomico de Investigacion y Ensenanza. 19 pp.

- 0512 MCCLURE, R.M., FLOWERDAY, A.D., SHAPIRO, C.A., and SULLIVAN, W.M. 1981. Crop yield and plant differences as effected by cropping sequence. Agronomy Abstracts 73:109.

A dryland cropping sequence experiment was conducted at Mead, Nebraska, from 1973 to 1980. The crop sequence included corn, soybeans, and Sorghum bicolor. The cropping sequences were planned so that in the four year rotation each crop would follow corn, sorghum, soybeans or fallow every year. Weather conditions were variable over the period of research resulting in a range of results. Continuous corn, soybeans and sorghum produced lower yields of 76, 84 and 90 percent respectively compared to the same crops in rotation or after fallow. Plant height was also affected by the previous crop.

- 0513 MEAD, R., and STERN, R.D. 1981. Statistical considerations in experiments to investigate intercropping. Pages 263-276 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

A survey is made of the implications of various standard statistical concepts for designing and analyzing intercropping trials. Methods of collecting and analyzing growth data are examined, and suggestions are made of ways in which these could be improved. For the analysis of yield data, it is particularly important to develop computer programs so that the basic analyses can be performed simply. For further analyses, the value and limitations of using a land equivalent ratio as an index of total yield are discussed, and some further possibilities are introduced.

- 0514 MENENDEZ, J., and MARTINEZ, J.F.

1981. Yield of legumes associated with sorghum. (Es). Ciencia y Tecnica en la Agricultura. Serie: Pastos y Forrajes 3(1):83-100. 13 ref. (Summary: En).

0515 MITAWA, G.M. 1981. Effect of densities and row arrangement on intercropped sorghum and pearl millet. M.Sc. thesis, University of Nebraska, Lincoln, Nebraska, USA. 124 pp. 71 ref.

Yields were higher when sorghum and millet were grown in certain associated patterns. Growing crops in alternate rows or within row mixtures also showed yield gains. An alternative row arrangement could be applied in mechanized agriculture while within row mixtures may have potential for adoption by farmers with low levels of technology.

0516 NATARAJAN, M., and WILLEY, R.W. 1981. Growth studies in sorghum/pigeonpea intercropping with particular emphasis on canopy development and light interception. Pages 180-187 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Two experiments were conducted at ICRISAT Center on a medium deep vertisol during 1977 and 1978 to study in detail the growth and resource use by the sole crops and intercrops of sorghum and pigeonpea. In the first experiment, growth and yield of sorghum in an intercropping pattern of 2 rows sorghum: 1 row pigeonpea was similar to that of sole sorghum, and the pigeonpea produced seed yield equivalent to 70% of the sole crop. Light use by the intercrop canopy was efficient except for a period of very low interception during the period immediately after sorghum harvest. In the second experiment attempts were made to improve light interception during this period by changing the row arrangement to a 1:1 pattern and increasing the pigeonpea population.

Data so far available indicate that both factors had increased the light interception, and produced a dry-matter response, but final seed yields were not available.

0517 OSIRU, D.S.O., and KIBIRA, G.R. 1981. Sorghum/pigeonpea and finger millet/groundnut mixtures with special reference to plant population and crop arrangement. Pages 78-85 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Sorghum/pigeonpea and finger millet/groundnut mixtures were examined in alternate-row and within-the-row arrangements. A "replacement-series" technique was used; all treatments were examined at four levels of population. Yields of mixtures were large in comparison to respective sole-crop stands. In the sorghum/pigeonpea mixture, yield advantages up to 29% were achieved; in the finger millet/groundnut mixture, yield increased up to 44%. It is concluded that the higher yield from mixtures occurred because the component crops were able to utilize the environment better than their sole-crop stands.

0518 PLUCKNETT, D.L., ESCALADA, R.G., and DE LA PENA, R.S. 1981. Ratoon cropping of rice and sorghum: recent advances. Madras Agricultural Journal 67(11-12):31-39. 28 ref.

0519 PUJARI, B.T. 1981. Effect of intercrops and irrigation levels on the growth and yield of rabi hybrid sorghum in an intercropping system. M.Sc. thesis, University of Agricultural Sciences, Bangalore, Karnataka, India. 139 pp.

0520 RANDHAWA, N.S., and RAO, M.S.R.M. 1981. Management of deep black soils for improving production levels of cereals, oilseeds, and pulses in the semi-arid region. Pages 67-79 In Proceedings, Seminar on

Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, 21 May 1981, New Delhi, India. Patancheru, Andhra Pradesh, India: ICRISAT. 10 ref.

The major problem in black soils is one of increasing efficiency of otherwise low rainfall and ensuring safe disposal of inevitable runoff with minimum soil loss. These objectives could be achieved by adopting suitable mechanical structures at specified vertical intervals along with supporting practices in the inter-terraced areas. Combination of right choices of crop, variety, and improved agronomic techniques are equally important. Sorghum is recommended to be the most suitable variety for rabi black soils of the region based on the yield data.

0521 RAO, M.R., and WILLEY, R.W. 1981. Stability of performance of a pigeonpea/sorghum intercrop system. Pages 306-317 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT. 21 ref.

Results of 89 experiments available on sorghum/pigeonpea intercrops have been pooled, and some basis for understanding the stability of performance is presented. On an average, the intercrop system provides the equivalent of 90% of the sole-sorghum yield and about 52% of the sole-pigeonpea yield. Row arrangements do not make much difference to sorghum yields. Stability is evaluated by the (1) coefficient of variation in yields, (2) relative advantage of the intercrop with changes in fertility and water use, (3) regression of yields, and (4) returns from soles and intercrops against the environmental index based on location mean performance. Coefficient of variation of intercrop yields was less than the yields of sole crops. The relative advantage of intercropping remained more or less similar at different

levels of fertility. Regression analysis showed that the intercrop system is superior to sole crops at all levels of yields and is more widely adoptable.

0522 RAO, M.R., WILLEY, R.W., SHARMA, D., and KEEN, J.M. 1981. Pigeonpea genotype evaluation for intercropping. Pages 263-270 In Proceedings, International Workshop on Pigeonpea, 15-19 December 1980, Patancheru, Andhra Pradesh, India. v.2. Patancheru, Andhra Pradesh, India: ICRISAT. 6 ref.

Three years' data are presented from a wide range of pigeonpea genotypes intercropped with sorghum. The relative importance of a number of plant characters as possible determinants of yield in intercropping is examined. The extent to which intercrop performance of a given genotype can be predicted from its sole crop performance is considered.

0523 RAO, N.G.P., RANA, B.S., and TARHALKAR, P.P. 1981. Stability, productivity, and profitability of some intercropping systems in dryland agriculture. Pages 292-298 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

An attempt has been made to design and develop appropriate intercropping systems that reflect transgressive yielding, stability, and profitability, for semi-arid tropics. Studies on competition between species revealed that under competition stress sorghum was the most stable species followed by pigeonpea. Varieties of pigeonpea, like Hy-3a with no basal branches, were more stable at an appropriate population level in intercropping systems. Sowbhagya castor and CSH-6 sorghum are similar examples. While the yields of intercropping systems generally tend to fall between the yield levels of component crops, transgressive yielding of the system is not ruled

out. Apart from yield, prevailing prices also become an important factor in the choice of component crops. In seven of the most profitable intercropping systems identified, sorghum was a constant component. It is inferred that in-depth studies on factors involving transgressive yielding ability could further enhance stability, productivity, and profitability of intercropping systems.

0524 RATHORE, S.S. 1981. Intercropping studies in sorghum under dryland agriculture to meet weather aberrations. Pages 73-76 In Proceedings, National Symposium on Crop Management to Meet the New Challenges, 14-16 March 1981, Hissar, Haryana, India (eds. R.Prasad, K.S.Parashar, and R.P.Singh). New Delhi, India: Indian Society of Agronomy.

0525 REGO, T.J. 1981. Nitrogen response studies of intercropped sorghum with pigeonpea. Pages 210-216 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

To study the N response of intercropped sorghum with pigeonpea, three experiments were conducted during 1977 and 1978 in vertisols at ICRISAT. Based on the results of these experiments, it was concluded that intercropped and sole sorghum responded similarly to applied N. Different sorghum populations in the intercrop performed similarly. Pigeonpea did not seem to be contributing any N to its companion sorghum. Sorghum at higher N levels had a greater effect on pigeonpea yield. Sorghum as well as pigeonpea did equally well at 45 cm and 90 cm when grown as sole crops.

0526 RYAN, J.G., and SARIN, R. 1981. Economics of technology options for vertisols in the relatively dependable rainfall regions of the Indian

semi-arid tropics. Pages 37-57 In Proceedings, Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, 21 May 1981, New Delhi, India. Patancheru, Andhra Pradesh, India: ICRISAT. 9 ref.

The economics of the improved technologies that have evolved from research at ICRISAT Center and in villages aimed at enabling crops to be grown in vertisols in the rainy season, is discussed.

0527 SARROCA, J., CORONA, L., and PARETAS, J.J. 1981. Sowing methods in sorghum intercropped with bermuda grass cv. coast cross 1. (Es). Ciencia y Tecnica en la Agricultura. Serie: Pastos y Forrajes 4(2-3):7-16. (Summary: En).

0528 SATYANARAYANA, D.V., and REDDY, M.R. 1981. Economic of intercropping in grain sorghum. Andhra Agricultural Journal 28(5-6):251-253. 3 ref.

The grain yields of sorghum sole crop with spacings of 45 x 12 cm and 60 x 9 cm. were on par. This proved the feasibility of taking up a sorghum crop with 60 x 9 cm spacing and growing an additional intercrop in between the two rows of sorghum without sacrificing the grain yields of sorghum. Sorghum with soybean intercrop was found to be most beneficial followed by sorghum + groundnut intercrop.

0529 SINGH, S.P. 1981. Intercropping studies in sorghum. Pages 22-24 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

The planting geometry of sorghum, the compatibility of different intercrops, and the possible effect of a legume intercrop on the non legume base crop are described. Experiments included comparison of sorghum in uniform (45 cm, and 60 cm) rows and paired (30/60 cm, and 30/90 cm) rows



with different intercrops. Sorghum was also grown at uniform spacing of 60 cm with a range of legumes at a number of locations. Sorghum in paired rows of 30/60 cm yielded equal to uniform rows of 45 cm, and the space created by paired-row patterns enhanced legume intercrop yield. A list of compatible intercrops for different locations is given. Some beneficial effects of legume intercrops on sorghum yield are also reported.

0530 SINGH, S.P. 1981. Studies on spatial arrangement in sorghum-legume intercropping systems. *Journal of Agricultural Science Cambridge* 97(3):655-661. 7 ref.

Field experiments on spatial arrangements in intercropping systems were conducted under rainfed conditions in north-western India during 1975 and 1976. Sorghum yield increased by 21.6, 20.3, 29.2, 36.5 and 14.2% when grown in association with the legumes greengram, blackgram, grain and fodder cowpeas and groundnut respectively when compared with sorghum alone. Spatial arrangements had only marginal effect on sorghum yield but the yields of all the intercrops were appreciably affected. Paired rows with two rows of intercrop in 90 cm spacing resulted in maximum yield of all the intercrops. Planting of sorghum in paired row having two rows of grain cowpea within 90 cm spacing gave maximum land equivalent ratio in both the years; however, net returns were maximum with fodder cowpea in same spatial arrangement.

0531 STINSON, D.L., ARKIN, G.F., HOWELL, T.A., RICHARDSON, C.W., and WILLIAMS, J.R. 1981. Modeling grain sorghum ratoon cropping and associated runoff and sediment losses. *Transactions of the ASAE* 24(3):631-635, 642. 11 ref.

A crop growth model, hydrologic model, and sediment model were combined to simulate a grain sorghum ratoon cropping system. The effects of grain sorghum ratoon cropping on

the total water balance, sediment yield and grain yield were evaluated.

0532 STOOP, W.A. 1981. Cereal based intercropping systems for the West African semi-arid tropics, particularly Upper Volta. Pages 61-68 In *Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.*

The traditional cereal/legume cropping systems based on photosensitive tall, tillering sorghum and millet varieties in combination with photosensitive spreading cowpea, are well adapted to early planting and thus provide an effective Boil coverage early in the season. Moreover, with the aid of various crop combinations- e.g., millet cowpea or sorghum cowpea- the full length of the season both for poor, shallow and for good, deep soils is utilized. With the introduction of improved sorghum, millet, and cowpea varieties, with different plant types and maturity cycles than the locals, it is possible to develop more productive cereal/cowpea cropping systems, which also have the stability typical for the traditional system. This involves, adaptation to different major soil types (shallow and deep soils), effective soil coverage, and yield stability even at fairly low plant populations.

0533 SULLIVAN, W.M., FLOWERDAY, A.D., and WOZNIAK, K.L. 1981. The effect of corn, sorghum and soybeans on following small grains. I. Winter wheat. *Agronomy Abstracts* 73:114.

Experiments on sequential cropping systems were conducted at Nebraska, during 1978-81, to evaluate the production of a corn, sorghum or soybean-winter wheat sequence that could be used in eastern Nebraska. The development of high yielding early season row crop cultivars and improved irrigation practices led to the conclusion that an intensive row crop-winter wheat sequence could be

developed. The winter wheat crop was successfully grown in two of three sequence periods. Wheat following irrigated or nonirrigated soybeans produced mean grain yields 19 and 42% higher, respectively, than wheat following irrigated or nonirrigated corn and sorghum.

0534 TANGHIAN, G.J., Jr. 1981. Effect of tillage, stand establishment and residue management on performance of sorghum grown under upland and rainfed lowland conditions. Ph.D. thesis, University of Philippines at Los Banos, Los Banos, Laguna, Philippines. 133 pp. 51 ref.

0535 TARHALKAR, P.P., and RAO, N.G.P. 1981. Genotype-plant density considerations in the development of an efficient intercropping system for sorghum. Pages 35-40 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Studies were undertaken in 1975/1976 on the development of an optimum sorghum/pigeonpea intercropping system by growing suitable crop genotypes under different planting patterns at two plant densities to assess total productivity and economic profitability. Sorghum yields at various planting patterns were 97% yield of its sole crop. When intercropped with pigeonpea, reduction in sorghum yield was more (12%) from the HY-2 cultivar than from the erect, long-duration cultivar HY-3a (8%). The optimum sorghum/pigeonpea intercropping systems were, paired rows (60-30 cm) of sorghum intercropped with 27,000 plants/ha of pigeonpea, or the wide-rows (60 cm) of sorghum intercropped with full (55,000 plants/ha) pigeonpea density. Sorghum population in both systems remained at 148,000 plants/ha. Wide rows of sorghum were preferred from the crop management point of view.

0536 TOUCHTON, J.T., and MARTIN, P.B.

1981. Response of ratooning grain sorghum to nitrogen fertilizer and insecticides. Agronomy Journal 73(2):298-300. 10 ref.

To evaluate the effects of fertilizer N and insecticides on the production of ratooning Sorghum bicolor, field studies were conducted for 2 years on a Greenville soil (Rhodic Paleudult). Nitrogen (0 to 157 kg/ha) was applied immediately after the first crop was harvested and a combination of insecticides was applied just prior to heading and during the early bloom stage. Nitrogen uptake, grain size, grain yield, and insect population counts were used to determine treatment effects. Yield increased with increasing N rate up to 67 kg/ha in the insecticide-treated area but there was no response to applied N when insecticides were not applied. Data from this study suggest that 67 kg/ha of N fertilizer is sufficient for ratooned grain sorghum; the applied N will be economical if a well managed insecticide program is followed.

0537 TREFFRY, P.T. 1981. Use of a residual flow waterway in a strip cropping system in the Quirindi district. Journal of the Soil Conservation Service of New South Wales 37(2):59-64. 1 ref.

Some of the major changes to the traditional farming practices that have been adopted to overcome erosion and low flow inundation problems are described. The introduction of strip cropping over low slope plains aims at keeping flood water spread as far as possible and the system will accept silt deposits as a thin sheet of deposition without causing any alteration to an established drainage pattern. Sorghum was grown as an opportunity crop (210 ha) in late summer on strips.

0538 UMRANI, N.K., KALE, S.P., and BHOI, P.G. 1981. Studies on crop planning for drought prone area of Maharashtra. Journal of Maharashtra Agricultural Universities

The performance of crops over a period of 7 years under dryland conditions of Solapur region (India) was studied. It was observed that rabi crops are more stable than kharif crops. Millet was the most productive and economic in water use for kharif season when sowings were done in time. Pure cropping of kharif crops was risky. Amongst rabi crops, sorghum was the most productive and economic in water use. Wheat as a dry crop was very poor in production. It is suggested to delete the crop from the cropping and divert the area to more productive crops like gram and safflower.

0539 VENKATESWARLU, J. 1981. Management of deep black soils for increased production of cereals, oilseeds, and pulses. Pages 81-91 In Proceedings, Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, 21 May 1981, New Delhi, India. Patancheru, Andhra Pradesh, India: ICRISAT.

0540 VENKATESWARLU, J., SANGHI, N.K., RAO, U.M.B., and RAO, C.H. 1981. Maximising production in a sorghum/pigeonpea intercropping system in the semi-arid tropics. Pages 30-34 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Experiments and verification trials on farmers' fields proved that a full yield of sorghum and 60% of the pigeonpea yield could be achieved by (1) switching over to high-yielding hybrids of sorghum (CSH-5, CSH-6) and 150-day varieties of pigeonpea (HY-2), (2) using 40-30-0 kg N, P205, and K20/ha, (3) adopting suitable plant-protection measures, and (4) resorting to a 2:1 system of planting with 120,000 plants/ha population of sorghum and 40,000 plants/ha population of pigeonpea at 45 cm.

0541 VERMA, G.P., and RAJE, S.R.

1981. Integrated multidisciplinary approach for the management of black soils of Madhya Pradesh to increase and stabilize agricultural production. Pages 93-103 In Proceedings, Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, 21 May 1981, New Delhi, India. Patancheru, Andhra Pradesh, India: ICRISAT. 2 ref.

Highlights the problems of black soil management in Madhya Pradesh (India). The available technology on land and water management, cropping program, farm machinery and implements, and livestock has been improved and tried in the Indo-UK Dry Farming Project area. The technology consists of a multidisciplinary approach for exploiting land and water resources on a catchment basis, by adopting appropriate land and water management practices, by growing of crops in kharif over as much area as possible, by improving the livestock by better feeding and upgrading it through breeding.

0542 VIRMANI, S.M., WILLEY, R.W., and REDDY, M.S. 1981. Problems, prospects and technology for increasing cereal, and pulse production from deep black soils. Pages 21-36 In Proceedings, Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, 21 May 1981, New Delhi, India. Patancheru, Andhra Pradesh, India: ICRISAT. 5 ref.

0543 WILLEY, R.W., and RAO, M.R. 1981. Genotype studies at ICRISAT. Pages 117-127 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

A sorghum/pigeonpea experiment in 1977 at ICRISAT Center, examined 17 genotypes of pigeonpea with a standard sorghum genotype. Sorghum produced yields ranging from 82 to 99% of the sole-crop yield. The pigeonpea genotypes achieved yields ranging from

## Weeds and Weed Control

36 to 73% of their sole-crop yields, giving total land equivalent ratios (LERs) up to 1.66. The absolute pigeonpea yields in intercropping were dependent on sole-crop yields, which only accounted for 40% of the variability in intercrop yields. There were indications that the most suitable pigeonpea plant type had a reasonably compact growth in the early stages to avoid competition from the sorghum but a spreading habit later to utilize resource after sorghum harvest. Two later experiments examined four sorghum genotypes in combination with four millet genotypes. Yield advantages ranged upto just over 30%.

0544 WOZNIAK, K.L., SULLIVAN, W.M., FLOWERDAY, A.D., and WALDEN, R.P. 1981. The effect of corn, sorghum and soybeans on following small grains. II. Spring oats. *Agronomy Abstracts* 73:116.

The role of previous row crop and crop management effects on the following oats, were studied to understand the requirements of the complete cropping system. The number of mature oat plants were not influenced by previous crop but the rate of seedling emergence was visibly reduced following corn and sorghum. Oats following soybeans produced more dry matter at early stages of growth with only the difference in dry matter production observed after flowering. No previous crop effects were noted in years when moisture was adequate during small grain development. Oats following irrigated row crops produced 100% more grain when the preceding crop was soybeans in stress years. Heavy quantities of corn and sorghum residue showed an allelopathic influence on developing oats. Oats following soybeans produced heavier grain which graded in a higher quality class than did oats following corn or sorghum.

0545 ANONYMOUS. 1981. Sorghum: weed control. (Fr). Page 77 In *Experimentation* 1979-80. Paris, France: Association de Coordination Technique Agricole.

0546 ANONYMOUS. 1981. Weed control in sorghum. (Fr). *Cultivar* 136:63.

0547 ALVARADO SILVERA, I. 1981. Effects of several methods of weed control in sorghum yield. (Es). Thesis, Universidad de Panama, Panama. 64 pp. 33 ref.

0548 BARRETT, M., and MEGGITT, W.F. 1981. Weed control guide for field crops 1982. East Lansing, Michigan, USA: Michigan State University. 35 pp. (Extension Bulletin, E-434).

0549 BORSE, R.H., and MAHAJAN, U.B. 1981. Studies on the relative efficiency of triazine compounds, 2,4-D and slow release 2,4-D in comparison with mechanical methods of weed control in hybrid jowar CSH-1 (Sorghum bicolor (Linn) Moench). *Journal of Maharashtra Agricultural Universities* 6(2):161-163. 7 ref.

A trial of 9 treatments was conducted at Dhule, Maharashtra (India) and data pertaining to weed count and percent mortality over control at 60 days, dry matter of weeds and plant population/ha at harvest and mean grain and fodder yield/ha as affected by various treatments were recorded. Mechanical treatment viz. two hand weeding and one hoeing plus one weeding was found better. Amongst herbicidal treatments pre-emergence application of atrazine and simazine with post-emergence application of 2,4-D was found more effective in controlling the weed and increasing the grain and fodder yields. None of the treatments showed

phototoxic effect on the plant.

0550 BOVEY, R.W., and MEYER, R.E. 1981. Effects of 2,4,5-T, triclopyr and 3,6-dichloropicolinic acid on crop seedlings. Weed Science 29(3):256-261. 25 ref.

Triclopyr 2,4,5-T, and 3,6-dichloropicolinic acid were applied to the foliage of juvenile crop plants at 0.002, 0.009, 0.03, 0.14, and 0.56 kg/ha. Corn, oat, wheat, Sorghum bicolor, and kleingrass were generally more tolerant to the herbicides than were peanuts, cotton, cucumber, and soybean. Triclopyr was usually more phytotoxic to corn, oat, grain sorghum, and kleingrass than either 2,4,5-T or 3,6-dichloropicolinic acid at 0.14 and 0.56 kg/ha, but few differences occurred among herbicides at lower rates.

0551 BRACY, R., MASON, L., and ALLEN, M. 1981. Effects of herbicide treatment on performance of forage and grain sorghum hybrids 1981. Pages 19-22 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Tests were conducted on NK 300 forage sorghum and Funk's G-623 GBR grain sorghum. For NK 300, highest yield of 23.4 t green forage/acre was obtained using aatrex 4L broadcast. Percentage gain on a dry basis ranged from 17.1 for paraquat to 24.8 for aatrex 4L broadcast. Data for Funks' G-623 GBR grain sorghum also did not show significant effect of herbicides on forage yield but the plot treated with dual E produced 9.2 against 6.7 t green weight/acre for the check. Yield of grain harvested at combining stage of maturity varied from 1488 lb/acre (paraquat, broadcast) to 1907 lb/acre (dual 6E, broadcast). All herbicides effectively controlled weeds without crop damage.

0552 BRECKE, B.J., CURREY, W.L., and TEEM, D.H. 1981. Weed control in

grain sorghum. Soil and Crop Science Society of Florida Proceedings 40:131-136. 3 ref.

Several herbicides and herbicide combinations were evaluated over a 4-year period for weed control in Sorghum bicolor. Atrazine plus propachlor applied preemergence, atrazine plus phytobland oil applied early postemergence, and directed postemergence treatments of paraquat plus atrazine, cyanazine plus 2,4-D, ametryn plus 2,4-D and linuron plus 2,4-D provide consistently good weed control and high grain sorghum yields. Postemergence applications provide control later in the growing season and would be especially advantageous for ratoon cropped grain sorghum.

0553 BREWER, F., TALBERT, R.E., and LAVY, T.L. 1981. Effect of DBCP on fluchloralin persistence. Weed Science 29(5):605-609. 16 ref.

Three field studies were conducted over a 2-year period to evaluate the persistence of fluchloralin and to determine whether DBCP affected persistence. Gas chromatography and sorghum root-elongation bioassay indicated that fluchloralin persistence was unaffected by DBCP. A greenhouse sorghum bioassay of soil samples showed residual activity of fluchloralin, in one test, but differences were not attributable to DBCP.

0554 CARLSON, D.R., and BURNSIDE, O.C. 1981. Use of the recirculating sprayer to control tall weed escapes in crops. Weed Science Society of America Journal 29(2):174-179. 11 ref.

Field experiments were conducted with the recirculating sprayer (RCS) at Lincoln, Nebraska from 1974 through 1978. Different spray pressures, spray nozzles, and spray volumes with the RCS showed no significant differences in shattercane control or soybean injury when herbicides were applied at three stages of weed growth. When shattercane was treated

in a grain sorghum field, poor weed control and excessive crop injury occurred during treatment at the early growth stage as compared with treatments applied 2 weeks later. The final treatment date gave selective weed control in grain sorghum, but many of the shattercane heads had already developed viable seed. A weed-to-crop height differential of at least 45 cm resulted in maximum weed control with minimum crop injury. By preventing spray drift and splash when using the RCS, glyphosate and paraquat will give selective control when applied to weeds growing in grain sorghum.

0555 CHRIST, R.A. 1981. The effect of CGA 43089 as a safener of metolachlor in sorghum (*Sorghum bicolor*) (Recordings of elongation rates on single sorghum leaves). *Weed Research* 21(1):1-8. 8 ref. (Summaries: De, Fr).

The safener CGA 43089 showed no effect on the elongation rates when used in normal concentrations. The combined application of safener and metolachlor (concentration ratio 1:3) prevented the growth reductions due to metolachlor. When the safener was applied before metolachlor the safening action was as good as that of the combined application. When the safener was applied 1 or 2 days after the herbicide the safening effect was diminished. It is revealed that CGA 43089 does not interfere with herbicide uptake into the plant. The safener is, however, able to reduce the active amount of herbicide when present at the right time at the site of effect.

0556 COELHO, A.D., and PINTO, E.T. 1981. The use of propachlor to control weeds in sorghum. (Pt). I Congresso Portugues de Fitiatria e Fitofarmacologia. Ill Simposio Nacional de Herbologia 4:107-117. (Summary: Fr).

Results of 3 efficacy trials confirmed the great sensitivity of *Echinochloa crus-gallis* to propachlor,

and usefulness of the mixture of propachlor and atrazine if the weeds are dicotyledonous. The phytotoxic trials demonstrated that the double dose of the two herbicides (upto 9,1 kg/ha of propachlor and 5,2 kg/ha of atrazine) is not risky for the crop.

0557 CRAMER, G.L., and BURNSIDE, O.C. 1981. Control of common milkweed *Asclepias-syriaca*. *Weed Science* 29(6):636-640. 16 ref.

Control of *Asclepias syriaca* with postemergence herbicides was investigated in greenhouse and field experiments. Postemergence herbicides commonly used in corn, sorghum, and soybeans had little effect on emerged common milkweed. Removal of the weed top-growth as early as 1 day after treatment did not effect subsequent growth reduction from glyphosate at 0.3 kg/ha or higher. In the field, satisfactory control (70% or more) of the weed was obtained with glyphosate at 2.2 kg/ha.

0558 DAVIES, E.L.P., and SHETTY, S.V.R. 1981. Herbicide research on groundnut and sorghum under farmer conditions in the Indian semi-arid tropics. *Tropical Pest Management* 27(4):472-479. 8 ref.

Plots 17 x 5 m were laid out in farmers' fields in three villages. Treatments (replicated thrice) included atrazine (0.5 or 1.0 kg a.i./ha) on sorghum and nitrofen (0.75 and 1.5 kg a.i./ha) on groundnuts with or without hand-weeding or using farmers normal weed control. Groundnuts were unfertilized, sorghum received 20 or 80 kg N/ha. In sorghum there were no differences between high and low fertilizer regimes. Atrazine gave superior yields as compared to farmers' weed control. All treatments were better than the unweeded control. Problems associated with research in farmers fields included: selection of farmers who would participate correctly, variability between different farmers' weeding practices and between different fields due to previous crops and cultural practices; lack of control of farmers weeding

operations and the distance of experimental plots from the research station. It is suggested that small experiments with only 4-6 treatments are easier for participating farmers to comprehend, selecting suitable size and shape of plots is important and that if many farmers are involved the number of replicates can be reduced.

0559 FAO. 1981. Weeds in tropical crops: selected abstracts on constraints on production caused by weeds in maize, rice, sorghum, millet, groundnuts and cassava 1952-1980. Rome, Italy: FAO. 92 PP. 481 ref. (FAO Plant Production and Protection Papers, 32).

0560 FAWCETT, R.S., NELSON, J.E., and BECKER, R.L. 1981. Weed control guide for 1981. Ames, Iowa, USA: Iowa State University, Cooperative Extension Service. 28 pp.

The guide summarizes research conducted by Iowa Agricultural Experiment Station on the effectiveness of various methods of cultural and chemical weed control. Recommendations are made for use of various herbicides, their broadcast rate and weeds most effectively controlled by them on major field crops viz. corn, soybean, sorghum etc.

0561 FENDERSON, J.M., and MURRAY, D.S. 1981. Crop response to spray vs. granular herbicide formulations. Proceedings Southern Weed Science Society 34:104. (Abstract).

0562 FRANS, R., MCCLELLAND, M., and TERHUNE, E. 1981. Herbicide field evaluation trials on field crops 1980. Mimeograph Series, Arkansas Agricultural Experiment Station no.288. 62 pp.

0563 HAMDOUN, A.M., and HAMADA, A.A. 1981. Weed control. Pages 38-49 In Gezira Research Station and Sub-stations annual report 1974/75. Gezira, Sudan: Ministry of Agriculture, Food and Natural

Resources.

Two experiments were carried out at Wed Medani (Sudan), in a field with common weed flora. Predominant weed species recorded were, *Brachiaria eruciformis*, *Ischaemum afrum*, *Heliotropium sudanicum*, *Acalypha indica*, *Phyllanthus niruri*, and *Ocimum basilicum*. In the first experiment pre-emergence application of atrazine at 0.15 kg controlled 82% and 74% weeds at 4 and 8 weeks respectively. Weed control was slightly better at higher rates. Post-emergence application at 0.5 kg controlled 66% weed populations after 8 weeks. Broad-leaved weeds were controlled better than grasses. Pre-emergence application of 0.4 kg chlorbromuron + 0.2 kg atrazine gave excellent weed control for most of the growing season. In the second experiment, sorgoprim pre-emergence gave excellent weed control for most of the growing season. Faneron + dicuran effected 79% weed control after 8 weeks. Post-emergence application of oleogosoprim at 0.8 kg controlled 88% weed flora after 8 weeks.

0564 HARDCASTLE, W.S. 1981. Sicklepod control with metolachlor plus propazine. Proceedings Southern Weed Science Society 34:45. (Abstract).

The commercial mix of metolachlor + propazine is formulated as a 2:1 ratio for use with cyoxmetrinil treated *Sorghum bicolor* seed. This formulation is not effective for the control of sicklepod. Experiments on Cecil sandy clay loam indicate that a ratio of at least 1:1 used at a rate appropriate for soil type is needed for effective weed control where sicklepod is present.

0565 HURST, H., and PALMERTREE, H.D. 1981. Chemical weed control in row crops, 1980. MAFES Research Highlights 44(3):8.

0566 JENNINGS, V.M. 1981. Integrated plant protection for corn and sorghum in the United States:

weeds. Pages 433-435 In Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T. Kommedahl). Minneapolis, Minnesota, USA: Burges Publishing Company. 4 ref.

Present weed control technology in corn and sorghum rely heavily on a combination of cultural and chemical methods of control. Herbicides will remain an increasingly important component of corn and sorghum production. However, increasing qualitative environmental demands will result in the use of less persistent herbicides. Conservation practices limiting potential for chemical loss from treated fields will become a high priority concern. Future attention will be given to precise and timely placement of herbicides to more effectively control weeds and to minimize contact with the crop and non target areas. Developing integrated pest management programs will demand an improved data base on weeds. More emphasis will be placed on the biology of weeds and environmental factors affecting weed seed germination, growth, and development in coming years.

0567 KEELING, J.W., and ABERNATHY, J.R. 1981. Field comparisons of herbicide-sorghum seed protectants. Proceedings Southern Weed Science Society 34:45. (Abstract).

Field tests were established to evaluate the effects of preplant incorporated and preemergence herbicide applications on growth and yield of sorghum. Sorghum stand counts and visual injury ratings showed no significant injury from any preemergence treatments but significant injury did result from preplant incorporated treatments. Seed treated with a protectant had significantly less stand reduction, less injury, and produced higher yields as compared to untreated seed. No significant difference in sorghum injury or yield was noted between seed treatment with either Concep or Mon

4606. With use of a protectant, no significant injury or yield reduction was observed from preplant incorporated applications of metolachlor + terbutryn, metolachlor alone, or alachlor. Applications of Mon 097 caused slight to moderate injury even with use of a seed protectant.

0568 KETCHERSID, M.L., and MERKLE, M.G. 1981. Response of grain sorghum to CGA-43089 (Concep) and metolachlor (dual). Proceedings Southern Weed Science Society 34:44. (Abstract).

0569 KETCHERSID, M.L., NORTON, K., and MERKLE, M.G. 1981. Influence of soil moisture on the safening effect of CGA 43089 in grain sorghum (Sorghum bicolor). Weed Science 29(3):281-287. 26 ref.

In field tests, neither alachlor nor metolachlor was phytotoxic to unprotected grain sorghum when the surface soil remained dry until the sorghum had emerged. CGA-43089 protected sorghum emerging from moist soil that had been treated with alachlor or metolachlor at rates of 2.24 or 3.36 kg/ha. Growth chamber tests showed that CGA-43089 was less effective in protecting sorghum from herbicide injury when Ships clay was continuously wet for 3 to 5 days than when soil was wet for only 1 or 2 days prior to emergence. But, if the surface soil remained dry until the coleoptile reached the soil surface, alachlor and metolachlor had little effect on sorghum even without protectant. When sorghum was planted in Arenosa sand containing 5% organic matter, protected sorghum and the control grew well even under continuous high moisture conditions. Alachlor and metolachlor were most phytotoxic when placed in the surface 1.25 cm of moist soil or when incorporated. The grain sorghum response to these herbicides depends on herbicide placement and availability to the coleoptile. Under conditions normally leading to phytotoxic effects from alachlor or metolachlor, grain sorghum



growth was significantly better from seed protected with CGA-43089 than from unprotected seed.

0570 KONDAP, S.M., and BATHKAL, B.G. 1981. Crop weed competition studies in sorghum under different management practices. Pages 117-122 In Proceedings, Eighth Asian-Pacific Weed Science Society Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.2. Bangalore, Karnataka, India: Asian-Pacific Weed Science Society. 6 ref.

The first experiment consisted of different weed free and no weeding periods in CSH-5 and CSV-3 of sorghum crop and the second experiment compared in relation to four fertility levels under rainfed as well as under irrigated conditions. Critical period of crop weed competition of the sorghum was between 15 to 30 days from sowing. The grain obtained was 82% and 76% of the weed free period till harvest in 1975 and 1976 seasons respectively. The CSH-5 cultivar was found to be superior to CSV-3 in grain yield and weed competition. The dry matter production of weeds was several times higher than that of crop upto 60 days and later on reverse trend was observed. The weed dry matter increased with increase in fertility level which indicated that the higher yields of sorghum could not be maintained by simply increasing the nitrogen level in the presence of weeds.

0571 KOROKNAI, B. 1981. Distribution of dangerous weed species in the department Veszprem in 1981. (Hu). *Novenyvedelem* (Hungary) 17(10-11):491-494.

0572 LEEK, G.L. 1981. Efficacy of CGA-43089 [ $\alpha$ -(cyanomethoximino)-benzacetone nitrile] as a herbicide antidote for sorghum (*Sorghum vulgare* Pers.). Ph.D. thesis, Michigan State University, East Lansing, Michigan, USA. 77 pp.

0573 MARSHALL, R.J., and NEL, P.C.

1981. Effect of post emergence applied 2,4-D and MCPA on growth and yield of grain sorghum. Proceedings National Weeds Conference of South Africa 4:99-104. 11 ref.

The tolerance of six grain sorghum cultivars to post-emergence applications of 2,4-D and MCPA was tested in the field. A high degree of crop safety was experienced with MCPA amine. However, application of any of the other three formulations resulted in large differences in cultivar reaction.

0574 MONAGHAN, N.M., and BROWNLEE, H. 1981. Control of *Solanum karsensis* in grain sorghum. *Weed Research* 21(1):43-46. 8 ref. (Summaries: De, Fr).

A screening trial of 14 herbicides showed that atrazine was the most effective treatment, though 2,4-D also suppressed *S.karsensis* in *Sorghum bicolor* cv. Rico for the duration of the crop. Grain sorghum yields were higher in plots treated with atrazine at 2.5 kg (a.i)/ha than for any other herbicide treatment or the untreated control. Because the root system remained viable, annual herbicide application would be necessary for the continued control of *S. karsensis*.

0575 MULLER, G., and NYFFELER, A. 1981. CONCEP (CGA-43089): a safening agent protecting sorghum (*Sorghum bicolor*) from metolachlor injury. *Acta Phytopathologica Academiae Scientiarum Hungaricae* 16(1-2):245-248. 3 ref.

Details are given on biological performance of CONCEP under various laboratory and field conditions. The application of the safening agent and the extension of metolachlor into grain sorghum hybrids is summarized.

0576 NATARAJAN, M., SHETTY, S.V.R., and WILLEY, R.W. 1981. Weed research: a component of ICRISAT's Farming Systems Research Program. Pages 43-47 In Proceedings, Eighth Asian-Pacific Weed Science Society

Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.2. Bangalore, Karnataka, India: Asian-Pacific Weed Science Society. 6 ref.

Studies started in 1975 indicate that in the Indian semi-arid tropics, the farmer's level of weed control was usually satisfactory for his traditional systems, but better weed control measures should be adopted if they were to be more remunerative. Some aspects of the ICRISAT research are described to illustrate how the cropping system itself may be manipulated to improve weed control. Some evidence is presented on the possible benefits of smother crops, and some examples are given of the role that herbicides could play in improved systems.

0577 NDAHI, W.B., CHOUDHARY, A.H., and LAGOKE, S.T.O. 1981. Chemical weed control in sorghum, millet and wheat. Pages 152-157 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 4 ref.

A systematic evaluation of herbicides in sorghum and millet in various ecological zones of Nigeria is given. Atrazine at 1.5 kg ai/ha and terbutylazine plus terbutryne, terbutylazine plus atrazine and terbutryne plus atrazine at 2.0 kg ai/ha have been recommended for effective control of weeds. Half of these doses can be applied provided one supplementary weeding, ridge remoulding or post-emergence herbicides are applied.

0578 PANDIT, B.R., PATEL, B.P., and VORA, U.A. 1981. Allelopathic potential of *Trianthema portulacastrum* Linn. on *Andropogon sorghum* Brot. Science and Culture 47(8):290-291. 7 ref.

0579 PARKER, C. 1981. Possibilities for the selective control of *Rottboellia exaltata* in cereals with the help of herbicide safeners.

Tropical Pest Management  
27(1):139-140.

Pendimethalin, a main herbicide for control of *Rottboellia exaltata*, failed under dry soil conditions. Work was started at WRO to explore the possibilities of other herbicides in conjunction with herbicide safeners especially NA (1, 8-naphthalic anhydride) as a seed dressing at 0.5%. Among other combinations of herbicides and safener tested, NA provided better protection against herbicides. Sorghum and rice were found more tolerant to herbicides when used with NA.

0580 PENG, S.Y., and TWU, L.T. 1981. Further studies on chemical weed control for sugarcane intercropping in Taiwan. (Ch). Report of the Taiwan Sugar Research Institute 94:1-9. 6 ref. (Summary: En).

New herbicides recommended for preemergence weed control in sugarcane mono-cropping, were tested with the sorghum-, garlic- and tomato-sugarcane intercropping systems. Half doses of cyanazine at 1 kg ai/ha, or diuron at 1 kg ai/ha, or isouron at 0.5 kg ai/ha, or Velpar K-4 at 0.5 kg ai/ha in a broadcast preemergence application, assured more than 80% weed control and good harvests of sorghum comparable to that given by hand-weeding, when climate during early growing was normally cold and dry. In case of abnormal heavy rains during the spring planting time, the latter 2 new products were more resistant to leaching than diuron and cyanazine. Sugarcane intercropped with sorghum was affected by competition and its yield was reduced by 17%. Under intercropping conditions, yield of sugarcane was not related to yield of sorghum grains but to its survived plants on the interrows and to abundance of re-emerged weeds in furrows, after being treated by the herbicides.

0581 RAO, A.N., and SHETTY, S.V.R. 1981. Investigation on weed suppressing ability of smother

cropping systems in relation to canopy development and light interception. Pages 357-364 In Proceedings, Eighth Asian-Pacific Weed Science Society Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.1. Bangalore, Karnataka, India: Asian-Pacific Weed Science Society. 11 ref.

Canopy development and pattern of light interception was analyzed to understand the eco-physiological mechanisms of sorghum/mungbean smother cropping systems. The weed biomass accumulation in sorghum/cowpea and sorghum/mungbean smother cropping systems with one hand weeding was observed to be less than that observed in sorghum sole situation with two hand weedings. Light interception pattern and leaf area index (LAI) observations revealed that inclusion of smother crop resulted in quicker and earlier attenuation of maximum LAI and maximum percentage of light interception by component crops. Significant positive correlation was observed between LAI and percentage light interception. Significant negative correlation was observed between percentage light interception by component crops and weed biomass accumulation. The growth and resource use by different cropping systems are analysed and the net productivity with different systems are computed.

0582 RAPPARINI, G. 1981. Seasonal weeding: maize and sorghum. (It). *Informatore Agrario* 37(9):14377-14380.

0583 RAWSON, J.E., and BATH, S.J. 1981. Chemical control of giant pigweed, sesbania pea and fierce thomapple in sorghum. *Queensland Journal of Agricultural and Animal Sciences* 38(1):13-19. 2 ref.

Giant-pigweed growing in Sorghum bicolor was controlled in the seedling stage by atrazine at a rate of 0.14 kg/ha, but plants 5 cm in diameter required a rate of 1.12 kg/ha. Control of giant pigweed did not increase the yield of sorghum grain. Sesbania pea was susceptible to 2,4-D

at the rate of 0.56 kg/ha and atrazine applied post-emergence at a rate of 2.24 kg/ha. Control of sesbania pea resulted in a yield increase in one experiment. Fierce thomapple was controlled by atrazine applied post-emergence at a rate of 1.12 kg/ha, 2,4-D at a rate of 0.56 kg/ha and 'Tordon 50-D' at a rate of 0.7 l/ha. The atrazine and 'Tordon 50-D' treatment gave residual control of fierce thomapple plants which germinated later and also increased yield of sorghum grain.

0584 RODRIGUEZ, N., and DE PEREZ, M.P. 1981. Weed control in grain sorghum: present situation, new technologies. (Es). *Informativo de Tecnologia Agropecuaria para la Region Semiarida Pampeana* 77:3-8.

0585 ROGERS, N.K., and TALBERT, R.E. 1981. Dissipation and leaching of metriflufen under field and controlled conditions. *Weed Science* 29(5):561-565. 11 ref.

In the field, delaying incorporation of metriflufen did not affect its activity in Taloka silt loam as shown by bioassay with grain sorghum. In a growth chamber bioassay sorghum growth in treated soil gave a dose-response in a range of 0.02 ppmw, 0.09 ppmw, and 0.38 ppmw. When soil treated with metriflufen at 1 ppmw was incubated for specified times under soil moisture levels of 5, 15, or 25% and temp. of 15, 25, or 35 deg C, soil incubated at 15 deg C for 75 days completely inhibited sorghum growth. Sorghum growth inhibition was reduced with incubation time and warmer temperatures.

0586 SCHON, M.K., and EINHELLIG, F.A. 1981. Allelopathic effects of cultivated sunflower on grain sorghum. *Proceedings South Dakota Academy of Science* 60:171-172. (Abstract).

Experiments were designed to test the phytotoxic potential of sunflower cultivar (interstate 894). Aqueous fresh-leaf extracts were prepared from sunflower leaves and added to the

nutrient media used in growing sorghum. Results indicate that some sunflower cultivars interfere with the growth of subsequent crops through allelopathic interference. This impact may be magnified when water availability is critical.

0587 SHARANAPPA. 1981. Weed management in sorghum (*Sorghum bicolor* (L.) Moench) by intercropping systems. M.Sc. thesis, University of Agricultural Sciences, Bangalore, Karnataka, India. 138 pp.

0588 SHETTY, S.V.R., and RAO, A.N. 1981. Weed management studies in sorghum/pigeonpea and pearl millet/groundnut intercrop systems: some observations. Pages 238-248 In Proceedings, International Workshop on Intercropping, 10-13 January 1979, Hyderabad, Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

Studies were initiated at ICRISAT Center to examine the competition between weeds and intercrop systems and the increased weed suppression by the inclusion of additional crops. Some preliminary observations on sorghum/pigeonpea and pearl millet/groundnut intercrop systems are highlighted, with particular reference to weed growth as affected by a few selected biophysical factors. With increase in density of a sorghum/pigeonpea system, there was rapid decrease in weed dry weights. The inclusion of additional smother crops like cowpea and mung bean minimized weed infestation. These crops could replace one hand weeding without affecting the main crop yields. Cowpea was more efficient than mung in its weed-suppressing ability later in the season.

0589 SOLOMON, M.J., and BHANDARI, D.C. 1981. Allelopathic potential of *Gomphrena decumbens* on 2 rain fed crops. *Geobios* 8(1):9-12.

0590 SWAIN, D.J. 1981. Atrazine dissipation in irrigated sorghum cropping in southern New South Wales.

Weed Research 21(1):13-21. 22 ref.

Dissipation of atrazine after pre-emergence application to irrigated sorghum was investigated in an experiment on a Birganbigil clay loam in the Hurrumbidgee Irrigation Areas of New South Wales. Dissipation followed first-order kinetics with a half-life of 70 days. This rate of disappearance did not differ significantly between application rates of 2, 5 and 10 kg/ha. A laboratory incubation experiment demonstrated that dissipation of atrazine in Birganbigil soil was more rapid than in three other soils from the Murrumbidgee and Murray valleys. Dissipation rate and atrazine adsorption were both correlated with the organic carbon content of the soils, which ranged from 1.43% to 0.72%. There was no correlation between either dissipation rate or adsorption and clay content, even though clay contents ranged from 37 to 78%.

0591 SWANN, C.W. 1981. Chemical weed control in corn and grain sorghum. Bulletin, Georgia University, Cooperative Extension Service no.824. 17 pp.

0592 TABORA, R.S., OLIVA, A., and PAMPLONA, P.P. 1981. The influence of some weed control practices on the yield of ratooned sorghum. *WSSP Newsletter* 9(3):3.

0593 UPADHYAY, U.C., LOMTE, M.H., and SHELKE, V.B. 1981. Integrated weed management in sorghum. Pages 85-89 In Proceedings, Eighth Asian-Pacific Weed Science Society Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.1. Bangalore, Karnataka, India: Asian-Pacific Weed Science Society. 4 ref.

The results of a field experiment conducted in 1980-81 revealed that the pre-emergence application of atrazine at the rate of 1 kg a.i./ha followed by one weeding and hoeing at 6 weeks stage of the crop produced 16.07 q/ha yield which was significant superior

to the recommended practices of 2 weeding and 2 hoeings at 3 and 6 weeks stage of the crop and control. Keeping the field free from weeds for forty days, pre-emergence application of atrazine 1 kg a.i./ha followed by post-emergence application of 2,4-D at the rate of 1 kg a.i./ha at 6 weeks stage and pre-emergence application of 0.5 kg a.i./ha followed by one weeding and hoeing at 6 weeks stage proved their efficacy at par, yielding 15.52, 14.08 and 13.74 q/ha of sorghum grain respectively, with the treatment of pre-emergence application of atrazine at the rate of 1 kg a.i./ha followed by one weeding and hoeing at 6 weeks stage which had also given maximum additional net income of Rs.686 per ha over the control.

0594 VAN BILJON, J.J., and JOOSTE, J.V.D.W. 1981. Metolachlor for weed control in grain sorghum. Proceedings National Weeds Conference of South Africa 4:105-117. 12 ref.

Results have shown that metolachlor can be used successfully in grain sorghum provided the seed has been treated with CGA 43089. When metolachlor is used at double the recommended dosage rate some transient injury may occur under conditions associated with high rainfall, low cation exchange capacity of the soil and deep planting. This injury is, however, completely outgrown and has no effect on yield. No differences have been observed in the important cultivars.

0595 VICTORIA FILHO, R., and RIBEIRO, J.A. 1981. Susceptibility of two sorghum varieties, Sorghum bicolor (L.) Moench to herbicides applied in pre-and postemergence. (Pt). Solo (Brazil) 73(2):53-59. 12 ref. (Summary: En).

Atrazine at 2.5 kg/ha in preemergence and postemergence, terbutylazine + terbutryne at 2.5 kg/ha in preemergence; terbutryne + atrazine at 2.5 kg/ha in preemergence; 2,4-D at 0.48 kg/ha in postemergence and linuron at 1.5 kg/ha in

postemergence and directed spray, were used to verify the susceptibility of two sorghum varieties in anoxisol (Latosolic B) at Jaboticabal, Brazil. The main weeds recorded were, Indigofera hirsuta L., Acanthospermum hypsidum D.C. and Digitaria sanguinalis L. The best results were obtained with linuron in postemergence, atrazine in pre and postemergence, terbutylazine + terbutryne, and terbutryne + atrazine giving more than 70% control. Phytotoxic effect to the sorghum by the herbicides, was not observed.

0596 WALTER, H. 1981. Investigations into the nature and importance of weeds in sorghum in Yemen. Plant Protection Bulletin, Yemen Arab Republic, Ministry of Agriculture, Department of Plant Protection 2:13-17.

0597 WIESE, A.F. 1981. Pest management systems for sorghum weeds. Pages 575-586 In CRC handbook of pest management in agriculture (ed. D.Pimentel). v.3. Boca Raton, Florida, USA: CRC Press. 63 ref.

0598 WIESE, A.F. 1981. Shattercane and johnsongrass: can sorghum yields stand them? Southwest Farm Press 19 February: 34, 58.

Samples were taken from seven fields infested with johnsongrass and eight fields infested with shattercane. Sorghum was grown on beds from 30-40 inches. Results revealed that shattercane and johnsongrass grow in patches and average atleast a medium-high infestation which cut yields about 3500 lb/acre or about 65% of the total potential yield. Financial loss is estimated to be \$1560 on a 100 acre field.

0599 WIESE, A.F., PETR, F.C., CHENAULT, E.W., and LAVAKE, D.E. 1981. Effect of shattercane, barnyardgrass, crabgrass, and johnsongrass on sorghum yield. Proceedings Southern Weed Science

Society 34:46. (Abstract).

Sorghum was grown on beds from 30 to 40 inches wide. Seven sorghum fields infested with johnsongrass, eight fields with shattercane and barnyardgrass; and one field infested with crabgrass were sampled. Samples were taken in weed-free areas and in low, medium, medium high and high weed infestations. R<sup>2</sup> values indicated that the effect of weeds on yield was curvilinear. With shattercane, barnyardgrass and johnsongrass, there were large differences in the amount of yield lost per weed head in different fields.

0600 WRAGE, L.J., and ARNOLD, W.E. 1981. Chemical weed control in sorghum 1981. Brookings, South Dakota, USA: South Dakota State University. 5 pp.

0601 ZHATKANBAEV, ZH.ZH., GEORGIADI, A.G., and YUSUPOVA, G.M. 1981. Changes in sorghum biochemical composition resulting from herbicide application. (Ru). Vestnik Sel'skokhozyaistvennoi Nauki Kazakhstana 1:59-61.

## Harvesting and Equipment

0602 ALLEN, R.R., and HOLLINGSWORTH, L.D. 1981. Combine header performance in lodged grain sorghum. Transactions of the ASAE 24(6):1426-1428, 1431. 3 ref'.

Combine header losses during harvesting of standing and lodged grain sorghum were investigated on the Southern Great Plains. A platform header, used as a standard, was compared with a row crop header. The row crop header was more efficient in both standing and lodged grain. The row crop header gathered most lodged seed heads unless they fell parallel to row direction. In a 1979 test with typical conditions, the extra grain saved by the row crop header was 0.6, 2.6, and 5.3 percent, respectively, of

the crop yield for standing, moderately, and highly lodged sorghum.

0603 GANNO, K., GOTO, Y., and IRIE, M. 1981. Studies on the combine harvesting of grain sorghum. 2. An adaptability of head feeding combines on the market. (Ja). Farm Work Research 43:14-18.

0604 GANNO, K., and IRIE, M. 1981. Studies on the combine harvesting of grain sorghum. 1. Performance of head feeding combines modified for grain sorghum. (Ja). Farm Work Research 43:7-13.

0605 NAZARENKO, O.K., and OLEKSENKO, YU.F. 1981. Technology and mechanization of sorghum harvesting. (Ru). Kukuruz 5:15-16.

0606 WALKER, T.S., and KSHIRSAGAR, K.G. 1981. The village level impact of machine threshing and implications for technology development in semi-arid tropical India. Patancheru, Andhra Pradesh, India: ICRISAT. 33 pp. (ICRISAT Economics Program Progress Report, 27).

Innovations in mechanical threshing in India and the issues that affect diffusion of threshers to village level over time are outlined. Particular attention is given to price determination for machine hiring within the village economy. The paper concludes with comments on implications for research policy on potential threshing technologies in semi-arid tropical India. Data on method of threshing, distribution and size of output by threshing method, labor and bullock inputs required, cost of threshing etc. for sorghum (local and hybrid CSH-1) are presented to illustrate the study.

## PLANT DISEASES, PESTS, AND CONTROL

0607 BLANCHET, C. 1981. Observations on the diseases of

sorghum and feasibility of taking off the leaves without affecting the grain yield. (Fr). Port-au-Prince, Haiti: Faculte d'Agronomie et de Medecine Veterinaire. 27 pp.

0608 COMMONWEALTH MYCOLOGICAL INSTITUTE. 1981. Sorghum diseases 1921-1972: selected from Review of Applied Mycology and Review of Plant Pathology volumes 1-51. Kew, Surrey, UK: Commonwealth Mycological Institute. 135 pp. (CAB Annotated Bibliographies Plant Series).

0609 COMMONWEALTH MYCOLOGICAL INSTITUTE. 1981. Sorghum diseases 1969-1980: selected from Review of Plant Pathology volumes 52-60. Kew, Surrey, UK: Commonwealth Mycological Institute. 71 pp. (CAB Annotated Bibliographies Plant Series).

0610 DHALIWAL, J.S., SIDHU, M.S., and SINGH, G. 1981. Effect of different dates of sowing of sorghum on the incidence of red leaf spot disease and major insect pests in Punjab. Journal of Research Punjab Agricultural University 18(4):400-405. 5 ref.

Studies on sorghum (variety SL 44) showed that the mean incidence of Colletotrichum graminicolum was very high at Ludhiana and Kheri. Its occurrence was in the order of Kheri<sup>1/2</sup> Ludhiana<sup>1/2</sup> Abohar<sup>1/2</sup> Faridkot. Damage by Atherigona soccata was high at Ludhiana followed by Kheri and Abohar, and it was more on late-sown crops at Ludhiana and Kheri. The infestation by Chilo partellus was heavy at Ludhiana followed by Faridkot, Abohar and Kheri. Out of the infested stalks of late-sown crop 51.3% harboured the hibernating larvae, whereas 59.6% of the infested stubble of early sown crop contained hibernating larvae of the borer. On the basis of yield data, and disease and insect pest incidence, Abohar (Ferozepur) was found quite suitable for its seed production by adopting late sowing which gave high grain yield. Highest fodder yield was obtained from early sowing at all the stations.

0611 FAO, REGIONAL OFFICE FOR ASIA AND THE FAR EAST. 1981. Pest, disease, and weed complexes in high yielding varieties in Asia and Pacific: an overview. Bangkok, Thailand: FAO, Regional Office for Asia and the Far East. 19 pp. (FAO-RAPA, 46).

0612 SARASOLA, A.A., and ROCCA DE SARASOLA, M.A. 1981. Diseases and damages on maize, sorghum and sunflower in Argentina. (Es). Buenos Aires, Argentina: Hemisferio sur. 102 pp. 156 ref.

0613 SIVAPRAKASAM, K., and BALASUBRAMANIAN, G. 1981. Impact of plant protection on the pest and disease complex of sorghum. Pestology 5(4):29-31. 3 ref.

## Pathology

### Fungus Diseases

0614 ABDEL-HAK, T. 1981. Pre- and post-harvest diseases problems of major food crops in Africa. Pages 243-258 In Proceedings, Third General Conference of the Association for the Advancement of Agricultural Sciences in Africa, 9-15 April 1978, Ibadan, Nigeria. v.3. Ibadan, Nigeria: Association for the Advancement of Agricultural Sciences in Africa. 3 ref.

Describes the stem, leaf and stripe rusts and septoria diseases of wheat, and blast and brown leaf spot diseases of rice. Late wilt, bacterial soft rot, charcoal rot, fusarium stalk rot and pink rot, leaf blight, corn and sorghum rust, downy mildews, head smut, covered kernel smut and long smut diseases of maize, sorghum and millet are also described.

0615 BANDRE, T.R., DAGINAWALA, H.F., and POWAR, C.B. 1981. Double infection by citrinin-producing fungi on sorghum. Current Science 50(24):1068-1070. 12 ref.

Two experiments were conducted to

study the double infection by *Penicillium citrinum* and *Aspergillus candidus*. In the first experiment, one set of infected sorghum grains was directly inoculated on Czapek-Dox rose bengal streptomycin agar (CDRSA) in petridishes. The other set of CDRSA was inoculated with uninfected healthy sorghum grains as a control. In the second experiment healthy and experimental sorghum grains were surface-sterilized by immersing for two minutes in 0.1% HGC12 rinsed repeatedly with distilled water, crushed and then inoculated separately on CDRSA medium. Results showed that *A. candidus* infection was deep seated and occurred before grain formation while *P. citrinum* infection was superficial and occurred after the formation of grains.

0616 CANEZ, V.M., Jr., and KING, S.B. 1981. Fungal infection of developing sorghum panicles. *Journal of the Mississippi Academy of Sciences* 26(suppl.): 11. (Abstract).

Two Sorghum bicolor varieties, TX2536 and Redlan, were planted in the field at Mississippi state on May 8 and July 1, 1980 respectively. Panicle parts, including florets, seed, rachis branches, rachis, and peduncles, were assayed for fungal infection. Assays were made at anthesis (A), one week after anthesis (A+1), three weeks after anthesis (A+3), grain physiological maturity (PM), and harvest maturity (HM) by incubating surface sterilized tissues on potato dextrose agar. *Fusarium moniliforme* and *Alternaria* spp. were most frequently isolated while *F. roseum* 'Semitectum' and species of *Curvularia*, *Helminthosporium*, *Phoma*, and *Nigrospora* were less frequently isolated.

0617 DIENER, U.L., MORGAN-JONES, G., WAGENER, R.E., and DAVIS, N.D. 1981. Toxicogenicity of fungi from grain sorghum. *Mycopathologia* 75(1):23-26. 24 ref.

The mycoflora of nine varieties of grain sorghum was determined by

plating serial dilutions of ground samples on rose bengal-streptomycin agar. Seventeen species of fungi representing 10 genera were identified. *Curvularia*, *Penicillium*, *Mucor*, and *Aspergillus* were dominant genera. Extracts of *P. herquei* were highly toxic to brine shrimp, while those of *C. clavata*, *C. lunata*, and *Mucor mucedo* showed low to moderate toxicity. Extracts of *C. clavata*, *C. lunata*, and *M. mucedo* were highly toxic to chicken embryos; those of six other species showed low to moderate toxicity. Extracts of *C. clavata*, *C. lunata*, *M. mucedo*, *Fusarium moniliforme*, *Alternaria tenuissima*, *P. herquei*, and *P. steckii* showed varying degrees of toxicity to day-old cockerels.

0618 EL SHAFIE, A.E., and WEBSTER, J. 1981. *Setosphaeria khartoumensis* sp. nov. and its exserohilum conidial state. *Transactions of the British Mycological Society* 77(22):442-446. 8 ref.

*Setosphaeria* isolated from Sorghum bicolor var. Mayo from Sudan, together with its exserohilum conidial state is described. This species is homothallic and produces ascospores which are distinct from those of other species but the conidia are very similar to those of *S. holmii* and *S. rostrata*.

0619 GOWDA, D.N., JANARDHAN, A., and REDDY, H.R. 1981. Occurrence of udabatti disease on sorghum in Karnataka. *Current Science* 50(12):536. 6 ref.

Few earheads of sorghum showed symptoms typical to those of *Ephelis* infection on several graminaceous crops. Microscopic examination of the fungus revealed the conidia to be acicular, hyaline, aseptate, straight or slightly curved which was close to the spore size of *Ephelis oryzae* Syd. Thus sorghum was concluded as a new host for *Ephelis oryzae*.

0620 MANZO, S.K. 1981. Studies on the ecology of *Fusarium moniliforme*



## Smuts

SheId. under sorghum culture. Ph.D. thesis, Kansas State University, Manhattan, Kansas, USA. 70 pp.

0621 RAMARAJ, B., and RAJAGOPAL, K. 1981. Screening for disease resistance against foliar diseases and head mould of sorghum. Pages 14-17 In Proceedings, National Seminar on Disease Resistance in Crop Plants, 22-23 December 1980, Coimbatore, Tamil Nadu, India (eds. N. Shanmugam, R. Jeyarajan, and P. Vidhyasekaran). Coimbatore, Tamil Nadu, India: Tamil Nadu Agricultural University. 8 ref.

0622 RAVINDRANATH, V. 1981. Sorghum, *Sorghum bicolor* (L.) Moench. Pages 120-131 In A review and analysis of insect pest, plant disease, and weed complexes in high yielding varieties and hybrids under intensified agricultural practices in Asia and Pacific. Bangkok, Thailand: FAO, Regional Office for Asia and the Far East. 39 ref.

Reviews the major diseases of sorghum and the extent of damage or losses caused by them. Outlines future plans for integrated approach for crop production.

0623 WALKER, C., and RHODES, L.H. 1981. *Glomus albidus*: a new species in the Endogonaceae. Mycotaxon 12(2):509-514. 9 ref.

0624 ZUMMO, N. 1981. Pest management systems for sorghum diseases. Pages 563-574 In CRC handbook of pest management in agriculture (ed. D. Pimentel). v.3. Boca Raton, Florida, USA: CRC Press. 19 ref.

The important diseases of sorghum, viz. seed and seedling diseases, rot and stalk rots, foliage diseases, smut diseases, and fusarium head blight are described along with their chemical, biological and cultural control. Development of disease-resistant varieties is recommended to be given top priority.

0625 AL-SOHAILY, I.A., and AL-JIBBOURI, M.H. 1981. Susceptibility stage of sorghum to infection with long smut pathogen. Page 47 In Abstracts, Third International Symposium on Plant Pathology, 14-18 December 1981, New Delhi, India. New Delhi, India: Indian Agricultural Research Institute.

Highly susceptible local cultivar of sorghum was grown to study the stage of infection of long smut (*Tolyposporium ehrenbergii*) in Iraq. Sorghum seeds or plants at different stages of growth were exposed to chlamydo spores or sporidial suspension of the fungus. The inoculations were done either by spraying or hypodermic injections with the inoculum. Results show that contaminated soil or infested seeds could not cause infection. Spraying the plants with chlamydo spores or sporidial suspension was unsuccessful in establishing the disease, but injecting the plant, 2-6 days before emergence of the head from host boot leaf resulted in diseased plants. Both chlamydo spores and sporidia can be used in establishing the disease if they were lodged at the proper time of the head development.

0626 BETANCOURT - VALLEJO, A. 1981. The nature of resistance to head smut *Sphacelotheca reiliana* (Kuhn) Clint in *Sorghum bicolor* (L.) Moench. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 79 pp.

0627 CHAUHAN, L.S., and VERMA, S.C. 1981. Two new host records for India. Indian Journal of Mycology and Plant Pathology 11(2):246-247. 3 ref.

Two important fungal records viz. *Pyricularia grisea* on *Eleusine indica* and *Tricothecium roseum* on sori of *Sphacelotheca sorghi* on *Sorghum bicolor* were observed during routine mycological surveys. A brief account of both the fungi is presented.

## Downy Mildews

0628 CLAFLIN, L.E. 1981. Control of seed decay, seedling blights and covered kernel smut of sorghum with seed treatments 1980. Fungicide and Nematicide Tests 36:161-162.

Sorghum seed was infested with 0.5% Sphacelotheca sorghi teliospores by volume (5 ml teliospores/1000 ml seed), then treated with the fungicide formulations at various rates and tumbled 5 min to obtain even coverage. All fungicide treatments increased stand counts but some treatments were more efficacious than others. Excellent control of covered kernel smut (1% or fewer smutted panicles) was obtained with all of the fungicides tested except Abbott (A-48150) at the 2 oz rate and Terra-Fla 25 +methoxychlor. The low percentage (11.5%) of infected panicles in the control was attributable to the late planting date and warm, moist soil conditions. None of the materials was phytotoxic at the rates tested.

## Rust

0629 ANAHOSUR, K.H. 1981. Chemical control of sorghum rust. Indian Journal of Agricultural Sciences 51(2):111-113. 3 ref.

Application of mancozeb 0.2 and 0.4%, sprayed 4 times starting from the 35th day of sowing at an interval of 10 days, significantly reduced the rust infection and increased the grain yield of sorghum bicolor.

0630 NAIK, S.T., ANAHOSUR, K.H., and HEGDE, R.K. 1981. Role of sugars, phenols, and amino acids in rust resistance in sorghum. Mysore Journal of Agricultural Sciences 15(2):282-289.

0631 BALASUBRAMANIAN, K.A. 1981. Chlorophyll content and mineral composition of downy mildew affected chlorotic leaves of sorghum. Indian Phytopathology 34(4):500-501. 15 ref.

A highly downy mildew susceptible line of sorghum CSV-2 was used to study the changes in chlorophyll and some mineral contents of the chlorotic leaves. Both types of leaves were collected 60 days after planting. Results revealed that chlorophyll a and b were reduced to the extent of 94% and 93% respectively in chlorotic leaves but chloride content of both healthy and chlorotic leaves did not differ, suggesting that chloride is not responsible for chlorosis in downy mildew affected leaves. In chlorotic leaves P concentration was found higher and iron declined by 32%. Concentration of Cu and Zn increased by 41.6% and 6.7% respectively.

0632 BHAT, M.G. 1981. Studies on inheritance of resistance to downy mildew Peronosclerospora sorghi (Weston and Uppal) Shaw in sorghum. M.Sc. thesis, University of Agricultural Sciences, Bangalore, Karnataka, India. 156 pp. 135 ref.

Sorghum crosses involving resistant lines UCh V2 and QL3, and susceptible lines SPV3 and CSV2 were studied for inheritance of (i) downy mildew resistance, (ii) plant pigmentation, and (iii) quantitative characters. Resistance to downy mildew was found to be inherited as a dominant character and was controlled by a set of six genes. There was no linkage between resistance to downy mildew and plant pigmentation. Additive gene action was more important in majority of the crosses. Among the two resistant lines, UCh V2 was found to be better in grain yield

and grain quality.

0633 BONDE, M.R., and PETERSON, G.L. 1981. Host range of a Taiwanese isolate of *Peronosclerospora-sacchari*. *Plant Disease* 65(9):739-740. 11 ref.

Sixty-six plant species representing 31 genera within eight grass tribes including sorghum (two species) were tested for susceptibility to systemic infection after conidial inoculation with an isolate of *Peronosclerospora sacchari* from Taiwan. Not all species tested in these genera were susceptible, and in many instances only a small percentage of the plants of a susceptible accession became infected. Some susceptible species are common perennial grasses in the continental United States. These, and perhaps other closely related plants, might allow *P. sacchari* to overwinter if the pathogen were to spread to the United States. Oospores were not detected.

0634 JANKE, G.C. 1981. Two cultural practices for the control of sorghum downy mildew, *Peronosclerospora sorghi*, in grain sorghum (deep tillage and roguing (crop rotation)). M.S. thesis, Texas A and M University, College Station, Texas, USA.

0635 LAL, S. 1981. Developmental stages in *Peronosclerospora sorghi*: the sorghum downy mildew of maize. *Acta Botanica Indica* 9(2):171-174. 9 ref.

Developmental stages in asexual structures of *Peronosclerospora sorghi* on the leaves of maize hybrid Ganga 5 grown under dark conditions at 22 deg C and  $1/2$ 95% R.H. were studied and morphological characters are described. Conidial initials were at first bulbous, then elongated, later formed dichotomics bearing sterigmata and conidia. Heavy sporulation was obtained within 9 hrs of incubation. Germination of conidia was by germ tubes. Oospores were observed in the naturally infected leaves.

0636 RAMALINGAM, A., and RAJASAB, A.H. 1981. Epidemiology of sorghum downy mildew. 6. Relative importance of oospores and conidia in epidemics of systemic infection. *Proceedings of the Indian National Science Academy Part B* 47(5):625-630. 26 ref.

Incidence of systemic downy mildew in sorghum variety 'bili jola', inoculated separately with oospores and conidia of *Peronosclerospora sorghi* was estimated on plants effectively isolated from non-applied inoculum and air-borne conidia. The oospore inoculum gave only 1.2% infection, whereas a conidial suspension applied to young seedlings produced systemic infection in just over half the crop. The relative importance of the two inocula is discussed.

0637 SHETTY, H.S., and SAFEEULLA, K.M. 1981. Effect of some environmental factors on the asexual phase of *Peronosclerospora sorghi*. *Proceedings of the Indian Academy of Sciences (Plant Sciences)* 90(1):45-51. 26 ref.

*Peronosclerospora sorghi*, produced a maximum of 10,800 conidia/sq.cm. of diseased sorghum leaves at 100% relative humidity but only about 3600 conidia at 85% relative humidity under in vitro conditions. The sporulation was totally inhibited at 80% relative humidity and below. Infected sorghum leaves kept in darkness after completion of the previous crop of the spores, did not sporulate in continuous darkness even at the optimum relative humidity and temperature. Optimum temperature for sporulation is 21-23 deg C, 31 deg C and 30 deg C are minimum and maximum respectively. At 26 deg C and above, conidiophores were malformed and produced only a few conidia. For conidial germination, 21-25 deg C were optimum while-at 13 deg C conidial germination was as low as 52%. At 32 deg C, 80% germination was recorded but 35 deg C and above no germination occurred. After inoculation with

conidial suspension, a minimum of 3 hr moisture was essential to induce systemic infection.

0638 SHETTY, H.S., and SAFEEULLA, K.M. 1981. Factors affecting infection by *Peronosclerospora sorghi* on sorghum. Proceedings of the Indian Academy of Sciences (Plant Sciences) 90(5):465-470. 14 ref.

Age of sorghum plants is important in the development of downy mildew disease incited by *Peronosclerospora sorghi*. Plants inoculated just after emergence and up to 4-5 leaf stage are highly susceptible. In plants inoculated after 6-7 leaf stage, systemic symptoms were not observed but only local lesions appeared. Conidial concentration of 40/seedling brings about 100% infection if the host seedlings are inoculated through root. Systemic infection occurs in 10 and 22 days depending upon the conidial concentration. Roots of the seedlings inoculated with 1000 conidia/seedling get infected earlier. Mature conidia are highly infective compared to immature or old conidia. Soil and seed-borne inoculum can initiate both systemic and local lesion type of symptoms at any growth stage of the host plant in addition to air-borne conidia. Late expression of systemic infection can result both from air-borne conidia and oospore present in the soil or seed.

0639 TRAYLOR, E.A., and DUNKLE, L.D. 1981. Effects of antibiotics and metabolic inhibitors on germination of *Peronosclerospora sorghi* conidia. *Phytopathology* 71(8):909. (Abstract).

Synchronous sporulation of *Peronosclerospora sorghi*, causal agent of sorghum downy mildew, is induced by incubating systemically-infected sorghum seedlings at 19 C in darkness and dew for 7.5 hr. Attempts were made to interrupt the differentiation sequence between sporulation and germination and to induce dormancy by incubating conidia in metabolic or biosynthetic inhibitors. Antibiotics

known to inhibit protein biosynthesis in prokaryotes or eukaryotes prevented conidial germination. Metabolic inhibitors and most inhibitors of RNA biosynthesis also were effective. However, the inhibitory effects of all compounds tested were irreversible, and conidia failed to germinate when transferred to water.

0640 TULEEN, D.M., and FREDERIKSEN, R.A. 1981. A crop loss model for sorghum downy mildew. *Phytopathology* 71(8):909. (Abstract).

A model is presented for calculating yield loss in grain sorghum due to systemic sorghum downy mildew caused by *Peronosclerospora sorghi*. Equations were developed using data sets from field experiments conducted over several years in South and Central Texas. Empirical data indicate that: 1) a low incidence of systemic infection can thin dense sorghum stands to an optimum plant density and allow the healthy plants to prosper, 2) genetic resistance effectively reduces grain yield losses caused by the disease, and 3) rainfall within 4-7 days after planting is associated with a low incidence of the disease at locations observed. Model estimates were plotted against measured crop yields using seven data sets. Multiple regression analysis performed on the data showed that the model simulated grain yield with acceptable precision.

0641 TULEEN, D.M., and FREDERIKSEN, R.A. 1981. Simulating yield losses in grain sorghum due to sorghum downy mildew. *Agronomy Journal* 73(6):983-987. 16 ref.

To calculate yield loss in *Sorghum bicolor* due to systemic sorghum downy mildew caused by *Peronosclerospora sorghi*, a model was developed using data sets from field experiments conducted in South and Central Texas. Empirical data indicate that: 1) a low incidence of systemic infection can thin dense sorghum stands to an optimum plant density and allow healthy plants to

prosper, 2) genetic resistance effectively reduces grain yield losses caused by the disease, and 3) rainfall within 4 to 7 days after planting is associated with low incidence of sorghum downy mildew at the locations observed. Model estimates were plotted against measured crop yields using seven data sets. Multiple regression analysis performed on the data showed that the model simulated grain yield with acceptable precision.

### Leaf Spot/Blight

0642 ANZALONE, L., Jr. 1981. Evaluation of foliar fungicides on grain sorghum hybrids 1980. Fungicide and Nematicide Tests 36:92.

Three fungicides were evaluated for control of zonate leaf spot of sorghum in a field test at Baton Rouge, LA. Two grain hybrids, Dekalb BR64 and Funk G-516BR, were planted in a sandy loam. Plots were 50 ft rows spaced 40 inches apart. The inner two rows were treated while the outer rows served as a buffer zone to minimize the effects of drift. Chemicals were applied in 25 gallons of water per acre at 40 ppl using a two-row C02 back-pack sprayer. Fungicides were applied as foliar sprays three times at 14 day intervals. The two inner rows were harvested to determine yield. Both foliage diseases occurred with sufficient prevalence to evaluate the effectiveness of the fungicides. All fungicide treatments reduced disease severity. Three applications of Dithane M45 at 2.0 lb of formulated material per acre showed increased grain yield compared to the nontreated plots.

0643 CHANG, S.C. 1981. Field evaluation of resistance in CMS sorghum to *Helminthosporium sorghicola*. (Ch). Report of the Corn Research Center, Tainan DAIS 15:15-19. 12 ref. (Summary: En).

Eighteen cytoplasmic male sterile lines of sorghum were screened for resistance to *Helminthosporium sorghicola* during 1979-81 using

natural inoculation. Results indicated the availability of good sources of resistance to the fungus. Ten lines including Ed. white martin, CK 60, Tx 3197, K-59, Tx 378, Tx 2219 5320, CK 6065, CK 605 and wheatland showed consistent resistance.

0644 DALMACIO, S.C., DAYAN, M.P., and PASCUAL, C.B. 1981. Identification of sources of resistance to some major diseases of sorghum in the Philippines. Philippine Phytopathology 17(1-2):38-46. 11 ref.

Artificial and natural inoculation methods were used to screen for resistance to five major diseases of sorghum, namely: gray, tar and target leaf spots, leaf rust, and *Rhizoctonia* sheath blight. The proportions of resistant lines to the number of lines tested are as follows: 201 resistant out of 555 lines tested for rust, 27 out of 2525 for gray leaf spot, 51 out of 2268 for tar spot, 198 out of 2484 for target leaf spot and none out of 88 for *Rhizoctonia* sheath blight. Possible implications of these results in breeding for disease resistance are discussed.

0645 GOWDA, B.A., and RAMALINGAM, A. 1981. Influence of sorghum pollen on germination of conidia and development of infection by *Colletotrichum graminicola* (CES.) Wilson. Indian Journal of Botany 4(2):37-41. 11 ref.

Sorghum pollen stimulated germination and six other factors which contributed to successful infection of *Colletotrichum graminicola*. A higher concentration of pollen was found to have a reduced effect. Production of secondary conidia was observed from conidia in controls as well as pollen treatments. A 50% increase in the infected area was noticed on leaves that received pollen simultaneously or three days after inoculation. However, the infected area was significantly less than controls on leaves that received pollen three days before inoculation.

0646 SANTAKUMARI, M., and REDDY, C.R.

1981. Antifungal property of herbicides against *Helminthosporium turcicum* Pass. *Pesticides* 15(2):25-28. 18 ref.

Two herbicides, alachlor and dalapon were tested for their effect on the growth of *helminthosporium turcicum* Pass in vitro, the incitant of leaf blight of maize and sorghum. It was found that alachlor is a better fungitoxic chemical than dalapon since it is more effective in inhibiting conidions.

## Rots

0647 ANAHOSUR, K.H., PATIL, S.H., PABAMESWARAPPA, R., and GOWDA, B.T.S. 1981. Investigations on charcoal rot of sorghum with reference to evaluation of sorghum genotypes, screening techniques and effect of grain yield. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 15 pp.

Sorghum genotypes from Sorghum Project, Hyderabad and ISCRN were screened by tooth pick method, and 20 plants in each replication were inoculated with infested tooth picks at anthesis. Observations on number of plants lodged, number of nodes crossed and length of spread were recorded at grain maturity. Evaluation of genotypes revealed that SPV-249, E36-1 and BJ-112 possess high level of resistance. Technique of infection through roots from soil to identify resistance sources was found best. Tooth pick method is suggested where natural infection is least. Genotypes with higher quantity of sugar and phenols were found more resistant.

0648 ARIAS, J.A., BRACKER, C.E., and DUNKLE, L.D. 1981. Cytological alterations induced by *Periconia circinata* toxin in the outer root cap of sorghum. *Phytopathology* 71(8):857-858. (Abstract).

*Periconia circinata* were exposed to 500 ng/ml of the host-specific toxin from *P. circinata* (treated) or to water (control) for 0.25, 2, 4, 8 and 12 hr. Cytologically, treated R-seedlings were similar to controls. In outer root cap cells of S-seedlings treated for 2 hr, hypersecretory activity was lost, vacuolation increased, and starch grains were diminished. Longer treatments resulted in further vacuolation, loss of starch, smaller plastids, pleomorphic dictyosomes with fewer cisternae, regularly stacked ER cisternae, and cellular autolysis. Before autolysis no lesions were observed in plasma membrane or tonoplast, and mitochondrial morphology was normal. Root cap size remained constant until autolysis, after which there was some shrinkage. Mitosis was inhibited in the apical meristem of S-seedling roots after treatments of 2 or more hr.

0649 BAPAT, D.R., SHINDE, M.D., and PADHYE, A.P. 1981. Studies on charcoal rot of sorghum (*Sorghum bicolor* (L.) Moench) caused by *Macrophomina phaseolina* (Tassi) Goid. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 4 pp. 7 ref.

Six F<sub>2</sub> populations along with their parents and checks were grown and artificial inoculation was done on third node from the ground when the crop was 63 days old. Varieties IS-2146, FR-203, SIV-277, and SIV-265 showed localized infection upto 70.83, 70.59, 70.00, and 66 percent respectively and the maximum spread was upto 4 nodes. Crosses involving above parents viz. SIV-265 x FR-203, FR-203 x IS-2146, and IS-2146 x SIV-277 showed infection upto 35 to 46 percent and maximum spread upto 4-5 nodes and was possible to isolate resistant lines since the gene action involved was of the additive type.

0650 DUNKLE, L.D. 1981. Global occurrence of sorghums sensitive to

toxin produced by *Periconia circinata*.  
Phytopathology 71(8):871. (Abstract).

Seedlings of sorghums (primarily durra and milo groups) from the world collection were tested for sensitivity to PC toxin (produced by *Periconia circinata*) a response directly related to susceptibility to the pathogen and an indirect assay for the semi-dominant PC gene which conditions susceptibility. The majority (90%) of the international sorghum lines tested were insensitive to PC toxin as were related or wild species. However, susceptible genotypes were found in accessions of sorghums from India, Sudan, Nigeria, and China in addition to the original milo cultivars from the US that were susceptible to *P. circinata* during the 1930's. Thus, the PC gene has persisted in sorghums near the center of origin of the crop where the pathogen is not known to exist. Selection pressure of pathogenic, toxin-producing strains of *P. circinata* in the US apparently favored resistant mutants.

0651 DUNKLE, L.D., and WOLPERT, T.J. 1981. Independence of milo disease symptoms and electrolyte leakage induced by the host-specific toxin from *Periconia circinata*. Physiological Plant Pathology 18(3):315-323. 16 ref.

The host-specific toxin produced by *Periconia circinata* induced an efflux of electrolytes and caused milo disease symptoms in seedlings of a near-isogenic resistant cultivar. The extent of electrolyte leakage depended on concentration of toxin up to c. 500 ng ml<sup>-1</sup>. Concentrations of toxin sufficient to elicit severe disease symptoms did not induce a marked leakage of electrolytes when applied after a 10-h treatment with low concentrations that produced no symptoms and caused only minimal loss of electrolytes. The dissociation of electrolyte leakage from milo disease symptoms suggests that, although toxin recognition may occur at the cell surface and result in loss of electrolytes, other physiological

responses are more significant to development of visible disease symptoms.

0652 MARCH, J., LEHARDON, S.L., and PRINCIPI, A. 1981. The incidence of sorghum stalk rot (*Sorghum bicolor* (L.) Moench) according to tillage and sowing practices. (Es). Revista de Ciencias Agropecuarias 2:125-134. 13 ref. (Summary: En).

*Sorghum bicolor* cv. Frontier 4122 was sown in split plots with four replications. The principal fungi associated with stalk rot in natural infections belonged to the *Fusarium* spp. group, being the most important *F. moniliforme* Sheldon; *Macrophomina phaseoli* (Maublanc) Ashby, *Nigrospora* spp. and *Helminthosporium* spp. were present very few times. Heavy rains during the growing season followed by dry conditions close to riping point helped stalk rot. The incidence of disease was notably reduced under either minimum tillage or zero tillage practices as compared to conventional tillage when early tilled soil was not carried out; when it was performed the incidence of disease highly decreased under minimum tillage compared with conventional and zero tillages.

0653 MAYEE, C.D., and GARUD, T.B. 1981. An assured method for evaluation of sorghum charcoal rot. Indian Phytopathology 34(3):368-369. 3 ref.

To evolve an efficient and reliable technique for mass screening of sorghum charcoal rot, existing inoculation methods viz. soil inoculation, seed inoculation, tooth pick inoculation (TPI), and stem tape inoculation (STI) methods were evaluated. It was found that infection was developed by all the methods of inoculations but highest infection was noticed in stem tape technique followed by tooth pick method. The STI technique was found to be convenient and assured method for screening huge entries of sorghum under field conditions. Out of 70

entries screened, 25 entries were found highly resistant to charcoal rot.

0654 MORE, B.B., WANI, P.V., KALE, K.D., and KONDE, B.K. 1981. Screening of sorghum cultivars against charcoal rot disease. *Agricultural Science Digest* 1(1):17-18.

0655 WOLPERT, T.J., and DUNKLE, L.D. 1981. Uptake of host-specific toxins by near-isogenic cultivars of sorghum. *Phytopathology* 71(8):913. (Abstract).

Seedlings of near-isogenic cultivars of sorghum susceptible (S) or resistant (R) to *Periconia circinata* were treated with 500 ng/ml of the host-specific toxins Ia or IIa produced by the pathogen. Uptake of the toxin during a 12-hr incubation period was quantified by high-pressure liquid chromatography. Uptake by S-seedlings was rapid during the first 3-6 hr and then the rate declined. R-seedlings took up only small quantities of the toxins at a slow rate. Precise quantitation of uptake by S-seedlings was hindered by the appearance of an associated compound in the medium that eluted very closely to the respective toxin (Ia or IIa). Treatment of seedlings with cycloheximide (5 micrograms/ml) or cordycepin (50 micrograms/ml) for 6 hr prior to treatment with toxin prevented uptake of toxin and protected seedlings against toxin-induced symptoms. The results suggest a protein-mediated binding or uptake of toxin at the plasma membrane in the S-genotype. However, two-dimensional gel electrophoretic analyses did not reveal qualitative differences in the membrane proteins of S- and R-genotypes.

### Ergot

0656 ATWELL, S.M., and MANTLE, P.G. 1981. Hydroxydihydroergosine, a new ergot alkaloid analogue from directed

biosynthesis by *Sphacelia sorghi*. *Experientia* 37(12) :-1257-1258. 11 ref.

0657 SANGITRAO, C.S., and GHODERAO, B.N. 1981. Separation of sclerotia of ergot disease of sorghum. Presented at the All India coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 8 pp.

The formation of Sclerotial bodies in sorghum enhances perpetuation of disease and life cycle of ergot fungus. Attempts were made to find out minimum and suitable concentration of salt solution for removal of ergot sclerotia from sorghum seed. One quintal CK-60A seed from heavily ergot affected field in the sample of 2.5 kg each were treated with 7 different concentrations of salt solution. It was noticed that 5% salt solution i.e. 250 gms common salt in 5 litres of water can be useful for removal of 100% sclerotia with 77% seed germination and minimum losses of light seed component.

### Fungi on Grain Seeds (Molds)

0658 AGARWAL, V.K. 1981. Sorghum. Pages 80-83 In *Seed-borne fungi and viruses of some important crops*. Pantnagar, Uttar Pradesh, India: Govind Ballabh Pant University of Agriculture and Technology.

Seeds of four varieties, CSH-1, CSH-3, C3H-4 and 302 were used to study (i) seed borne fungi (ii) influence of fungicidal seed treatment on seed-borne fungi and emergence, and (iii) effect of pre-storage fungicidal seed treatment on emergence. Results revealed that in all 16 fungi were associated with sorghum seeds. Seeds treated with Agrosan GN or thiram at 0.25% gave higher emergence in all the varieties. It was also found beneficial to treat seeds with Agrosan GN or thiram prior to storage.

0659 CANEZ, V.M., Jr., and KING, S.B.



1981. A comparison of methods for assessing grain mold in sorghum. *Phytopathology* 71(8):865. (Abstract).

Six varieties of *Sorghum bicolor* were field grown with and without aerial misting during seed development. At physiological maturity and harvest maturity, fungal invasion of seed was assessed by plating surface-sterilized seed on potato dextrose agar and by determining ergosterol content. *Fusarium moniliforme*, *F. roseum* 'Semitectum', *Curvularia* spp. and *Alternaria* spp. were the predominant fungi isolated. The greatest number of fungal colonies and highest ergosterol content were associated with misted seed at harvest maturity. Greater differences in fungal invasion among varieties were found with ergosterol analysis than with the plating technique. Visual assessment of grain mold was more closely correlated with ergosterol levels than with total fungal colonies.

0660 CASTOR, L.L. 1981. Grain mold histopathology, damage assessment and resistance screening within *Sorghum bicolor* (L.) Moench lines. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 192 pp.

0661 CASTOR, L.L., and FREDERIKSEN, R.A. 1981. Histopathology of *Fusarium moniliforme* infection of sorghum kernels. *Phytopathology* 71(2):208. (Abstract).

*Sorghum* lines were inoculated at anthesis with *Fusarium moniliforme* (FM) to determine when and how infection occurs. Observation of diseased and healthy kernels indicated that infection occurred in glumes, lemma, palea, and lodicules 5 days after anthesis. Subsequent colonisation occurred in pedicel and basal ovary tissue. Hats of fungal hyphae, produced between the ovary wall and aleurone layer entered the endosperm, germ and ovary wall tissues. A false black layer formed in some kernels resulted in the production of smaller kernels.

Histological evidence proved that FM infects sorghum kernels prior to maturity.

0662 EL SHAFIE, A.E., and WEBSTER, J. 1981. A survey of seed-borne fungi of *Sorghum bicolor* from the Sudan. *Transactions of the British Mycological Society* 77(2):339-342. 19 ref.

In a survey of seed-borne fungi of *Sorghum bicolor* from the Sudan, 43 species were isolated. Nine isolates were new host records for *S. bicolor*, 18 isolates were new records for the Sudan. The percentage frequencies of fungi in the seeds and in the samples were calculated. Seed discoloration in some varieties was found to be strongly correlated with the presence of seed-borne fungi and was associated with low percentage germination.

0663 FORBES, G.A., ZIV, O., and FREDERIKSEN, R.A. 1981. The influence of infection timing, infection techniques and site on the reactions of sorghum seedlings to *Pythium*. *Phytopathology* 71(8):874. (Abstract).

An in vitro infection technique was evaluated for determining reactions of sorghum seedlings to *Pythium graminicola*. Differential reactions of 12 sorghum cultivars were established based on the effects on root length, leaf length, fresh weight and dry weight. When the most resistant and susceptible cultivars were compared in infested soil, there was no significant difference in percent emergence. In other experiments tip infection killed the seedlings. The other infection site resulted in moderate damage. In corresponding greenhouse trials, seedlings planted at different distances from inoculum showed different responses, ranging from no emergence (1cm away) to no damage (4cm away). It appears that emergence is determined more by infection timing and site than by resistance of host tissue to infection.

0664 KULKARNI, N., HUSSAIN SAHIB, K., and MURTY, K.N. 1981. Genetics of mould tolerance in sorghum. Indian Journal of Genetics and Plant Breeding 41(1):84-87. 4 ref.

Thirteen mold tolerant progeny of F6 generation from the crosses CSV-4 x H-112, one resistant check CSV-4 and one susceptible check CSH-1 were grown at two locations to evaluate grain yield and head mold resistance. Among the varieties studied, H-142 recorded the highest grain yields with lowest incidence of head molds. Progenies with tan plant were found to be tolerant to head molds, and can form criteria for selecting progenies resistant to molds.

0665 MATHUR, K., and NAIK, S.M. 1981. Fungi associated with mouldy sorghum grain and reaction of sorghum cultivars to head moulds. Bulletin of Grain Technology 19(2):143-146. 7 ref.

To identify fungi associated with moldy sorghum seeds, infected seeds of variety CSV-3, and for reaction of sorghum against head molds, 35 sorghum lines were planted. Fungi most prevalent on moulded grain were *Curvularia lunata* and *Fusarium moniliforme* followed by *Helminthosporium sorghicola* and *Alternaria tenuis*. Out of 35 entries tested 18 were completely free from molds, 5 showed mold infection in traces, 7 had infection upto 25%, 4 had infection upto 50% and only one showed more than 50% infection and discoloration of grain. Moldiness of threshed grain varied from 10% to 50% in many entries but in one hybrid PP2B x IS1167, it was 75%.

0666 NAIK, S.M., SINGH, S.D., and MATHUR, K. 1981. Efficacy of fungicides in controlling head moulds of sorghum. Pesticides 15(11):25, 39. 6 ref.

Molds susceptible variety CSV-3 (370) was sown in kharif 1973-75 to find out efficacy of fungicides in controlling head molds. Eight treatments, viz. captan, thiram,

aureofungin + captan (in 1:5 ratio), maneb, thiovit, difolatan, bavistin and one unsprayed control were included. First spray was given at milk stage and second after 10 days. Best control of head molds was given by mixture of aureofungin and captan. Ear-head infection was 49.82% and grain infection 26.93% as compared to 79.72% and 54.81% in unsprayed check.

0667 NARAYANA, D., PRASAD, M.N., RAJAGOPAL, K., and THANGAVELU, O. 1981. Sorghum grain mould incidence in relation to host plant traits. Pages 126-130 In Proceedings, National Seminar on Disease Resistance in Crop Plants, 22-23 December 1980, Coimbatore, Tamil Nadu, India (eds. N.Shanmugam, R.Jeyarajan, and P.Vidhyasekaran). Coimbatore, Tamil Nadu, India: Tamil Nadu Agricultural University. 5 ref.

Five hundred sixty five elite sorghum germplasm lines were sown to identify the possible role played by host-traits, viz. plant type, earhead shape, grain color, grain size, glume coverage, and glume color for the grain mold incidence in sorghum. All the lines showed grain mold incidence. Further studies on the interaction of these traits in relation to mold reaction and opting for best combination of these traits in future breeding programmes is suggested.

0668 SALIFU, A. 1981. Mycotoxins in short season sorghums in northern Nigeria. Samaru Journal of Agricultural Research 1(1):83-88. 7 ref.

Four short season duration sorghums (CK-60, Serena, IS-9289 and IS-5790) and two long season duration varieties (Farafara and short Kaura) were planted in 1976. The short season sorghums ripened during the rains, became moldy, and were found to be contaminated with aflatoxins, zearalenone and patulin. The long season duration sorghums ripened after the rains, were not moldy and were not found to be contaminated with known mycotoxins. All the sorghum species

were contaminated with different fungal species, but the population of fungi in the short season duration sorghums were higher than in the long season duration sorghums.

0669 SEITZ, L.M., MOHR, H.E., and BORROUGHS, R. 1981. Preharvest fungal invasion in sorghum grains. Cereal Foods World 26(9):510. (Abstract).

Five sorghum hybrids grown near Manhattan, Kansas in 1977 were harvested at 12 weekly intervals. Fungal invasion began at, or very soon after, physiological maturity. Ergosterol content increased rapidly in a 2- to 3- week period after physiological maturity and then slowly during the next 7 or 8 weeks as the grain became weathered and discolored. Hybrids differed little in susceptibility to fungal invasion. When *Alternaria* began invading the grain, ergosterol contents began to increase. Eight sorghum lines grown at College Station, Texas were harvested on two dates 29 days apart. Due to wet weather, fungal invasion was already extensive at the first harvest and was considerably greater in all the lines at the second harvest. Visual ratings of weathering and discoloration did not adequately indicate extent of fungal invasion. Grain from Dallas, Texas, was not weathered or discolored but differences in extent of fungal invasion were detected by ergosterol and whole seed plating assays.

0670 WILLIAMS, R.J., and RAO, K.N. 1981. A review of sorghum grain moulds. Tropical Pest Management 27(2):200-211. 49 ref.

Grain molds are a major component of the sorghum grain deterioration complex, and have become a widespread problem of improved sorghums in temperate and tropical regions. Many fungi have been isolated from moldy grain, the most commonly occurring genera being *Fusarium* and *Curvularia*, and vary from those such as *F. moniliforme* Sheldon which are

pathogenic on young developing inflorescences, to many saprophytic fungi which develop on the mature grains. The review covers terminology, causal agents, time of infection, predisposing factors, effects on yield and quality, control measures, resistance screening procedures and progress and recommendations for further research particularly in resistance.

## Bacterial Diseases

0671 GILLASPIE, A.G., Jr., DAVIS, M.J., HARRIS, R.W., and LAWSON, R.H. 1981. Isolation and pathogenicity of the ratoon stunting disease bacterium. International Sugar Journal 83(995):324-326. 19 ref. (Summaries: De, Es, Fr).

The procedures used for isolation and cultivation on an artificial medium of the ratoon stunting disease bacterium are described in detail. Tests demonstrating pathogenicity of the bacterium on sugarcane and on sorghum-sudan grass uprights are also described. The morphology of the bacterium in culture is compared in vitro and in situ and the serological properties of the bacterium are discussed.

0672 KOLEVA, N. 1981. Bacterioses of winter wheat. (Bg). Rastitelna Zashchita 29(3):15-17.

*Pseudomonas syringae* which is a common pathogen for winter wheat was observed attacking barley, rye, oats, sorghum and maize in Bulgaria. For its control, hot water treatment of seeds (53 deg C) for 30 minutes is recommended. Of the chemical preparations 0.1% phytobacteriomycin (21/100 kg seed), quinolate (200g), falisan (200g) and vitavax (carboxin) (200 g) were the most effective.

0673 LENGKEEK, V.H., and KROUSE, L.J. 1981. Chemical control of bacterial streak and bacterial stripe of sorghum 1980. Fungicide and Nematicide Tests 36:93.

A hybrid susceptible to the two

foliar diseases was planted June 13 in a Richfield silt loam, and plots were staked June 24. Treatments were initiated 45 days after planting and continued for three applications. Bacterial streak incidence was so low that ratings were not taken. However, bacterial stripe was present and ratings taken represent incidence of this foliar disease. Bacterial stripe was reduced significantly by RH-9867 at both rates and by Dithane M-45 at the 2 lb/a rate. Phytotoxicity was observed with both RH-9867 and Dithane M-45. However, when RH-9867 and Dithane M-45 were used in combination no phytotoxicity was noted. Eventhough disease incidence was reduced by several treatments, no differences in yield were noted.

0674 NAGARKOTI, M.S., and SWARUP, J. 1981. Further studies on a new bacterial brown leaf stripe and top-rot of sorghum. Page 47 In Abstracts, Third International Symposium on Plant Pathology, 14-18 December 1981, New Delhi, India. New Delhi, India: Indian Agricultural Research Institute.

A comparative study of morphology and biochemical characters of 31 isolates of the causal bacterium (from sorghum and minor millets) revealed it to resemble *Enterobacter* in fermenting wide range of carbohydrates, to grow at temperatures above 40 deg C, to decarboxylate arginine, lysine and ornithine, to break down urea and failure to show pectate degradation. It also shows similarity with *Erwinia* in its microaerogenic acid fermentation of a number of carbohydrates, inability of some isolates to utilize adonitol, positive to tyrosinase and production of hydrogen sulphide. As a plant pathogenic member of *Enterobacteriaceae*, the present bacterium according to historical orientation, is identified as *Erwinia sorghi* sp. nov. Cross inoculation studies with bacterial isolates from 6 natural hosts were positive. However, there was variation in pathogenic

behaviour pf these 31 isolates towards 11 varieties of sorghum and minor millets and on this basis these have been distinguished into 6 pathogenic strains.

## Virus Diseases

0675 ALL, J.N., KHUN, C.W., and JELLUM, M.D. 1981. Control strategies for vectors of virus and viruslike pathogens of maize and sorghum. Pages 127-131 In Virus and viruslike diseases of maize in the United States (eds. D.T.Gordon, J.K.Knoke, and G.E.Scott). Wooster, Ohio, USA: Ohio Agricultural Research and Development Center.

Various control methods for insect vectors of virus and viruslike diseases of maize and *Sorghum bicolor* are discussed with emphasis on maize dwarf mosaic, maize chlorotic dwarf, and corn (maize) stunt. The use of systemic insecticides has controlled diseases caused by pathogens transmitted by leafhoppers in either a semipersistent or persistent manner. Resistance in maize and sorghum to some vectors has been demonstrated, but its practical value is unknown. Several natural control agents (parasitoids, predators, and fungi) are able to suppress populations of aphid vectors of maize viruses, but little is known concerning biological control of leafhopper vectors. Since maize and sorghum lines immune to virus and viruslike diseases are not available, integration of several methods to suppress vectors probably would be advantageous.

0676 ALUM, E.K. EL-NASR, M.A.A., KAMEL, A.S., and BADR, A.E. 1981. Diagnostic features of an induced mosaic virus that recently attacked corn, *Zea-mays* fields in Egypt. Ain Shams University Faculty of Agricultural Research Bulletin 1643:1-14.

0677 GARUD, T.B., and MALI, V.R. 1981. Screening of sorghum germplasm against sorghum red stripe virus (SRSV). Indian Journal of Mycology and Plant Pathology 11(1):94-95. 6 ref.

Sorghum germplasms were screened to find out the tolerant or immune sorghum material for breeding purpose. Ten plants for each entry were raised from healthy seeds in earthen pots in an insect proof glasshouse. Virus maintained on CK-60A, a sorghum parental line were used as source of inoculum. Screening results indicated that of 1811 sorghum germplasm entries screened, 38 were highly susceptible, 36 susceptible, 1667 moderately susceptible, 43 tolerant and 27 immune. Tolerant and immune entries are listed.

0678 GILLASPIE, A.G., Jr., THOMAS, C.A., and PRESCOTT, B. 1981. Inhibition of sugarcane mosaic virus symptoms on sorghum by microbial and plant polysaccharides and their antigenic relationship. Phytopathologische Zeitschrift 102:107-113. 18 ref. (Summary: De).

Polysaccharides from 23 bacterial, fungal, and higher plant sources were tested for inhibition of systemic development of sugarcane mosaic virus (SCMV) in sweet sorghum (*Sorghum bicolor* 'Rio'). Extracts from virus infected leaves were mixed with the polysaccharides and inoculated onto plants with an artist's airbrush. Polysaccharides from yeast cell walls and from *Bacillus subtilis* and *Streptococcus pneumoniae* Type III cell-free culture, liquids inhibited SCMV-infection by 90-100% at concentrations as low as 250 micrograms/ml. The other polysaccharides inhibited infection by 29% or less at concentrations as high as 2000 micrograms/ml. Although several of the plant and microbial polysaccharides tested are antigenically related, no relationship between inhibitory activity and antigenic properties was apparent.

0679 GREBER, R.S. 1981. Maize stripe disease in Australia. Australian Journal of Agricultural Research 32(1):27-36. 11 ref.

Maize stripe disease occurs commonly in maize and sweet corn crops of coastal Queensland. Other hosts include wild *Sorghum verticilliflorum*, johnsongrass, sudangrass, and *S. sudanense* x *S. bicolor* hybrids. A purification procedure used chloroform clarification, polyethylene glycol precipitation and then a sucrose gradient separation in which two and sometimes three bands were located. A specific antiserum was produced and reacted like East African antiserum. It produced two lines in gel-diffusion serology with partially purified preparations.

0680 HEARON, S.S., GILLASPIE, A.G., Jr., and MOCK, R.G. 1981. Infrastructure of *Sorghum bicolor* 'Rio' infected with strains of sugarcane mosaic virus (SCMV). Phytopathology 71(8):879. (Abstract).

Each of seven SCMV strains (A, B, D, E, H, I, and K) was mechanically inoculated to the second leaf of 10 *Sorghum bicolor* 'Rio' seedlings. Samples from inoculated and systemically infected leaves and comparable samples from uninoculated control plants were excised, fixed and embedded at 5-7 and 12-14 days after inoculation in three experiments. Based on the morphology of the pinwheels, the strains were divided into three groups: those that formed 1) predominantly or only sheet laminations (SCMV-A, B, D); 2) circular laminations (SCMV-H, I); and 3) both circular and sheet laminations (SCMV-E, K)

0681 HILTY, J.W. 1981. Remote sensing of virus diseased corn and sorghum. Pages 124-126 In Virus and viruslike diseases of maize in the United States (eds. D.T.Gordon, J.K.Knoke, and G.E.Scott). Wooster, Ohio, USA: Ohio Agricultural Research and Development Center.

Reflectance studies of maize

dwarf mosaic virus-infected sorghum indicated that only after symptoms developed, could plants be detected in the visible range of the spectrum. Diseased but symptomless sorghum had lower reflectance between 675 and 900 nm than healthy plants, whereas plants with symptoms had higher reflectivities in the 400, 600, and 800 nm ranges than healthy plants. Diseased sorghum was photographed using Ektachrome Aero 2443 and disease severity ratings were accurately assigned to the imagery.

0682 KAWANO, S., SENBOKU, T., and SHIKATA, E. 1981. Host range of rice ragged stunt virus. (Ja). Annals of the Phytopathological Society of Japan 47(5):697-699.

0683 MAYHEW, D.E., and FLOCK, R.A. 1981. Sorghum stunt mosaic. Plant Disease 65(1):84-86. 7 ref.

Symptoms of a viruslike disease of sorghum in the Imperial Valley of California included chlorotic and necrotic mottling and streaking of leaves and severe stunting. Electron microscopy of leaf dips and sections showed bacilliform particles measuring 68 x 220 nm, and transmission tests showed that the leafhopper, *Graminella sonora*, was a vector. The virus was transmitted by leafhoppers to sorghum, corn, and wheat but not mechanically transmitted to any plant tested. The name sorghum stunt mosaic is proposed for this apparently new disease.

0684 SHUKLA, K. 1981. Studies on yield loss of sorghum infected with sugarcane mosaic virus. Zeitschrift fuer Pflanzenkrankheiten und Pflanzenschutz 88(10):635-637. 10 ref. (Summary: De).

0685 SHUKLA, K., and JOSHI, R.D. 1981. Effect of some plant growth regulators on the infectivity of sugarcane mosaic virus. Indian Journal of Microbiology 21(4):350. 7 ref.

The effect of some growth regulators including coconut milk on

the infectivity of sugarcane mosaic virus (SCMV) on *Sorghum bicolor* was studied. One ml. of the infected sap extracted from the pulp of B4 sorghum plant was added to one ml. of growth regulator and used to infect with 600 mesh carborundum, seedlings of 2-3 leaf stage. Results indicated that a maximum inhibition of 70% was obtained with coconut milk and gibberellic acid. Inhibition was found more when growth regulators were applied before inoculation.

0686 SHUKLA, K., and JOSHI, R.D. 1981. Effect of sugarcane mosaic virus on seed constituents of sorghum (*Sorghum vulgare* Pers.). National Academy of Science Letters 4(5):191-193. 10 ref.

Results showed that infection had an adverse effect on the carbohydrate content in the seeds of diseased plants. The early infection caused more reduction in reducing and non-reducing sugars and starch content. But it could show very little reduction in protein and cerotene content. It was concluded that all the constituents are depleted due to infection and disturbed level of these was found responsible for disturbed metabolism.

0687 TOSIC, M. 1981. Cross protection among some strains of sugarcane mosaic virus and maize dwarf mosaic virus. Agronomic 1(2):83-85. 16 ref. (Summary: Fr).

Among sugarcane mosaic virus (SCMV) and maize dwarf mosaic virus (MDMV) strains in corn as well as in sorghum only partial cross protection was detected. MDMV-B did not prevent multiplication of MDMV-A when challenge-inoculated in sweet corn, but it delayed the time after which it could be recovered. The biggest effect of corn infected previously with MDMV-B on recovery of the challenge virus was at 1 or 2 days. The same effect occurred when corn plants were inoculated with MDMV-A and then challenged with SCMV-1. Sorghum cv. Atlas seedling previously

infected with MDMV-A slowed down necrosis when challenge-inoculated by SCMV-1. The longest delay of necrosis was recorded with Atlas seedlings inoculated with MDMV-A 5 days after emergence, and then challenge-inoculated 3 days later with SCMV-1. Necrosis in this case was prolonged almost for 3 months.

### Nematode Diseases

0688 FERRIS, J.M. 1981. Integrated control of nematodes of corn and sorghum in the United States. Page 419 In Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T.Kommedahl). Minneapolis, Minnesota, USA: Burgess Publishing Company. (Abstract).

With plant parasitic nematodes, the severity of damage inflicted depends upon the species present, the number of individuals of that species, and probably also the presence of some form of stress on the plant (low soil fertility or moisture, or weed competition). Control measures for nematodes, e.g. crop rotation and pesticide application, also control other pests. Several nematicidal-insecticidal compounds are available which, at rates recommended for corn rootworm control (11.2 g active ingredient per 100 m of row), can also reduce populations of lesion nematodes (*Pratylenchus* sp.) from 60-90% as compared with untreated root systems. Control of weeds often reduces populations of economically important nematodes by depriving them of one source of food.

0689 SESHADRI, A.R. 1981. Integrated approach to control nematodes infesting corn and sorghum in the tropics and subtropics. Pages 420-424 in Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T.Kommedahl). Minneapolis, Minnesota, USA: Burgess Publishing Company. 97

ref.

0690 YASSIN, A.M. 1981. Nematodes. Pages 53-61 In Gezira Research Station and Sub-stations annual report 1974/75. Gezira, Sudan: Ministry of Agriculture, Food and Natural Resources.

Describes the plant parasitic nematodes associated with cotton, pigeonpea, dwarf white milo dura, lubia bean, and leaf curl and other virus diseases of tomato and sesame. Important nematodes recorded during the report under year were *Pratylenchus sudanensis*, *Melioidogone javanica*, *Heticotylenchus* spp., *Scutellomena clathricaudatum*, *Longidorus africanus* and *Paratrophurus lobatus*. Dura varieties were found medium class hosts, and the multiplication of *P. sudanensis* was slow under durra varieties.

### Parasitic Plants - Striga

0691 BEBAWI, F.F. 1981. Intraspecific physiological variants of *Striga hennonthisca*. Experimental Agriculture 17(4):419-423. 6 ref.

Preliminary evidence is presented for the existence of (1) intraspecific physiological variants of *Striga hermonthica*, with Gabob population as the most responsive strain to a range of *Sorghum bicolor* cultivars, and (2) a local Sudanese sorghum cultivar called Tetron with broad-spectrum resistance to *Striga*. Tetron is recommended as another standard resistant cultivar with reference to Framida of East Africa.

0692 BEBAWI, F.F. 1981. Response of sorghum cultivars and striga population to nitrogen fertilization. Plant and Soil 59(2):261-267. 6 ref.

Not one cultivar consistently showed the same degree of response to different fertilizer regimes over all yield components measured. The most responsive cultivars for number of

grains/head, straw yield, head weight, and striga infestation were Karkatib, Dabr 1/1/1/1, Feterita, and T.U.B.7 respectively. Maximum response to the different fertilizer regimes was realised at 215 kg N/ha. N-fertilization significantly increased host yields and reduced striga yields. Of all cultivars, Safra was the most efficient in allocating more nutrients to grain production than to straw. No consistent evidence was found to indicate that host responsiveness to nitrogen fertilization would invariably depress striga infestations.

0693 BEBAWI, F.F., and FARAH, A.F. 1981. Effects of patterns and methods of sowing on sorghum/striga relations. *Experimental Agriculture* 17(3):337-341. 8 ref.

Changing the geometry of planting under irrigated conditions from the traditional pattern of regular rows into double rows resulted in a significant reduction in overall yield components of sorghum but a marked increase in shoot yields of striga. A better yield of sorghum was obtained in ridged plots than in flat plots, associated with less striga infestation and a slightly higher soil moisture content under the ridged plots.

0694 BEBAWI, F.F., and FARAH, A.F. 1981. Effects of parasitic and non-parasitic weeds on sorghum. *Experimental Agriculture* 17(4):415-418. 8 ref.

The parasitic weed striga had significantly greater effects on sorghum yield components than non-parasitic weeds. Grain reduction caused by striga amounted to 65% compared with 32% reduction caused by non-parasitic weeds. Comparable reductions were also manifest in straw yield, grains/head and plant height of sorghum. Early removal of striga (a week after its emergence), and thereafter at regular weekly intervals, helped improve crop yields.

0695 BEBAWI, F.F., and FARAH, A.F. 1981. Effects of nitrophoska and atrazine on relations between Sorghum bicolor and striga hermonthica. *Experimental Agriculture* 17(4):425-430. 15 ref.

Nitrogen-atrazine combinations were significantly more effective in stimulating higher yield components of sorghum and depressing yield components of striga than sole treatments of either nitrogen or atrazine. Over all treatments nitrophoska at 129 kg N/ha in combination with atrazine at 1.75 kg/ha gave 224, 180, 155 and 151% increases in yield components over the control for head, straw, 1000 grain weights and plant height of sorghum, and a decrease in 83, 88 and 90% of striga density at 8, 12, and 16 weeks from sowing the sorghum. The synergistic effect of nitrogen-atrazine is demonstrated.

0696 HSIAO, A.I., WORSHAM, A.D., and MORELAND, D.E. 1981. A bioassay for dl-strigol using witchweed (*Striga asiatica* (L.) Kuntze) seed germination. *Zeitschrift fuer Pflanzenphysiologie* 104(1):1-8. 10 ref.

A new, sensitive, quantitative germination bioassay for dl-strigol (ST) was developed using *Striga asiatica* seeds. It was based on the physiological role of ST as a striga seed germination regulator that inhibits the conditioning process when applied during an early stage of conditioning and stimulates germination when applied at a later stage. Concentrations of ST from 0.01 pico M to 1 micro M or the equivalent activity in solutions containing striga germination stimulants or regulators from soil extracts of sorghum and other crops were measured. Sorghum plants grown in sandy loam soil exuded germination regulators equivalent to 0.3 micrograms of ST during the first 6 to 7 days of germination and growth.

0697 RAO, C.H., SANGHI, N.K., and



RAO, U.M.B. 1981. Screening technique and evaluation of sorghum for striga tolerance. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 6 pp.

Sorghum varieties were grown in a sick plot of 3 rows with 3 metres length each and observations were recorded on plants of central row. CSH-1 which could withstand upto 120 striga plants per 1 meter row length was used as a susceptible check. Resistant material from germplasm, released varieties/hybrids and pre-released varieties supplied by AICSIP were screened through 1978, 1979 and 1980. Results revealed that there was not a single entry absolutely resistant. Among the resistant sources, IS-2203 and IS-5218 were photo-sensitive while IS-3924 was early and photo-insensitive. PJ8K, a local variety was found highly tolerant and in moderate sick plots satisfactory grain yields were realized. Among the high yielding varieties, SPV103, SPV109, SPV107, SPV104 and SPV221 had field tolerance.

0698 RAO, M.J.V., CHIDLEY, V.L., and HOUSE, L.R. 1981. Breeding for striga resistance in sorghum. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 15 pp.

Resistance breeding activities at ICRISAT and developments on the resistance screening methodology are described.

0699 RAO, M.J.V., CHIDLEY, V.L., RAMAIAH, K.V., and HOUSE, L.R. 1981. Breeding sorghum genotypes with resistance to *Striga asiatica* at the ICRISAT Center. Presented at the Second International Striga Workshop, 5-8 October 1981, Ouagadougou, Upper Volta. 35 pp. 3 ref.

Fourteen thousand sorghum germplasm lines have been screened for their stimulant production and a set of 640 low stimulant lines have been

identified. Verification of the field resistance of these lines indicated that all are not field resistant. Studies on genetics indicated that there was preponderance of additive compared to non-additive genetic variance. Multilocation testing during 1977 to 1980 showed that N-13, 16-3-4, Serena IS-2203, IS-4202, IS-7471 and IS-9985 are the best available low susceptible lines.

0700 SETTY, T.K.P., and HOSMANI, M.M. 1981. Effect of striga infestation on sorghum. Pages 287-289 In Proceedings, Eighth Asian-Pacific Weed Science Society Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.1. Bangalore, Karnataka, India: Asian Pacific Weed Science Society. 6 ref.

The effect of striga infestation on growth and yield of sorghum genotypes (cv. Swarna and cv. CSH-1) was studied under potculture conditions. The effect of striga parasitisation on growth and yield was of similar nature in both the genotypes. Relative water content, free proline and nitrate reductase activity in sorghum were higher with striga parasitisation, while, chlorophyll content and photosynthetic rate decreased due to striga infestation. There was reduction in yield and yield components of sorghum due to striga infestation in both the genotypes of sorghum. The reduction in grain weight per ear due to striga infestation was upto 40%.

## Entomology

0701 ANONYMOUS. 1981. Recommended control measures for major sorghum pests (1981). Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 2 pp.

Control measures for sorghum shootfly, stemborer and earhead pests, are recommended.

0702 ADESIYUN, A.A. 1981. The prospects of breeding for insect resistance in sorghum in tropical Africa. Presented at the Second OAU/STRC Workshop on Sorghum and Millet, 16-20 March 1981, Gaborone, Botswana. 14 pp. 19 ref.

Reviews the progress made and constraints in producing insect resistant sorghum varieties in tropical Africa.

0703 BARAKAT, I. 1981. Crop pests. Pages 237-239 In Gezira Research Station and Sub-stations annual report 1974/75. Gezira, Sudan: Ministry of Agriculture, Food and Natural Resources.

Reports the main pests of dura observed at Kadugli Station during 1974-75. Both species of dura stem borer viz. *Chilo partellus* and *Sesamia cretica* were observed. All the varieties sown were attacked to varying degrees. Varieties sown at low seed rate received high damage. Spraying of Sevin 85% (W.P) at the rate of 1.5 lb/feddan brought about a little improvement. *Agonoscelis pubescens* were observed but no damage was seen. Heavy infestation of *Aphis sorghi* was also observed for which spraying of Malathion 57% E.C. @ 1.0 lb/fadden was effective. Carbyl spraying was found a good preventive measure for *Contarinia sorghicola*.

0704 BRENLERE, J. 1981. Integrated control of insect pests in tropical food crops. (Fr). *Agronomie Tropicale* 36(1):78-81. (Summaries: En, Es).

The integrated control of pests consists in combining all means to protect crops with a view to reducing pest populations to a level below the noxiousness threshold. Integrated control which includes chemical control and biological control applies to all crops, even if there appears to be no antagonism between these two forms of control. Integrating the different possible control means is very complex because this involves knowing exactly the agro-ecosystem

components, the pests and their related antagonists. Some examples of tropical insects are given and the importance of integrated control in the objectives of pest control are shown.

0705 BROOKS, L., and GATES, D.E. 1981. Kansas field crops insect control recommendations 1981. Manhattan, Kansas, USA: Kansas State University. 28 pp.

0706 DABHOLKAR, A.R., and MITTAL, V.P. 1981. Protect your jowar crop from these destructive insects. *Farmer and Parliament* 16(6):7-8, 30.

The nature of damage done by *Atherigona soccata*, *Chilo partellus*, *Sesamia inferans*, *Contarinia sorghicola*, and *Oilgonichus indicus*, is described. Control measures and adoption of improved agro-management practices are suggested.

0707 DANIELS, N.E. 1981. Small grain and grain sorghum. Pages 1-29 In *Some dryland agricultural arthropod pests of the great plains*. Bushland-Amarillo, Texas, USA: Texas Agricultural Experiment Station.

Pests of sorghum and other small grains viz. greenbug, yellow sugarcane aphid, oat bird-cherry aphid, corn earworm, fall armyworm, sorghum midge, sorghum webworm, thrips, and banks grass mite are reviewed. Their ability and degree of attack to host plants and several natural, cultural and chemical methods of their control are also described.

0708 DANIELS, N.E., and CHEDESTER, L.D. 1981. Greenbug and mite control in grain sorghum. Progress Report, Texas Agricultural Experiment Station no.3866. 9 pp. 15 ref.

In 1976, 1978 and 1979, biotype C greenbugs were controlled in dryland grain sorghum with spray treatments of several insecticides at 0.25 and 0.50 lb/acre. Grain yields were increased with three of the insecticides in 1978, when greenbug populations were highest. In 1980, seven pesticides were evaluated for control of both the

biotype E greenbug and the Banks grass mite. Grain yields were increased with parathion and methyl parathion at 0.25 lb/acre and with a carbamate (FMC 35001) at 0.5 lb/acre. Granular foliar treatments were also applied at 1 lb/acre and resulted in fair control of greenbugs and mites. Grain yields were significantly increased with the four pesticides used.

- 0709 GAHUKAR, R.T. 1981. Biological control of insect pests of sorghum and pearl millet in West Africa. Pages 69-91 In Biological control of pests, its potential in West Africa: proceedings of an International Conference, 9-13 February 1981, Dakar, Senegal. Dakar, Senegal: United States Agency for International Development, Regional Food Crop Protection Project. 42 ref.

Notes on distribution and host range of parasites, predators and pathogens are presented and the scope of biological control is discussed. Surveys and further studies on insect pests and natural enemies are suggested.

- 0710 GAHUKAR, R.T. 1981. Control strategies for the major pests of sorghum and millets in West Africa. Pages 169-189 In Proceedings, Third General Conference of the Association for the Advancement of Agricultural Sciences in Africa, 9-15 April 1978, Ibadan, Nigeria. v.3. Ibadan, Nigeria: Association for the Advancement of Agricultural Sciences in Africa. 29 ref.

Important pests of sorghum and millets viz. shootflies, stem borers, grain midges, earhead caterpillars, and bird pests in West Africa are described, and the developments in control strategies are reviewed. Long term research is suggested to get more information on the economic injury level, yield loss, seasonal incidence, geographical distribution, carry over during dry season, and endemic areas of pest attack.

- 0711 ICRISAT, FARMING SYSTEMS

RESEARCH PROGRAM, CROPPING SYSTEMS SUBPROGRAM. 1981. Cropping entomology: report of work 1980-81. Patancheru, Andhra Pradesh, India: ICRISAT. 50 pp. (ICRISAT Cropping Systems (Entomology) Progress Report, 8).

- 0712 JOTWANI, M.G. 1981. Insect resistance in sorghum plants. Insect Science and Its Application 2(1-2):93-98. 43 ref.

Reviews the work done on insect pest resistance in sorghum plants with emphasis on shootfly, stem borer, and sorghum midge, further intensive work is suggested on identifying naturally occurring plant products associated with antibiosis mechanism.

- 0713 JOTWANI, M.G. 1981. Sorghum and pearl millet: pest complexes in high yielding varieties of sorghum, bajra (pearl millet) and other millets. Pages 95-119 In A review and analysis of insect pest, plant disease and weed complexes in high yielding varieties and hybrids under intensified agricultural practices in Asia and Pacific. Bangkok, Thailand: FAO, Regional Office for Asia and the Far East. 37 ref.

Reviews the major pests of sorghum and millets. Outlines the necessary infrastructure for implementation of control programmes in high input and low input areas. Emphasizes the training of crop protection specialists as a vital part of integrated pest control. List of insect and mite pests of sorghum and millets, high-yielding varieties and hybrids released in India, natural enemies recorded on sorghum insect pests, sources of resistance utilized in sorghum breeding programme, and seasonal incidence of shootfly in different parts of India are also appended.

- 0714 KULKARNI, K.A., BHUTI, S.G., PARAMESWARAPPA, R., GOWDA, B.T.S., THONTADARYA, T.S., and JOTWANI, M.G. 1981. An overview of the resistance status in the advanced sorghum

- genotypes to major pests. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 8 pp.
- The level of resistance in the sorghum genotypes to shootfly, stem borer and midge were examined by screening them for above pests, over three seasons. Results revealed that fairly high tolerance was incorporated in advanced yield trial material to sorghum shootfly and stem borer. Genotypes were highly susceptible to midge.
- 0715 MOHYUDDIN, A.I. 1981. Investigations on the insect enemies of abutilon, amaranthus, rumex and sorghum in Pakistan: final report September 1975 - September 1980. Rawalpindi, Pakistan: Commonwealth Institute of Biological Control, Pakistan Station. 88 pp.
- 0716 MOTE, U.N., BAPAT, D.R., SHIROLE, S.M., and MURTI, T.K. 1981. Estimation of losses caused by major pests in main and ratoon crops of sorghum. Indian Journal of Plant Protection 9(1):50-55. 10 ref.
- Field trials were conducted in 1976-77, 1978-79 and 1979-80 to estimate losses caused by major pests on main (kharif) and ratoon (rabi) sorghum, by adopting recommended control measures. The shootfly incidence caused substantial loss of grain and fodder in unprotected plots. The ratoon crop suffered more by the pests as compared to the main crop. The average loss of grain and fodder in main and ratoon crop was to the extent of 24.71 and 28.97 q/ha respectively. A net profit of Rs.3405 and Rs.3169/ha was obtained in main and ratoon crop respectively by using insecticides.
- 0717 PETERS, D.C., and STARRS, K.J. 1981. Pest management systems for sorghum insects. Pages 549-562 In CRC handbook of pest management in agriculture (ed. D.Pimentel). v.3. Boca Raton, Florida, USA: CRC Press.
- 38 ref.
- 0718 SADAKATHULLA, S. 1981. Studies on the control of stemborer and grain midge on sorghum. Pesticides 15(6):27-29. 12 ref.
- Spraying fenvalerate 0.01% or FMC 35001 (Posse 24% EC) 0.24% or whorl application of dusts of phenthoate 2% or hildan 4% or hilthion or carbaryl 2.5% thrice on 20, 30 and 40 days after germination effectively controlled stemborer as that of carbofuran 3G or FMC 35001-3G applied on 25th and 35th day after germination. For grain midge control, either two rounds of spraying of monitor 0.05% or malathion 0.05% or fenvalerate 0.04% or dusting of BHC 10% or phenthoate 4% or malathion 4% was found effective.
- 0719 SINGH, B.U., RANA, B.S., and RAO, N.G.P. 1981. Host plant resistance to mite (*Oligonychus indicus* Hirst) and its relationship with shoot fly (*Atherigona soccata* Rond) resistance in sorghum. Journal of Entomological Research 5(1): 25-30. 11 ref.
- The reaction of several cultivars to *Oligonychus indicus* were studied in multilocational experiments. Several of them, viz., CSH-5, CSH-6, CSH-9, SPH-80, CSV-5, 2077B, IS 3687, SPV Nos.106, 135, 192, 220, 222, 224, 265 showed high degree of resistance. Resistance to mites was common in tan plant types, though all tan types were not resistant. The purple pigmented types were generally more susceptible. On the other hand, greater level of *Atherigona soccata* resistance was available from purple pigmented types. Antixenosis appeared to be the dominant mechanism of resistance for shootfly as well as mite.
- 0720 THONTADARYA, T.S., RAO, K.J., RANGADHAMAIAH, K., and KULKARNI, K.A. 1981. Problems and prospects of biological control of major pests of sorghum. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981,

Navsari, Gujarat, India. 7 pp.

Parasites and predators of major sorghum pest viz. *Atherigona soccata*, *Chilo partellus*, *Mythimma separata*, *Calocoris angustatus*, *Contarinia sorghicola*, and *Heliothis annigera* are listed. An indepth study of natural enemies to arrive at a pest management programme through biological control is recommended.

0721 UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT, REGIONAL FOOD CROP PROTECTION PROJECT. 1981. Biological control of pests, its potential in West Africa: proceedings of an International Conference, 9-13 February 1981, Dakar, Senegal. Dakar, Senegal: United States Agency for International Development, Regional Food Crop Protection Project. 254 pp.

Proceedings are presented in 3 parts. The introductory part containing one paper provides a review of biological control methods. Control of pests of sorghum, pearl millet and cassava are dealt with in the second part containing 8 review papers. Seven papers in third part are related to Sahelian agriculture including stemborers of cereals, use of insect pathogens, aerial application of *Bacillus thuringiensis*, biological control of weeds, value of *Nosema locustae* for the control of grasshoppers and taxonomic constraints for the use of the parasite *Apanteles*.

0722 WISEMAN, B.R., and MORRISON, W.P. 1981. Components for management of field corn and grain sorghum insects and mites in the United States. Agricultural Reviews and Manuals, USDA Agricultural Research Service Southern Series no.18. 18 pp. 83 ref.

The corn earworm, European corn borer, corn rootworms, fall armywonn, southwestern corn borer, black cutworm, sorghum midge, greenbug, sorghum webworm, and spider mites are discussed. Control of these major pests relies, for the most part, on conventional pesticides. Alternative control will depend on filling some

research, information, and education gaps.

0723 WISEMAN, B.R., and MORRISON, W.P. 1981. Integrated control of corn and sorghum arthropods in the U.S.: a brief summary. Pages 424-427 In Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T.Kommedahl). Minneapolis, Minnsesota, USA: Burges Publishing Company.

Losses due to insects are estimated at 12% for corn and 9% for 6orghum in U.S. production even with the use of current control methods. Present integrated insect control practices for corn and sorghum are summarized for several major pests. The importance of research in generating and the role of extension in implementing pest management technology is discussed. Data gaps in possible future control strategies are presented.

0724 YOUNG, W.R. 1981. Integrated control of corn and sorghum insect pests in the tropics and subtropics. Pages 428-432 In Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T.Kommedahl). Minneapolis, Minnesota, USA: Burges Publishing Company. 5 ref.

Indicated control measures for these pests include cultural practices, the development of resistant varieties, and the preservation and management of the rich complex in the tropics of natural enemies; parasites, predators, and pathogens. There is a continuing need to more effectively monitor the actual pest situation in farmers' fields as monocultural and mixed cropping systems are modified to increase production levels. Strategic use of carefully selected insecticides as seed treatments or soil and foliage applications may become economically feasible. Cooperative international research networks are speeding the

development of appropriate controls for corn and sorghum pests.

## Soil Pests

0725 PATIL, B.R., HASABE, B.M., and AJRI, D.S. 1981. Chemical control of white grub, *Holotrichia serrata* Fabr. infesting groundnut, paddy and sorghum. Indian Journal of Entomology 43(2):232-236. 5 ref.

Field experiments were carried out against *Holotrichia serrata* infesting groundnut, paddy and sorghum in kharif 1976 to evaluate the relative merits of some modern synthetic insecticides, viz. phorate 5G, mephospholan 3G, diazinon 5G, carbofuran 3G, and quinalphos 5G. In sorghum, the treatment with quinalphos 5G applied at the rate of 25 kg/ha was found most promising with only 0.76% infestation. Application of quinalphos 5G at the rate of 15 and 20 kg/ha, diazinon 5G 25 kg/ha, and mephospholan 3G 20 and 25 kg/ha were also found superior to other treatments. Based on overall efficacy of treatments, if it was observed that quinalphos 5G, diazinon 5G and mephospholan 3G at the rate of 25 kg/ha were effective against *H. serrata* infesting groundnut, paddy and sorghum.

## Aphids

0726 BARBULESCU, A., and ANTOHE, I. 1981. Resistance of some sorghum lines to the greenbug. (Ro). Analele Institutului de Cercetari Pentru Cereale si Plante Tehnice 47:273-280. 15 ref. (Summaries: En, Ru).

0727 CHANG, N.T. 1981. Resistance of some grain sorghum cultivars to sorghum aphid injury. (Ch). Plant Protection Bulletin (Taiwan) 23(1):35-41. 7 ref. (Summary: En).

Eleven sorghum lines were evaluated for resistance to the aphid. Selections from 2R, 5R, and HB 37 sustained the least damage ( $1/41.8$ ) and were regarded as resistant lines. The inheritance of resistance in sorghum to the aphid, *Longiunguis sacchari* was studied by using a bulk seedling test, i.e. 3-leaf-old seedlings were infested with fourth- and fifth-instar nymphs of the aphid, in net cages. Tests with F1 and F2 progenies of 80A x 2R, parents of a new variety Taichung No.5, revealed that resistance in cultivar 2R was controlled by a single dominant gene which was designated as Sal.

0728 CHANG, S.C. 1981. Sources of resistance in sorghum to sugarcane aphid *Melanaphis sacchari*. (Ch). Report of the Corn Research Center, Tainan DAIS 15:11-14. 23 ref. (Summary: En).

A total of 2,635 varieties of sorghum were tested for *Melanaphis sacchari* resistance under natural condition at Potzu Corn Research Center (Taiwan) in 1980 and 1981. The results indicated that varieties TAM 428, SC 110-14 and PI 257595, were highly resistant to this aphid.

0729 DANIELS, N.E. 1981. Migration of greenbugs in the Texas Panhandle in relation to their biotypes. Miscellaneous Publication, Texas Agricultural Experiment Station no.1487. 4 pp. 18 ref.

Traps for greenbugs, *Schizaphis graminum*, were posted year-round for 28 years 13 miles north of Bushland. Sticky traps were used and inspections made fortnightly. From 1953 to 1967 greenbugs were trapped during the spring and fall. From 1968 to 1970 they were only caught in August. From 1971 to 1975 greenbugs were caught in the spring and summer, and from 1976 to 1980 none were caught. Changes in migration pattern, deduced from these data, appeared at the time of heavy sorghum infestation and biotype change in 1968 and again in 1976. In 1979 biotype E appeared. However, the

actual cause of biotype changes is as yet unknown.

0730 DANIELS, N.E., and CHEDESTER, L.D. 1981. Biological and small grain resistance experiments with biotype E greenbugs. Progress Report, Texas Agricultural Experiment Station no.3870. 7 pp. 11 ref.

Biological experiment was conducted to determine the effect of temperature on reproduction and fecundity of biotype E. Results showed that higher the temperature lower the instar number in which biotype E greenbugs began reproduction. For resistance checks, greenbugs were collected from grain sorghum at locations near Bushland, Easter, Sunray and Groom.

0731 DREYER, D.L., REESE, J.C., and JONES, K.C. 1981. Aphid feeding deterrents in sorghum: bioassay, isolation and characterization. Journal of Chemical Ecology 7(2):273-284. 39 ref.

Improvements in a synthetic diet for use in a bioassay to screen for feeding deterrents against *Schizaphis graminum*, are reported. Feeding on the synthetic diet was highly pH dependent with maximum feeding occurring at about pH 8.0. The bioassay was used as a guide in the isolation of feeding deterrent substances from aphid-resistant lines of *Sorghum bicolor*. The major greenbug feeding deterrents isolated from sorghum leaves were p-hydroxybenzaldehyde (ED50 0.13%), dhurrin (ED50.0.16%), and procyanidin (ED50. 0.08%).

0732 GALLI, A.J.B., LARA, F.M., and BARBOSA, J.C. 1981. Resistance of sorghum genotypes to *Schizaphis graminum* (Rondani, 1852) (Homoptera-Aphididae). (Pt). Anais da Sociedade Entomologias do Brasil 10(1):61-72. 13 ref. (Summary: En).

Forty-seven sorghum genotypes were tested to verify the possible sources of resistance to *Schizaphis graminum* at Jaboticabal (SP)

conditions. The seedlings, 3 days after germination, were infested with 15 adult apterous greenbugs. The data were collected on number of aphids/plant (survivors + descendants) two days after inoculation, number of days of genotypes survival, and damages, five days after inoculation. The results showed that PI-302178, PI-302236, IS-809, EA-71, 7304032, and EA-252 sorghum genotypes were resistant to the greenbug, and EA-19, 7304003, EA-90, AF-28, and EA-290 were the most susceptible ones.

0733 HALL, D.G., IV. 1981. Damage assessment and alternate host plants of sorghum panicle-feeding bugs. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 122 pp.

0734 KINDLER, S.D., and STAPLES, R. 1981. *Schizaphis graminum*: effect on grain sorghum exposed to severe drought stress. Environmental Entomology 10(2):247-248. 6 ref.

During extreme drought in eastern Nebraska in 1974 in which only 1.57 cm of rain fell from June 11 to August 9, differences of 1274 and 991 biotype C greenbugs/plant caused significant yield reductions of 365 and 757 kg/ha respectively on grain sorghum in 2 field tests. These yield losses were 3 and 6 times greater than the current loss associated with the economic injury level (121 kg/ha). Greenbug densities on the 3 dates of insecticide application and at peak density were significantly ( $P = 0.05$ ) and inversely related to the numbers of heads in both tests.

0735 KIRKLAND, R.L., PERIES, I.D., and HAMILTON, G.C. 1981. Differentiation and developmental rate of nymphal instars of greenbug reared on sorghum. Journal of the Kansas Entomological Society 54(4):743-747. 7 ref.

0736 LOPEZ, J.V., SUAREZ, A., and RODRIGUEZ, J. 1981. The greenbugs: insects injurious to grain sorghum.

(Es). Informativo de Tecnologia Agropecuaria para la Region Semiarida Pampeana 77:3.

0737 MALINOVSKI, B.N., and BUDNIK, G.S. 1981. Breeding of sorghum for resistance to aphids. Soviet Agricultural Science 9:6-9. 7 ref.

The most harmful of aphids occurring on sorghum are Toxoptera graminum and Ropalosiphum maidis. The population dynamics of these aphids involved a wave-like reproduction pattern with one or two maxima. A five-point scale was worked out for evaluation of breeding stock resistant to aphids and employed in practical breeding. Resistance to aphids was a dominant trait in first generation hybrids. Heterotic hybrids resistant to aphids were; Stavropol'skii Kormovoi, Silosnoe 72, and Stavropol'skoe 32.

0738 PAUL, M.D., and NARAYANA, D. 1981. Sorghum pest situation in Maghi zone of Andhra Pradesh. Andhra Agricultural Journal 28(5-6):254-256. 5 ref.

Incidence of aphids on sorghum and the nature of their damage is reported. Screening of germplasm showed great variation of resistance to aphids. Biological and chemical control of pest is also discussed.

0739 STARRS, K.J., and WEIBEL, D.E. 1981. Resistance in bloomless and sparse-bloom sorghum to greenbugs. Environmental Entomology 10(6):963-965. 11 ref.

Four bloomless (bm bm) and three sparse-bloom (h h) sorghum entries were evaluated for resistance to biotype C of the greenbug, Schizaphis graminum in field tests at Stillwater, Okla., in 1975 and 1976 and the results were compared with those from seven greenbug-susceptible and two greenbug-resistant lines with bloom (Bm). Both bloomless and sparse-bloom entries reduced the reproduction of greenbugs and damage from natural infestations; however, reproduction and damage were not reduced when

greenbugs were confined to small leaf cages. Results of tests in large cages suggested that the resistance in bm bm and h h lines may not be effective in seedling sorghum or against the apterous form of the greenbug. Nonpreference was suggested as the mechanism of resistance.

0740 WILSON, R.L., and STARTS, K.J. 1981. Effect of culture-host preconditioning on greenbug response to different plant species. Southwestern Entomologist 6(3):229-232. 6 ref.

Greenbugs, Schizaphis graminum, reared on 5 plant species (wheat, oats, barley, rye, and sorghum) were used to determine if preconditioning on the culture-host species influenced the results of subsequent bioassays of different plant species for antibiosis and antixenosis. Results suggested that preconditioning had little effect on bioassays. Oats showed the highest level of antibiosis and rye showed the highest level of antixenosis, regardless of which plant had been used for rearing the insects. A few differences were observed, however, when the greenbugs were used to screen cultivars of proso millet.

## Shootfly

0741 ABDIN, A.M.Z.E. 1981. Review of sorghum shootfly research in the Sudan. Insect Science and Its Application 2(1-2):55-58. 22 ref.

In the Sudan, more than one species of Atherigona attack cereals, Atherigona soccata being the most dominant species. Sorghum plants attacked by the shootfly flower and ripen at different times. A study of the biology of the shootfly showed that the incubation period of the egg was 2-3 days, the pupation period was 6-8 days and the duration from egg to adult was 17 days. The closer the eggs were laid to the leaf blade, the better the chances of the shootfly causing 'dead-heart' symptoms. The



mortality of the first-instar larva was highest in the first 24 hr. The incidence of the shootfly coincided with rainfall and lower temperatures. In a selection programme, Combine Kafir 60 had the lowest infestation level, compared to sudan grass, abu sabein and feterita gadarif varieties.

0742 ADESIYUN, A.A. 1981. Seasonal abundance of shootflies infesting sorghum and their natural enemies in Samaru, Nigeria. *Insect Science and Its Application* 2(1-2):49-53. 9 ref.

A total of 1584 young sorghum plants showing typical 'dead-heart' symptoms were collected from the field at weekly intervals in 1978 and 1979. From these emerged adult flies belonging to eight families and 17 genera. Members of six of the families were scavengers, while those of the remaining two, Muscidae and Chloropidae, were phytophagous, causing primary or secondary damage to the plants. Three hundred and seventy-five *Atherigona soccata* adults emerged, representing only 23.7% of the damaged plants. This contrasts with previous records that rate *Atherigona soccata* as the most important source of 'dead-heart' damage in young sorghum plants. Other shootflies, also reared from the plants included *Oscinella* spp. (986), *Scoliophthalmus* spp. (344) and *Anatrichus erinaceus* (160). The numbers of probable parasites and predators of the shootflies that emerged were insignificant, when compared with the extent of damage and the numbers of the shootflies. Damage caused by the shootflies to the early plantings was low and insignificant, reached a peak in mid-season and remained high until the cessation of rain at the end of the season.

0743 BONZI, S.M. 1981. Seasonal fluctuations of sorghum shootfly populations in Upper Volta. (Fr). *Insect Science and Its Application* 2(1-2):59-62. 4 ref. (Summary: En).

In Upper Volta the sorghum shootfly is considered dangerous in the case of late and staggered sowing

or resowing due generally to irregular rainfall in the beginning of the rainy season. When using fish meal as bait in two different traps, one placed in a humid area and another in a dry area, the dynamics of the sorghum shootfly populations was studied for 2 years at Farako-Ba. Twenty-two different species of the genus *Atherigona* (Rondani) were identified, of which the commonest was *A. soccata* (Rondani). Some wild hosts of the sorghum shootfly were also identified. Attention is drawn to the importance of the pest in the case of extensive cultivation of irrigated sorghum in the managed valleys of the country.

0744 BORIKAR, S.T., and CHOPDE, P.R. 1981. Inheritance of shootfly resistance in sorghum. *Journal of Maharashtra Agricultural Universities* 6(1):47-48. 9 ref.

A eight parent F1 and F2 diallels were analysed to study the genetic architecture of shootfly resistance. Dead heart (%) was controlled by additive gene action. In respect of eggs per plant and plant recovery, although some amount of non-additive gene action was involved, predominance of additive gene action was observed. The heritability for dead heart (%), eggs per plant and plant recovery was observed to be 75 to 77%, 80 to 93% and 48 to 70% respectively. The heritability for shootfly resistance, therefore, appears to be around 23 to 25 per cent.

0745 BORIKAR, S.T., and CHOPDE, P.R. 1981. Shootfly resistance in sorghum. *Indian Journal of Genetics and Plant Breeding* 41(2):191-199. 7 ref.

The diallel analyses were undertaken to study combining ability for *Atherigona soccata* resistance and other related characters in sorghum. General combining ability (gca) variances were higher than specific combining ability (sca) variances for dead heart (%), eggs/plant, plant recovery and yield/plant. These results indicated predominance of additive gene action. The nature of

gene action for seedling height, tillers/100 plants, effective tillers and yield/productive plant was predominantly non-additive. All resistant parents recorded desirable gca effects for dead heart (%), eggs/plant and plant recovery. IS 5490 and IS 5604 were observed to be desirable general combiners for most of the characters. The parent 168 was also promising within the group of dwarf parents. Significant positive association between per se performance of parents and gca effects indicated that lines for breeding can be selected on the basis of parental performance. Predominance of additive genetic variance for shootfly resistance indicated that exploitation of IS 5490, IS 5604 and 168 through biparental approach may be rewarding.

0746 CLEARWATER, J.R. 1981. Practical identification of the females of five species of *Atherigona Rondani* (Diptera, Muscidae) in Kenya. *Tropical Pest Management* 27(3):303-312. 12 ref.

Morphological characters are described and illustrated to permit identification of the females of five species of *Atherigona* (*A. soccata* Rondani, *A. conigera* van Emden, *A. trapezia* van Emden, *A. laevigata* (Loew) and *A. (acritochaeta) orientalis* Schiner). The importance of being able to identify females of various species of *Atherigona* in ecological studies is discussed.

0747 CLEARWATER, J.R., THIEL, F., and KOKWARO, E.D. 1981. Comparative ultrastructure of the trifoliolate organ of *Atherigona Rondani* (Diptera: Muscidae). *Insect Science and Its Application* 2(1-2):11-23. 7 ref.

The morphology and function of the trifoliolate organ of five species were studied. Two examples are given where the ultrastructure of this organ assists the interpretation of speciation. The movement of the trifoliolate organ during the courtship of *Atherigona laevigata* and its position during copulation is briefly

described. A simple (*A. soccata*) and a complex (*A. conigera*) organ are described in detail, with emphasis on structure and function of the sensilla, and surface microsculpture. The *A. hancocki*-group organs are described and possible functions are suggested for these unusual structures. A distinct population is separated from the *A. lineata* species complex. A group of three species *A. steeleae*, *A. secrecauda* and *A. matilei* are confirmed to have a close, natural relationship.

0748 DABROWSKI, Z.T., and PATEL, N.Y. 1981. Investigations on physiological components of *Atherigona soccata* larvae and their interaction with sorghum. 1. Larval enzymes. *Insect Science and Its Application* 2(1-2):73-76. 10 ref.

The assumption was made that for a complete understanding of the feeding behaviour and nutrition of *Atherigona soccata* larvae on various cultivars of sorghum, it was necessary to investigate the relationship between plant chemicals occurring in resistant sorghum plants and the digestive enzymes of larvae. However, at least an introduction to the anatomical organization of the alimentary canal of larvae is needed to understand the digestion and absorption of food taken from resistant and susceptible sorghum lines.

0749 DAVIES, J.C., and REDDY, K.V.S. 1981. Observations on oviposition of sorghum shootfly, *Atherigona soccata* Rond. (Diptera: Muscidae). Patancheru, Andhra Pradesh, India: ICRISAT. 8 pp. 9 ref. (ICRISAT Sorghum Entomology Progress Report, 4).

Observations on oviposition on sorghum plants by *Atherigona soccata* at ICRISAT Center, near Hyderabad, India, confirmed its high rate of incidence particularly during postrainy season. Eggs were normally laid on the under surface of the fourth or fifth leaf, usually one egg

per plant was laid. The number of eggs laid was highest per unit area at high plant densities- 10 mm or less between plants. At these densities more plants were laid on, and this applied to both main plants and tillers. There was a very high correlation between the number of plants laid on and the number showing dead heart symptoms. Very few plants at low densities escaped attack. Soil type did not affect oviposition. It was concluded that, for maximizing shoot fly build-up for screening for resistance in sorghum, dense plant populations should be sown in the spreader rows, but for material under test spacings of 200 mm or more were optimal.

0750 DAVIES, J.C., and REDDY, K.V.S. 1981. Shootfly species and their graminaceous hosts in Andhra Pradesh, India. *Insect Science and Its Application* 2(1-2): 33-37. 15 ref.

In Andhra Pradesh (India) nineteen fly species were recorded from 41 graminaceous species including cultivated sorghum. *Atherigona soccata* was reared from 22 host plants. Only cultivated and wild species of sorghum were important as hosts of this pest species. It was observed that alternative host Gramineae were of minor importance in the 'carryover' of *Atherigona soccata* through the off season, but the irrigated sorghum grown for fodder could be an important source of flies. In general, shootflies of a particular species usually favored one graminaceous host above others. The numerically dominant fly reared from wild Gramineae was *Atherigona falcata*, which was recorded on 17 hosts, including sorghum. Other common species in Gramineae were *Atherigona pulla*, *Atherigona oryzae*, *Atherigona punctata* and *Atherigona atripalpis*, all of which were also reared in very low numbers from sorghum. Five new species of *Atherigona* were reared.

0751 DELOBEL, A.G.L. 1981. The distribution of the eggs of the

sorghum shootfly, *Atherigona soccata* Rondani (Diptera: Muscidae). *Insect Science and Its Application* 2(1-2):63-66. 22 ref.

Field and laboratory observations revealed that the placement of eggs of the sorghum shootfly, *Atherigona soccata*, among sorghum stems tended to be random or slightly aggregated rather than regular, which suggests that the site of oviposition by a female is little or not determined by the presence of other eggs already laid. The possible effects of this type of distribution on the mortality of the first-instar larvae are briefly discussed.

0752 DELOBEL, A.G.L., and UNNITHAN, G.C. 1981. The status of Sorghum arundinaceum as a host of *Atherigona soccata* Rondani (Diptera: Muscidae) in Kenya. *Insect Science and Its Application* 2(1-2):67-71. 9 ref.

Surveys were conducted in semi-arid and arid zones of Kenya to monitor egg, larval and pupal populations of the *Atherigona soccata*, on a wild host, Sorghum arundinaceum. Populations were found to be usually higher on wild sorghum than on local varieties of Sorghum bicolor. During dry periods, shootfly eggs and larvae were still found on wild sorghum, especially in moist areas such as beds of temporary streams or river banks. Population levels seem to be related primarily with the availability of susceptible stems, which in itself is determined by rainfall, soil conditions, density of other vegetation and by the phenology and the distribution of the host plant, Sorghum arundinaceum. Since no evidence of the existence of an aestivation diapause has been found, it is reasonable to assume that Sorghum arundinaceum is a major reservoir for *A. soccata*, especially during the dry season.

0753 DHALIWAL, G.S., and SANDHU, G.S. 1981. Effect of the dates of sowing and seed-rates on the infestation of sorghum shootfly, *Atherigona soccata*

Rond. and the yield of sorghum fodder. Journal of Research Punjab Agricultural University 18(2):157-162. 9 ref.

The effect of the dates of sowing and seed-rates on the infestation and on the yield of green fodder was studied by sowing sorghum in April, May, June, July and September, with seed-rates of 50, 75 and 100 kg/ha. The maximum number of eggs was laid on the September-sown crop and the minimum number was laid on the crop sown in May and June. The same trend was observed with regard to the incidence of dead-hearts due to the infestation. Under one date of sowing, the different seed-rates did not affect the number of eggs laid and the incidence of dead-hearts. The yield of green fodder from the April-sown crop was more than the yields of the crops sown in June and July. Under one date of sowing, a higher yield was obtained with 100 kg/ha of seed than with 50 kg/ha of seed. There was no difference in yield with 75 and 100 kg/ha of seed. In the case of high infestation (12.5 to 27.1% dead-heart<sup>6</sup>) caused by the shootfly in the April- and September-sown crop, a higher yield of green fodder was obtained with 75 kg/ha of seed.

0754 GIBSON, P.T. 1981. Inheritance of resistance to shootfly in sorghum. Ph.D. thesis, Iowa State University, Ames, Iowa, USA. 290 pp.

0755 JOTWANI, M.G. 1981. Integrated approach to the control of the sorghum shootfly. Insect Science and Its Application 2(1-2):123-127. 21 ref.,

A large number of high yielding and shootfly-resistant derivatives have been developed by crossing agronomically desirable exotic lines with identified resistant sources. The new hybrids and varieties released recently possess low to moderate levels of resistance. Parasites and predators affecting different stages of the shootfly have been identified but utilization of these natural

enemies for the biological control of the pest is yet to be undertaken. Carbofuran seed treatment has proved to be highly effective for protecting sorghum from shootfly damage. An integrated package has been traditional sorghum growing in India.

0756 MEKSONGSEE, B., CHAWANAPONG, M., SANGKASUWAN, U., and POONYATHAWORN, P. 1981. The biology and control of the sorghum shootfly, *Atherigona soccata* Rondani in Thailand. Insect Science and Its Application 2(1-2):111-116. 8 ref.

The preoviposition period was 3-5 days long. The females deposited a mean of 238 eggs with an average incubation period of 3 days. The larval development required an average of 7.8 days, and the pupal stage was 7.1 days long. The adults were reared with ordinary sugar, yeast and water. The females lived an average of 30 days and the males 20 days. Carbofuran granular formulation was found the leading product for the control of the shootfly. The application rate in the seed furrow was 0.45-0.60 kg a.i./ha with a row spacing of 75 cm. Furadan 30ST, can also be used as a seed dressing at a rate of 20 c-cm/kg of seeds. Counter, another soil systematic insecticide has been found effective in controlling the sorghum shootfly. A modification of the sorghum shootfly is described. The trap may be effective in reducing the fly population.

0757 MOTE, U.N., SHIROLE, S.M., and BAPAT, D.R. 1981. Screening of local kharif varieties of sorghum for resistance to shootfly. Journal of Maharashtra Agricultural Universities 6(2):165-166. 1 ref.

Thirty-three PJ varieties of sorghum were screened in kharif seasons of 1978 and 1979 alongwith resistant and susceptible checks at Rahuri, Maharashtra (India). Total number of eggs of shootfly and number of plants showing dead hearts were counted at 14 and 28 days after

- germination. Results of both the years indicated that varieties viz. PJ-3K, PJ-20K, PJ-4K, PJ-6K, PJ-19K and PJ-21K were more promising.
- 0758 NATARAJAN, K., and CHELLIAH, S. 1981. Evaluation of insecticides against sorghum shootfly (*Atherigona soccata* Rondani). Indian Journal of Plant Protection 9(2):202-203. 4 ref.
- Sorghum variety CSH-S was sown during kharif 1981 for the control of shootfly with ten treatments. Fish meal was applied in all the plots to ensure heavy infestation. Treatments included soil application of carbofuran and isofenphos, seed treatment with carbofuran, bendiocarb, chlorpyrifos, and monocrotophos, and spraying of insecticides like endosulfan and plant products like neem seed extract, and neem oil. Observations were recorded on shootfly dead heart incidence at 14 and 28 days after germination. Soil application of carbofuran 3G was found to be the best among the treatments.
- 0759 ODHIAMBO, T.R. 1981. Foreword to special issue on the biology, ecology and control of the sorghum shootfly, *Atherigona soccata* Rondani. Insect Science and Its Application 2(1-2):1-2. 1 ref.
- To review the global progress in sorghum shootfly research, and to examine its relevance to the practical problems of shootfly control, an International Study Workshop on the Shootfly was jointly convened by International Centre of Insect Physiology and Ecology (ICIPE), and International Fund for Agricultural Development. The work done by ICIPE in this regard and the nature of the workshop is outlined.
- 0760 OGWARO, K., and KOKWARO, E.D. 1981. Development and morphology of the immature stages of the sorghum shootfly, *Atherigona soccata* Rondani. Insect Science and Its Application 1(4):365-372. 11 ref.
- Development and survival of larvae at different growth stages of the sorghum plant were investigated in the laboratory. Survival and rate of larval development were dependent on the size of the host plant. Survival was usually highest when plants about 2 weeks old were infected, low in very young plants and lowest in plants more than 50 days old. Within groups of insects hatched from eggs laid on the same day, the occurrence of various larval instars overlapped. The first instar was found from the 2nd to the 8th day after egg-laying, the second instar from the 4th to the 12th day, and the third instar from the 5th to the 18th day. Pupation started on the 14th day and adults started to emerge on the 21st day.
- 0761 OGWARO, K., and KOKWARO, E.D. 1981. Morphological observations on sensory structures on the ovipositor and tarsi of the female and on the head capsule of the larva of the sorghum shootfly, *Atherigona soccata* Rondani. Insect Science and Its Application 2(1-2):25-32. 28 ref.
- Trichoid, basiconic and campaniform sensilla have been observed on the ovipositor and tarsi of the *Atherigona soccata* Rondani. The ovipositor of *A. soccata* comprises abdominal segments 6-9, with most of the trichoid sensilla located on the ninth segment. Two olfactory pegs each are located on the paired leaflets of the ninth segment. Sensilla on the tarsi include long and short basiconic sensilla and campaniform sensilla located near the anterior margin of the last tarsal segment. The sensory organs on the head capsule of the larva were studied by light, scanning and transmission electron microscopes. Four types of sensory receptors were observed on the cephalic lobes. They consist of four knob-shaped sensilla, two styloconic sensilla, two campaniform sensilla, and eight basiconic sensilla.
- 0762 RAINA, A.K. 1981. Deterrence of repeated oviposition in sorghum shootfly, *Atherigona soccata*. Journal of Chemical Ecology 7(5):785-790. 11

ref.

*Atherigona soccata*, under low population density conditions lays one egg per sorghum plant. Possible regulatory mechanisms of this oviposition behavior are reported. The presence of an egg thoroughly washed and reattached to a leaf does not deter further oviposition, indicating the absence of visual cues. When washings from eggs were sprayed on sorghum plants, or when plants from which eggs had been removed were presented to a gravid female, significant deterrence was observed. Apparently a deterrent pheromone is associated with the water-soluble glue with which the females attach their eggs to the leaves. Some deterrent effect persists for at least 7 days.

0763 RAINA, A.K. 1981. Movement, feeding behaviour and growth of larvae of the sorghum shootfly, *Atherigona soccata*. *Insect Science and Its Application* 2(1-2):77-81. 10 ref.

Movement, feeding behaviour and growth of larvae of *Atherigona soccata*, were studied under controlled conditions on a susceptible sorghum variety, CSH-1. The time of hatching coincided with the presence of moisture on the leaf, a condition favourable to movement of the larvae to the base of the leaf. Cutting of the central shoot at its base by the larva caused the 'dead heart'. The three larval instars are described and changes in the cephalopharyngeal skeleton discussed. Movement of the larva to the base is not due to positive geotaxis. Larvae in plants placed horizontally to the ground did not develop normally and a high mortality resulted. The larvae are strongly cannibalistic inside the host-plant but not outside of it. The first-instar larvae do not migrate from one plant to another, but the third instars may do so if the source of food is exhausted.

0764 RAINA, A.K., THINDWA, H.Z., OTHIENO, S.M., and CORKHILL, R.T. 1981. Resistance in sorghum to the

sorghum shootfly: larval development and adult longevity and fecundity on selected cultivars. *Insect Science and Its Application* 2(1-2):99-103. 17 ref.

Seven cultivars were selected for investigating the mechanisms of resistance. CSH-1 was used as a susceptible control. Mortality among the first-instar larvae was very high on IS 2146 followed by IS 2312 and IS 5613. IS 2146, IS 3962 and IS 2312 sustained the leaf growth of larvae. The larvae in these cultivars were often confined to the upper region of the central shoot. The survival rate of flies from IS 2146 was very low, and the longevity was significantly reduced in case of flies from IS 2146 and IS 2195. The preoviposition period was significantly longer when flies were released on IS 1082 and IS 2312. Fecundity of the flies did not differ significantly when released on CSH-1; however, it was significantly reduced when released on parent cultivars in all cases except IS 1054. It was concluded that IS 2146 possesses strong antibiosis for the sorghum shootfly followed by IS 2312 and IS 5613.

0765 RANA, B.S., JOTWANI, M.G., and RAO, N.G.P. 1981. Inheritance of host plant resistance to the sorghum shootfly. *Insect Science and Its Application* 2(1-2):105-109. 12 ref.

The behaviour of shootfly resistance was examined over the F<sub>1</sub>, F<sub>2</sub>, F<sub>3</sub> and advanced generations. The F<sub>1</sub> was intermediate between two parents with an added heterotic advantage of a lower 'dead-heart' percentage. Resistance showed partial dominance under low to moderate shootfly infestation but this relationship could shift under heavy infestation conditions. The resistance was polygenic in nature and governed by additive genes. In the absence of host immunity, gradual accumulation of favourable genes was possible by line breeding from R x 1 and 1 x 1 crosses by selecting 1 SD below the population mean. Selection

for multiple characters limited the genetic advance for shootfly resistance- resulting in 0-5% selection intensity and relatively less resistant but high yielding desirable progenies. Multilocation tests enable the selection of varieties stable for shootfly resistance.

0766 REDDY, K.V.S., SKINNER, J.D., and DAVIES, J.C. 1981. Attractants for *Atherigona* spp. including the sorghum shootfly, *Atherigona soccata* Rond. (Muscidae: Diptera). Insect Science and Its Application 2(1-2):83-86. 8 ref.

The use of fish meal and detergent water has been shown to be simple, economic and reliable for sampling of shootfly populations. Various mixtures of fish meal with other ingredients were evaluated. The most potent mixture was fish meal-yeast-ammonium sulphide, but generally fish meal alone was adequate and the most readily available attractant. The attractance of fish meal was found to be related to its degradation; it increased from the first to the third or fourth day, and then decreased. The chemicals responsible for the attractance of fish meal have yet to be identified, but in all probability they may be the amines resulting from biodegradation of the meal.

0767 SADAKATHULLA, S. 1981. Efficacy of different new insecticidal formulations in different methods of application for controlling sorghum shootfly, *Atherigona soccata* Rond. Pesticides 15(3):14-16. 6 ref.

Three rounds of spraying of phosalone 0.05%, diazinon 0.05% or methyl demeton were found as effective as that of either soil application of carbofuran 3G, or carbofuran 3G encapsulated form. In general, all the carbofuran formulations were quite effective for shootfly control. Among them seed treatment with carbofuran 50% SP and carbofuran 40% W/W flowable at 5% and carbofuran 3G soil

application @ 10 kg/acre were superior. Among seed soaking, seeds soaked in monocrotophos at 8 g ai/acre of carbofuran 40% W/W flowable @ 50 g ai/acre for 3 and 4 hrs. respectively were found superior.

0768 SHIE, S.L., FAN, Z.D., and SU, Z.H. 1981. Studies on the sorghum shootfly in China. Insect Science and Its Application 2(1-2):39-47. 3 ref.

As an important measure for increasing grain production, hybrid sorghum has been cultivated in the whole area of the Peoples Republic of China since 1970. Over the past 10 years the sorghum shootfly has gradually become the worst pest of sorghum in several places in the southern parts of China. In 1973, some regions of Gung Dong, Gui Chou and Gung Xi Provinces were affected by the shootfly with a rate of 30% for the heavier damage, and a few even exceeding 90%.

0769 SRIVASTAVA, K.P., and JOTWANI, M.G. 1981. Recent advances in the chemical control of the sorghum shootfly. Insect Science and Its Application 2(1-2):117-121. 37 ref.

Reviews the earlier work on conventional foliar sprayings and dustings of the insecticides to control the shootfly. Work carried out in the early 1960s showed that the application of phorate, disulfoton, aldicarb and carbofuran granules in the soil at the time of sowing was very effective in controlling the pest. Isufenphos and fensulfotion were found to be equally effective. However, the cost of applying these insecticides was high. Seed treatment with carbofuran at 5 parts a.i per 100 parts of seed proved to be highly effective and economical. It has been found that dosage of carbofuran can be further reduced by using a 6:4 mixture of treated and untreated seed. Trials have been conducted to determine the residues of effective insecticides in the soil and in plants at different intervals. Investigations have also been carried out to establish the

correlation between the residues of different insecticides in plants and their efficacy in controlling the shootfly. A future strategy for the chemical control of the shootfly is outlined.

0770 SUKHANI, T.R., and JOTWANI, M.G. 1981. Control of sorghum shootfly with insecticides applied as seed treatment or in furrows. Indian Journal of Agricultural Sciences 51(11):799-802. 11 ref.

Diazinon seed treatment @ 0.2 kg ai/ha and chlorpyrifos granules @ 2.0 kg ai/ha applied in seed furrows proved effective in the first trial but failed to give satisfactory control in the second. Carbofuran 5% seed treatment and fensulfothion and quinalphos granules proved highly effective and reduced the dead-heart formation significantly. Grain and fodder yields of sorghum were maximum in carbofuran 5% seed treatment. Fensulfothion 5G and quinalphos 5G applied in seed furrow @ 2.0 kg ai/ha also gave significantly high yields. The net monetary benefits owing to use of carbofuran and quinalphos were Rs.3,220 and 1,514 respectively.

0771 SUKHANI, T.R., and JOTWANI, M.G. 1981. Evaluation of dust and spray formulation of different insecticides for the control of sorghum shootfly, *Atherigona soccata*. Pestology 5(10):15-20.

772 TALEY, Y.M., RAJURKAR, B.S., and THAKARE, K.R. 1981. Bionomics of *Atherigona soccata* (Rondani) (Diptera: Anthomyiidae). PKV Research Journal 5(1):62-68. 10 ref.

The bionomics of *Atherigona soccata* was studied during the year 1968-69. A single fly on an average laid 28 eggs. The incubation period was on an average 40.21 hours. There were three larval instars. On an average the first, second and third instars of larvae and pupal instar were completed in 45.06, 52.31, 72.38 hours and 6.80 days respectively in Vidarbha (India) climate. The total

life cycle was completed in 17 to 37 days. The sex ratio for male to female was 1:1.4. The alternate host plants as recorded were, *Sorghum halepense*, *Cynodon dactylon*, *Eleusine coracana* and *Andropogon sorghum*. The parasites, *Opius* sp., *Tetrastichus nyemitavus* Rower, *Tetrastichus* sp., *Spalangia endius* Walker, *Rhopstromeris* sp., *Trichopria* sp., *Monelate* sp., and *Trichogramma australicum* Girault were recorded for the first time on *A. soccata*.

0773 UNNITHAN, G.C. 1981. Aspects of sorghum shootfly reproduction. Insect Science and Its Application 2(1-2):87-92. 20 ref.

Describes the internal reproductive system of the female sorghum shootfly, *Atherigona soccata*. Studies the effects of mating and or presence of the male on egg maturation, fecundity and fertility. The number of ovarioles per female ranged from 20 to 47. *A. soccata* exhibits autogeny, but carbohydrate is essential for egg production and survival. Nutritional deficiency led to a high incidence of oocyte resorption. A mixture of baker's yeast and sugar was a better adult food than brewer's yeast and glucose. Sorghum aphid honeydew was a nutritious adult food. Shootflies provided with sorghum aphid honeydew showed an acceleration of vitellogenesis, a decrease in the frequency of oocyte resorption and a shortening of the preoviposition period. Egg maturation does not seem to be influenced directly by mating or by the presence of males. The continuous presence of the male also has no significant effect on fecundity. Shootfly females seem to mate only once and this single mating ensures fertilization of eggs laid even long after mating.

0774 YOUNG, W.R. 1981. Fifty-five years of research on the sorghum shootfly. Insect Science and Its Application 2(1-2):3-9. 55 ref.

*Atherigona soccata* Rondani, is



the main species of *Atherigona* attacking cultivated and wild species of sorghum in Africa and Asia. The past 55 years' research on the pest has produced means for its management. The bionomics of *A. soccata* are well known and are being applied for its cultural control by adjusting planting dates. Natural enemies of the shootfly are few and their biology little known. The systemic insecticide carbofuran as a seed and seed furrow treatment provides effective fly control where the cost-benefit is favorable. Sources of host plant resistance to shootfly have been recognized for about 35 years. Incorporation of this resistance in high yielding varieties through plant breeding should be more rapid now that the mechanisms of resistance and their inheritance, through additive gene action, are better understood. These resistance factors include non-preference for oviposition, antibiosis and recovery through tillering.

### Armyworms

0775 RAJURKAR, B.S., BODHADE, S.N., and THAKARE, K.R. 1981. Screening of sorghum varieties against armyworm, *Pseudaletia* (=Cirphis) *unipunctata* Haw. PKV Research Journal 5(2):201-203. 4 ref.

Sixteen varieties including local and hybrids of sorghum were screened for their relative susceptibility to armyworm under natural level of infestation. On the basis of number of plants infested and nature and extent of leaf injury, the variety NJ-156 was found to be most resistant followed by Improved ramkel, Improved sroner, Pahelwan, and NJ-164; while the variety C.K.60A was most susceptible one followed by I.S.3691, CSH-1 and CSH-2. These results also indicated that the hybrids and their parents are more susceptible to armyworm as compared to local

varieties of sorghum.

0776 RAO, B.N., and RAO, D.V.S. 1981. Effect of insecticides on the survival of natural enemy *Apanteles* sp. on armyworm (*Mythimna separata*). Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 3 pp.

An experiment was conducted to find out the suitable chemical control and the survival of natural enemy *Apanteles* on armyworm. CSH-5 was used as a test variety and the dust formulations used were BHC 10%, carbaryl 2.5%, endosulfan 4%, phenthoate 2%, quinalphos 1.5%, phosalone 4% and malathion 5% at the rate of 10 kg/ha. One application of insecticides was made at 45 days after sowing. Data were collected prior to treatment and after 5 and 10 days of dusting. Quinalphos treated plot recorded maximum yield and application of phenthoate or endosulfan or carbaryl were found to be effective for control of armyworm with least interference on natural enemy.

0777 SCHWAGER, B., and PITRE, H. 1981. Evaluation of sorghum for resistance to fall armyworm, *Spodoptera frugiperda*. Journal of the Mississippi Academy of Sciences 26(suppl):15. (Abstract).

### Stem Borers

0778 KANAUIA, K.R., CHAUDHARY, R.N., and SHARMA, V.K. 1981. Influence of time of the day on the emergence of *Chilo partellus* (Swinhoe). Indian Journal of Ecology 8(1):116-118. 3 ref.

Emergence behaviour and its relationship with time of the day in *Chilo partellus* was studied for trapping the moths through suitable devices. Larvae were collected from infested fields and culture was maintained in the laboratory. The

observation of emergence of moths in relation to the time of day showed that the male adults (72.52%) emerged from 1900 to 2300 hours while females confined their emergence between 2100 and 0100 hour (64.66%).

0779 KULKARNI, N., and MURTY, K.N. 1981. Stem borer resistance in sorghum. Indian Journal of Genetics and Plant Breeding 41(1):167-169. 4 ref.

The nature of gene action for stem borer resistance was studied in F2 and F3 of a six variety diallel cross. Significant general (gca) and specific combining ability (sca) variances in F2 and F3 indicated that both additive and nonadditive components influence stem borer resistance. However, the higher magnitude of gca in F3 indicated that stem borer resistance is predominantly governed by additive and additive x nonadditive components of genetic variance. 'IS 4664', 'CSV-3' and 'SR-18' were good combiners. The gca effects indicated that at least one parent should be a good combiner in breeding for stem borer resistance.

0780 NIKAM, P.K., and BASARKAR, C.D. 1981. Life-tables and intrinsic rate of natural increase of *Xanthopimpla stemmator* Thunberg (Hymenoptera: Ichneumonidae) population on *Chilo partellus* pupae. Insect Science and Its Application 2(4):209-212. 17 ref.

The parasitoid *Xanthopimpla stemmator* oviposits in the pupae of the sorghum stem borer. The adult parasitoid emerges from the pupal case, killing it in the process. Ten mated females of the parasitoid had an average longevity of 30 days. The number of progeny produced ranged from 71 to 115. The male: female sex-ratio of their progeny averaged 1.14:1. The maximum mean progeny production per day was 1.9. The innate capacity for increase was 0.131 per female per day; and the population multiplied 43.43 times in the generation time of 28.78 days.

0781 SINGH, B.U., RANA, B.S., RAO, V.J.M., REDDY, B.B., and RAO, N.G.P. 1981. Host plant resistance to stem borer and its genetic analysis in sorghum. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 6 pp.

Experiments were conducted to identify sources, mechanism and genetics of resistance. Seventy varieties were infested with ten freshly hatched larvae on 25th and 55th day of plant development. Varieties SPV 35, SPV 86, SPV 135, SPV 140, R 133, IS 2312 and Aispuri were found highly resistant to stem borer. Varieties with long peduncle were found highly susceptible but gave highest yield as compared to medium or short peduncle types. Combining ability effect of 11 out of 17 parents indicated that SPV 104, SPV-140, E 302, SPV-35 and CS 3541 were better combiners for grain yield than SPV 135, IS 2312 and IS 4664. SPV 104 was found better combiner for low no. of holes/stalk, no. of larvae + pupae, no. of tunnels and % tunnelling.

0782 TEMERAK, S.A. 1981. Qualitative and quantitative survey on the oophagous wasps attacking the pink borer, *Sesamia cretica* Led. (Lep., Noctuidae) on 3 gramineous crops in upper Egypt. Zeitschrift fuer Angewandte Entomologie 91(4):398-402. 8 ref. (Summary: De).

## Spider Mites

0783 GUTIERREZ, J., and ETIENNE, J. 1981. Some data on tetranychid mites injurious to crops in Senegal. (Fr). Agronomie Tropicale 36(4):391-394. 12 ref. (Summary: En).

From a series of collections made on crops in Casamance, eight species of Tetranychidae belonging to three different genera (*Eutetranychus*, *Oligonychus* and *Tetranychus*) were identified. Seven of these species

were reported for the first time in Senegal. Extensive damage was noted on rice, but affected crops also included groundnut, cassava, maize, sorghum and soybean.

0784 KULKARNI, K.A., HOLIHOSUR, S.N., and NAGESHACHANDRA, B.K. 1981. A predacious mite on the sorghum shoot-bug *Peregrinus maidis* (Homoptera: Delphacidae) at Dharwad. Page 110 In Contributions to acarology in India: proceedings of the First All India Symposium in Acarology, 23-25 April 1979, Bangalore, Karnataka, India (ed. G.P.Channabasavanna). Bangalore, Karnataka, India: Acarological Society of India. (Abstract).

Studies on the incidence of the predacious mite *Erythraeus* spp. on *Perigrinus maidis* (Ashmead) revealed that the mite infestation ranged from 0 to 38.10% and the average was 9.12%. The larvae of the mite were found to adhere to the abdominal segments whereas the adults moved freely on sorghum foliage.

0785 MITAL, V.P., KADAM, J.R., and DESAI, K.B. 1981. Control of sorghum mite (*Oligonychus*) in South Gujarat. Pages 193-203 In Contributions to acarology in India: proceedings of the First All India Symposium in Acarology, 23-25 April 1979, Bangalore, Karnataka, India (ed. G.P.Channabasavanna). Bangalore, Karnataka, India: Acarological Society of India.

The trial was conducted in kharif 1977 at Navsari (India) on variety Surath-1 for finding efficacy of some pesticides to control *Oligonychus indicus*. The treatments included sulphur W.P. (0.2%), sevisulf (0.2%), dicofol (0.02%), methyl-0-demeton (0.025%), quinalphos (0.025%), formothion (0.025%), phenthoate (0.025%), phosalone (0.075%), leptophos (0.025%), thiometon (0.025%), water spray and control. The crop was given three sprays of these pesticides on 60th, 70th and 80th day after germination of the

crop. On the basis of grain yields in treatments receiving three applications, the order of efficacy was phosalone (56.40 q/ha), thiometon (53.46 q/ha), quinalphos (50.88 q/ha), phenthoate (50.70 q/ha), formothion (48.06 q/ha), sulphur (48.0 q/ha), leptophos (47.1 q/ha), sevisulf (43.7 q/ha), methyl-0-demeton (46.26 q/ha), dicofol (39.06 q/ha), water spray (37.98 q/ha) and control (12.51 q/ha). A maximum net return ratio was found in the case of three applications of phosalone i.e. 1:3.53 while net incremental cost benefit ratio was maximum (1:42.82) in the case of 0.025% phenthoate spray.

### Sorghum Midge

0786 BARWAD, W.L. 1981. Note on the hibernation of *Contarinia sorghicola* Coquillet in pedicellate spikelet of sorghum ear. Indian Journal of Agricultural Sciences 51(2):138. 5 ref.

Attempt was made to investigate the hibernation of sorghum midge in the empty spikelets (sessile and pedicellate) and to determine the reasons of partial grain setting in the cob. Five ears were randomly selected from sorghum varietal screening trial, harvested and dried in the field. The hibernating maggots, pupae and parasites of midge fly were studied after dissecting the empty spikelets. Out of 400 sessile spikelets dissected 23.25% had grain setting, 48.75% had hibernating maggots, 25% had pupae and adults and 3% were empty for unknown reasons. Out of 315 pedicellate spikelets dissected 64 had hibernating maggots (21% hibernation).

0787 BAXENDALE, F.P., and TEETES, G.L. 1981. Production of unisexual progenies by the sorghum midge, *Contarinia sorghicola*. Annals of the Entomological Society of America 74(4):412-413. 7 ref.

Mated females of the *Contarinia sorghicola* produce exclusively either male or female progenies. Unmated females deposit few eggs and produce no offspring. Production of single-sex progeny was not due to differential larval mortality of one sex.

0788 CHAUDHARY, H.R., and LOUCEL, C. 1981. Variation and correlation studies in some sorghum lines from Sorghum Conversion Programme. *Agronomy Abstracts* 73:57.

Studies were performed at two locations for resistance to sorghum midge and some other agronomic characters among 30 improved sorghum lines. The results indicated an abundance of genetic variability among the lines with regard to the majority of characters. The results also revealed that the degree of genetic resistance to sorghum midge depends, on the insect population around the plants at grain formation stage. The estimates of the phenotypic correlation provided an insight for the effectiveness of indirect selection in the improvement of certain characters. The variability and association parameters estimated in the present investigation showed enormous genetic potentiality of the lines. These lines may prove to be of great promise to those working for resistance to sorghum midge.

0789 KARANJKAR, R.R., and CHUNDURWAR, R.D. 1981. Sorghum midge economic injury thresholds. *Research Bulletin of Marathwada Agricultural University* 5:80-81. 2 ref.

Experiments were made to investigate the potential loss of the grain in each sorghum cob in relation to adult midge populations in the field. Results revealed that one adult midge caused 4.9% damage to the spikelets and eight females caused 8.32% damage. The percentage of grain damage was based on populations of adult midge per plant throughout the blooming stage. The presence of 2-8 adult midges on a flowering earhead may warrant to undertake the chemical

control operation.

0790 SHARMA, H.C., and DAVIES, J.C. 1981. A literature review on the sources and mechanism of resistance to the sorghum midge (*Contarinia sorghicola*). Patancheru, Andhra Pradesh, India: ICRISAT. 22 pp. 44 ref. (ICRISAT Sorghum Entomology Progress Report, 5).

Lists the sorghum germplasm lines reported to be resistant/less susceptible to the sorghum midge in journal articles, short communications and workshops, and the progress made in screening and breeding for midge resistance. It was intended to identify the most stable lines from these genotypes for use in breeding programs at ICRISAT.

0791 THONTADARYA, T.S., RAO, K.J., and RANGADHAMAIAH, K. 1981. A brief note on the research work done at the U.A.S., College of Agriculture, Dharwar on the parasites and predators of the sorghum earhead midge, *Contarinia sorghicola* during the year 1980-81. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 3 pp.

Survey for midge and its natural enemies was conducted in Belgaum, Dharwar and Raichur districts of Karnataka state (India). Two parasites, *Tetrastichus diplosidis* and *Eupelmus pupa* were noticed, and earlier was found to be more active than later. Among the predators *Orius maxidentex* Ghauri and *Scymnus nubilus* Muls were found to be more active than the Coccinellid and the spiders. It was also noticed that the insecticides recommended to control midge are equally harmful to the parasites and predators for 2 weeks.

0792 WUENSCH, A.L., TEETES, G.L., and JOHNSON, J.W. 1981. Field evaluation of converted exotic sorghums for resistance to sorghum midge, *Contarinia sorghicola*. *Miscellaneous Publication, Texas Agricultural Experiment Station*

no.1484. 30 pp. 35 ref.

Converted exotic lines of Sorghum bicolor were screened for resistance to the *Contarinia sorghicola* in field plots. Evaluation of 211 lines was conducted at two or more locations in Texas in one or more years from 1976 to 1979. Results of these screening trials indicated that at least 11 lines previously unreported as midge-resistant should be further investigated. These lines are IS 2549C, IS 2862C, IS 3071C, IS 6392C, IS 7064C, IS 7142C, IS 8231C, IS 8233C, IS 8263C, IS 8337C, and IS 12593C.

### Head Caterpillars

0793 DHANDAPANI, N., and BALASUBRAMANIAN, M. 1981. Growth of population of *Heliothis armigera* Hbn. on maize and sorghum. *Indian Journal of Ecology* 8(1):60-64. 5 ref.

Studies on the rate of multiplication of *Heliothis armigera* were conducted at a constant temperature of 26 + 2 deg C under conditions of unlimited space and sufficient food supply. The population increased with infinitesimal rate (rm) of 0.120 and 0.1405 and finite rate of 1.127 and 1.151 per female per day, on fresh grains of sorghum and maize respectively. The net reproductive rate (Ro) was 145.26 and 260.48 and a generation was completed in 41.49 and 39.60 days on sorghum and maize respectively. The population on reaching a stable age-distribution comprised 99% of immature stages. Maize grain was more suitable for rapid multiplication of *H. armigera* than sorghum grain.

### Stored Grain Pests

0794 DETHE, M.D., DHARNE, P.K., and

KALE, V.D. 1981. Studies on the susceptibility of grains of some sorghum hybrids and varieties to rice weevil and lesser grain borer. *Bulletin of Grain Technology* 19(1):22-25. 9 ref.

Out of four varieties tested, the grains of variety CSV-5 were found to be the least susceptible to *Sitophilus oryzae* and *Rhizopertha dominica* in storage. Grains of CSV-4 showed less infestation by both the pests. None of the hybrids tested was found resistant to these pests in storage. However, CSH-5 was less susceptible as compared to CSH-1 and CSH-6.

0795 MCMILLIAN, W.W., WISEMAN, B.R., and WIDSTROM, N.W. 1981. An evaluation of selected sorghums for multiple pest resistance. *Florida Entomologist* 64(1):198-199. 6 ref.

Seeds of 21 sorghum genotypes were tested for resistance to the rice weevil, *Sitophilus oryzae*. A wide diversity in sorghum germplasm for resistance to damage by the rice weevil was noticed. Some sorghums were found resistant to more than one pest, while others showed resistance to specific pests.

0796 TEETES, G.L., CHANTRASORN, W., JOHNSON, J.W., GRANOVSKY, T.A., and ROONEY, L.W. 1981. Maize weevil: a search for resistance in converted exotic sorghum kernels. College Station, Texas, USA: Texas Agricultural Experiment Station. 38 pp. 27 ref.

Kernels of 169 converted exotic lines of Sorghum bicolor were screened for resistance to the maize weevil, *Sitophilus zeamais*, utilizing free-choice and no-choice screening techniques. Results showed that there was congruity among different tests in identification of five converted exotic lines (SC 0226, SC 0233, SC 0309, SC 0311, and SC 0331) as exceptionally promising sources of resistance to the maize weevil. Lines SC 0199, SC 0224, SC 0227, SC 0230, SC 0289, and SC 0333 were recommended for further investigation as sources of

resistant germplasm.

0797 VILJOEN, J.H., COETZER, J.J., and VERMAAK, C.J. 1981. Fumigation trials with a mixture of methyl bromide and carbon dioxide in larger type solo bins. *Phytophylactica* 13(3):127-137. 5 ref. (Summaries: Af, Fr).

Tests with mixtures of methyl bromide and carbon dioxide for the control of stored product pests were conducted in silo bins at Settlers, Driefontein and Bloekomspruit. Very high methyl bromide concentrations and a complete kill of insects were obtained at Settlers where the CO<sub>2</sub> was applied as a gas. At Driefontein, where the CO<sub>2</sub> was applied as snow, and at Bloekomspruit, where it was applied as dry ice, the methyl bromide concentrations were much lower, and there were distinct areas where very low concentrations and some insect survival occurred. The size of the bin did not play an important role in the distribution of the gas mixture, but rather the way in which the CO<sub>2</sub> was applied. The logistic and economic implications of this result are discussed.

### Other Insect Pests

0798 BONZI, S.M. 1981. Note on the sorghum cicadella: *Poophilus costalis* Walker. (Fr). *Agronomie Tropicale* 36(2):185-187. 8 ref. (Summaries: En, Es).

An account of the identity and outbreaks of *Poophilus costalis* Walker (Aphrophoridae: Homoptera), a sap sucking pest in Upper Volta is given. The pest caused heavy losses of young sorghum plants during 1978 and 1979 rainy seasons. Recommends the study of the exact nature of the damage and mechanism of this pest and to find out appropriate means for its control.

0799 BRAR, R.S. 1981. The natural enemy complex of *Pyrilla perpusilla*

Walker at Dhuri, Punjab. *Indian Journal of Entomology* 43(4):441-443.

*Pyrilla perpusilla* Walker is a major pest of sugarcane which also damages maize, sorghum, and wheat. The natural enemies of this pest are listed and the key for their identification is given.

0800 CHU, Y.I., and LIOU, R.F. 1981. The comparison of feeding marks and honeydew excretion of green rice leafhopper (*Nephotettix cincticeps* Uhler) on various graminaceous plants (Deltocephalidae: homoptera). (Ch). *Plant Protection Bulletin (Taiwan)* 23(4):243-253. (Summary: En).

The work was carried out to investigate the relationship between the suitability of host plants and feeding amount of green rice leafhopper. The feeding amount was evaluated by the number of feeding marks on 20 plants including sorghum (*Andropogon sorghum* Brot., Taihung No.3), and the sugar and amino acid content in honeydew. 10 3-4th-instar nymphs or 3-5-day-old adult leafhoppers were inoculated on each kind of host plant and exposed for 48 hours. The number of feeding marks on a host plant was not related to the suitability of the plant to the leafhopper. The honeydew from the most favorable host plants contained more carbohydrates and amino acids. It is suggested that estimation of carbohydrate and amino acids content in honeydew will provide a simple and rapid bioassay method for the evaluation of suitability of plants to green rice leafhopper.

0801 CHU, Y.I., LIOU, R.F., and MU, T. 1981. Evaluation of graminaceous plants as over wintering host plants of green rice leafhopper *Nephotettix-cincticeps*, Deltocephalidae Homoptera. *Plant Protection Bulletin (Taiwan)* 23(4): 235-242.

0802 DURANTON, J.F., LAUNOIS, M., LAUNOIS-LUONG, M.H., and LECOQ, M. 1981. Research on the pests of food-crops in the Sahel : the case of

grasshoppers. (Fr). Agronomie  
Tropicale 36(2):178-184. 45 ref.  
(Summaries: En, Es).

In addition to catastrophic but temporary pullulations of locusts, grasshoppers are a chronic problem of food crop protection in the whole Sudan-sahelian area in West Africa. Important developments in the knowledge of the mechanisms of the pest pullulations have been made possible through the recent evolution of research strategies. Results are reviewed and the priorities for the future are pointed out.

0803 HALL, D.G..IV, and TEETES, G.L. 1981. Alternate host plants of sorghum panicle-feeding bugs in Southeast central Texas. Southwestern Entomologist 6(3):220-228. 30 ref.

Five species of panicle-feeding bugs were collected from commercial sorghum viz., rice stink bug (*Oebalus pugnax* F.), southern green stink bug (*Nezara viridula* L.), leaffooted bug (*Leptoglossus phyllopus* L.), redshouldered stink bug (*Thyanta accerra* McAtee), and brown stink bug (*Euschistus servus* Say). A number of alternate host plant species were identified as potential sources of bugs prior to and during sorghum grain development. Alternate hosts commonly found near sorghum and which were usually infested with bugs included johnsongrass and oats (rice stink bug), Texas thistle (leaffooted bug, southern green stink bug, brown stink bug, and redshouldered stink bug), and silverleaf nightshade (leaffooted bug, redshouldered stink bug, and southern green stink bug). A 6th species of panicle-feeding bug, the hyaline grass bug (*Liorhyssus hyalinus* F.), migrated into sorghum research plots after commercial sorghum in the area had been harvested.

0804 HIREMATH, I.G. 1981. Studies on the bionomics, crop loss and control of the sorghum earhead bug, *Calocoris angustatus* Lethierry (Hemiptera: Miridae). Ph.D. thesis, University of Agricultural Sciences,

Bangalore, Karnataka, India. 239 pp.

0805 ICRISAT, FARMING SYSTEMS RESEARCH PROGRAM, CROPPING SYSTEMS SUBPROGRAM. 1981. In association with sorghum (*Sorghum bicolor* (L.) Moench. Pages 4-8 In Arthropod parasitoids of insect pests (excluding *Heliothis* spp) recorded in Andhra Pradesh, India. Patancheru, Andhra Pradesh, India: ICRISAT.

This compilation documents the arthropod parasites that have been reported to have been bred from insect pests collected from sorghum on research stations and from farmers' fields. Wherever possible brief notes are given on the insect stage attacked and on prevalence of the parasitoids.

0806 PRABHAKAR, B., RAO, P.K., and RAO, B.H.K.M. 1981. Note on hemipterous species complex on sorghum at Hyderabad. Indian Journal of Agricultural Sciences 51(11):818-819. 1 ref.

A sorghum plot of CSV-4 was raised during October 1976, to survey the Hemipterous species on sorghum. The aphid *Rhopalosiphum maidis* occurred in colonies during rainy and winter seasons. The leafhoppers, *Empoasca flavescens* Gill and *Nephotettix virescens* (Dist.) were observed in small numbers during early stages of the crop growth. *Vietnara maculifrons* (Mots) and *Typhlocyba* sp. occurred only in rainy season. The sorghum shoot-bug *Peregrinus maidis* occurred largely in the whorls of young seedlings both in rainy and winter seasons. Ear bug, *Calocoris angustatus* occurred in large numbers in both the seasons at panicle formation stage. Besides, other insects were also observed.

0807 SACHAN, G.C., and VERMA, S.K. 1981. Relative susceptibility of various sorghum lines to the attack of almond moth, *Ephestia cautella* (Walker). Pestology 5(1):18-19. 2 ref.

Eighteen sorghum lines less susceptible to shootfly were tested

against *Ephestia cautella*, a stored grain pest. CSV-1 and CSH-1 which are highly susceptible to shootfly were also tested simultaneously. *Ephestia* was reared at 27+ 1 deg C and 70-80% r.h. The data on average developmental period and per cent adult emergence and computation of growth index revealed that CSV-1 and CSH-1 were highly susceptible. Lines IS 5604 x 23/2 and IS 1082 were least susceptible to this pest.

0808 SMITH, M.T., WILDE, G., and MIZE, T. 1981. Chinch bug: damage and effects of host plant and photoperiod. *Environmental Entomology* 10(1):122-124. 9 ref.

Female *Blissus leucopterus* laid more eggs on sorghum than wheat or corn. Nymphs developed to the adult stage faster on sorghum than on corn, barley, or wheat. Males developed to the adult stage faster than females but female adults lived longer than males. Last instar nymphs killed seedling sorghum in fewer days than males or females collected from overwintering sites. Overwintering male and female adults with a one week pretest feeding and newly emerged females killed plants in fewer days than newly emerged males or males and females from overwintering sites with no pretest feeding. Chinch bugs collected from the field Sept. 6, Sept. 21, and Oct. 3 and confined to a 16-h photophase actively fed and mated and females laid eggs while those confined to an 8-h photophase did not. This is the first demonstration of a photoperiod induced diapause in this species.

## Birds, Rodents, and Other Pests

0809 BRUGGERS, R., MATEE, J., MISKELL, J., ERICKSON, W., JAEGER, M., JACKSON, W.B., and JUIMALE, Y. 1981. Reduction of bird damage to field crops in eastern Africa with methiocarb. *Tropical Pest Management*

27(2):230-241. 18 ref.

Summarises the results of field evaluations of methiocarb to protect ripening crops from birds in Somalia, Tanzania, Ethiopia, and Kenya. Methiocarb was applied in edge, alternate band, or spot treatments using ground spraying equipment. The positive results and favourable cost effectiveness obtained in nearly all the trial situations demonstrated that under certain farming conditions methiocarb can be an economical method of reducing crop losses due to birds.

0810 BRUGGERS, R., and RUELLE, P. 1981. Economic impact of pest birds on ripening cereals in Senegal. *Protection Ecology* 3(1):7-16. 18 ref.

Grain-eating birds cause extensive damage to agriculture in many African countries. Extrapolation from systematic damage sampling of the cereal crops of Senegal showed that birds were responsible for losses of 5% of total production or the equivalent of \$(US) 4-5 million. Sorghum and millet in the northern regions were the most severely attacked crops. *Ploceus cucullatus*, *Passer luteus*, and *Quelea quelea* are the important pest birds in Senegal.

0811 HOSHINO, T., and DUNCAN, R.R. 1981. Bird damage and tannin content in grain sorghum hybrids under different environments. *Japanese Journal of Crop Science* 50(3):332-337. 11 ref. (Summary: Ja).

This study was conducted to examine the mutual relationships among bird damage, tannin content, seed color, and flowering date under several environments. Bird resistant and non-bird resistant Sorghum bicolor hybrids were evaluated. Hybrids which contained tannin had no bird damage. Bird damage was not significantly correlated with seed color but was correlated with flowering date. It was concluded that the hybrids with the greatest bird resistance or high tannin content in one environment may not necessarily provide the best resistance or contain high tannin in



another environment.

0812 PAUL, M.D., and RAO, B.H.K. 1981. Occurrence of house mouse, *Mus musculus* homourus on sorghum ear heads. Indian Journal of Plant Protection 9(1):120-121. 1 ref.

Reports the observations made during 1978-79 kharif season in a sorghum plot where earhead were covered with paper bag<sup>6</sup> for experimental purpose. Mice were reported to have entered in these bags by cutting a small hole and made nests there. In the nests they were also observed to breed. These have been subsequently identified as *Mus musculus* homourus. This behaviour has been attributed to continuous wet weather which precluded the building up of nests in wet soil.

0813 RAO, A.M.K.M., and PRAKASH, I. 1981. Activity and hoarding behaviour of the desert gerbil *Meriones hurrianae*. Indian Journal of Experimental Biology 19(8):792-793. 7 ref.

The digging activity of the male *Meriones hurrianae* was more ( $P^{1/4} 0.001$ ) than that of females after release in the rattery. All the females constructed a nest in their burrows, whereas only 67% males did so. Hoarding behaviour was observed in 67 and 50% female and male gerbils respectively. Grain size influenced the extent of hoarding. Significantly more ( $P^{1/4} 0.001$ ) quantity of sorghum was hoarded as compared to millet.

## Plant Protection and Seed Treatment

0814 ANZALONE, L., Jr. 1981. Effect of seed treatment on sorghum seedling emergence in Louisiana 1980. Fungicide and Nematicide Tests 36:161.

Fifteen fungicide treatments were evaluated for control of soilborne diseases in a field test at Baton Rouge, Louisiana. A single seed lot of grain sorghum was treated Apr.10

with different fungicide formulations. The formulated fungicides were placed in distilled water (1 ml/0.125 lb seed) in glass jars, stirred until in suspension, and the suspended fungicide was applied as a coat to the inside of each jar. Weighed seed samples were poured into the coated jars, shaken by hand 2 min, and revolved on a jar mill 15 min. Treated seeds were planted in the field using a randomized complete block design with four replications. Each plot consisted of 200 seed planted in a 16 ft row. Stand counts were recorded three weeks after planting. Eight of the fifteen treatments significantly increased seedling emergence.

0815 BRADER, I., ROY, J., and VAN DER GRAAFF, N.A. 1981. FAO crop protection activities in cereal growing. EPPO Bulletin 11(2):3-8. 6 ref. (Summaries: Fr, Ru).

Brief review of FAO's field activities of research on control of grain-eating birds, breeding for stable resistance in wheat, integrated pest control in sorghum and millet, integrated pest control in rice-growing in South and Southeast Asia and reduction of post-harvest losses. The effective application of new plant protection technology is considered to be dependent on a better understanding of the agro-ecosystem concerned in order to make maximal use of knowledge collected elsewhere.

0816 DUSCHANOV, I.D. 1981. Fungicides for treatment of sorghum seed. (Ru). Khimiya v Sel'skom Khozyaistve 3:31-34. 3 ref.

0817 GRUBE, A.H. 1981. Preliminary benefit analysis of PCNB for seed treatment on small grains and soybeans. Urbana-Champaign, Illinois, USA: University of Illinois. 109 pp. (Illinois Agricultural Economics Staff Paper Series E Agricultural Economics, 81E-160).

0818 RAYCHAUDHURI, S.P., and VERMA,

J.P. 1981. Plant diseases: their identification and control (sorghum). Seeds and Farms 7(12) :9-11, 27-29.

States in brief the important methods of control on the basis of main source of infection viz. seed treatment, soil treatment, foliage sprays and dusts, chemical control, and cultural control. Control measures of some of the important diseases together with the causal agents and identifying symptoms on cereals, pulses, oilseeds, and vegetable crops are described in tabular form. The important diseases of sorghum mentioned are bacterial leaf stripe and red leaf blotch, chlorosis, ergot, downy mildew, charcoal rot, seedling stalk rot, top rot, rust, grain and head smut, long smut, and loose smut.

0819 RENFRO, B.L., and FREDERIKSEN, R.A. 1981. Integrated control of maize and sorghum diseases in tropical and subtropical areas. Pages 416-418 In Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T.Kommedahl). Minneapolis, Minnesota, USA: Burges Publishing Company.

Host resistance and avoidance are most frequently applied and are the principal methods used to control the sorghum grain head molds, maize ear rots, stalk rots, anthracnose, downy mildew, head smut and virus and spiroplasma incited diseases. Fungicidal seed treatment is often used to protect from seed decay, seedling blight, most smuts and, likely, for the future control of downy mildew. Storage rots are mainly controlled by avoiding grain moisture conditions above 12 percent. In the future multiple measures need to be integrated with other pest control and management systems for economic reasons and because insects, nematodes, weeds, soil conditions, agronomic practices and host reaction have profound influences on disease development. Research must be flexible, cognizant of changes and, must critically, develop a better

transfer system of technology.

0820 SHCHERBAKOV, V.I.A. 1981. Presowing irradiation of grain sorghum seeds. Visnyk Sil's 'kohospodarskoyi Nauky 8:21-24. 5 ref.

0821 TAITI, M. 1981. Cultural treatments for sorghum. (It). Incontri 13(4):3.

0822 ULLSTRUP, A.J. 1981. Integrated control of diseases of corn and sorghum in the United States. Pages 413-415 In Proceedings, Ninth International Congress of Plant Protection, 5-11 August 1979, Washington, DC, USA (ed. T.Kommedahl). Minneapolis, Minnesota, USA: Burges Publishing Company. 8 ref.

Control of corn and sorghum diseases in the United States involves inputs by both the grower and seed producer. Delay in planting until soil temperatures favor rapid germination and growth ensures maximum stands. This is a decision the grower must make. Treatment of seed with fungicides to protect against soil-borne pathogens is done by the seed producer. Rotation, crop sanitation, eradication of overwintering hosts, optimum harvest time and proper seed storage conditions are operations and practices entirely in the hands of the grower. The use of host-plant resistance is the most efficient and effective means of disease control in these two crops. This is an input entirely under control of the seed producer. Ways and means are available and are being increasingly employed to maximize diversity of germplasm, and thus avoid hazards of uniformity of susceptibility to disease.

0823 YANUCCI, D. 1981. Effect of the acephate in the treatment of sorghum seeds. (Es). Thesis, Universidad de Buenos Aires, Buenos Aires, Argentina. 52 pp.

## CHEMICAL COMPOSITION

0824 AKINGBALA, J.O., PALACIOS, L.G., SWEAT, V.E., and ROONEY, I.W. 1981. Thermal properties of sorghum starches. Cereal Foods World 26(9):486. (Abstract).

The differential scanning calorimeter (DSC) has been used to study the thermal properties of sorghum flour and starches at various moisture levels and a method established to measure the specific heat of sorghum flour/water systems. Gelatinization temperature range of waxy, heterowaxy and nonwaxy isolated sorghum starches and endosperm were determined. No difference was observed in the gelatinization temperature range of isolated versus unisolated starches still in the endosperm. Waxy sorghum starches had higher gelatinization temperature ranges and higher energies of gelatinization.

0825 ARGUELLO DE ESPINOSA, R. 1981. The chemistry and nutritional effects of tannins in sorghum. (Es). Boletín Tecnico LABAL 2(4):9-13. 11 ref.

0826 BVLLARD, R.W., YORK, J.O., and KILBURN, S.R. 1981. Polyphenolic changes in ripening bird-resistant sorghums. Journal of Agricultural and Food Chemistry 29(5):973-981. 44 ref.

Three chemical assays, three biochemical assays, and a paired preference assay on *Quelea quelea* were used to evaluate eight bird-resistant sorghum varieties in the milk, light dough, firm dough, and mature stages of grain development. Each assay showed an increase in the respective polyphenolic activity that peaked in the firm dough stage and then dropped in the mature stage. Polyphenol activity in varieties classified as group II tended to peak earlier in grain development and then dropped in the ripened grain. Although there was evidence that tannin biosynthesis goes to a higher degree of polymerization in group II than group II) sorghums,

the synthetic mechanism could not fully explain the differences. Gel permeation, thin-layer, and paper chromatography analyses indicated that the tannins were procyanidins in both groups. Therefore, further elucidation depended upon differences in grain structure or the influence of other grain components. Three of these factors are discussed.

0827 CASTRO, H.I., SILVA, H.G.B., and ESTEVES, A.D.L. 1981. Analysis and fermentation of sorghum stems regarding storage time. (Pt). Informativo do INT 14(27):39-46. 18 ref. (Summary: En).

0828 CHAVAN, J.K., KADAM, S.S., and SALUNKHE, D.K. 1981. Changes in tannin, free amino acids, reducing sugars, and starch during seed germination of low and high tannin cultivars of sorghum. Journal of Food Science 46(2):638-639. 17 ref.

Seedling growth and changes in tannin, starch, reducing sugars, and free amino acids were determined during germination of low and high tannin seeds of sorghum. The seedling growth was markedly suppressed in high tannin seeds as compared to low tannin seeds. About 73 and 20% tannins were lost during 120 hr germination in high tannin and low tannin seeds, respectively. Accumulation of reducing sugars, free amino acids, and degradation of starch were considerably low in high tannin seeds as compared to low tannin seeds. It is suggested that tannins are responsible for retarding the seedling growth by decreasing the rate of starch and protein degradation in germinating high tannin seeds.

0829 DOHERTY, C.A., FAUBION, J.M., and ROONEY, L.W. 1981. A semi-automated method for determining phytate phosphorus in sorghum and other cereals. Cereal Foods World 26(9):486. (Abstract).

Phytic acid from ground grain was isolated by extraction with dilute HCl-Na<sub>2</sub>SO<sub>4</sub> and precipitated as Fe

(Ill)-phytate through addition of FeCl<sub>3</sub>. The precipitate was digested by the micro-Kjeldahl procedure to release phytate-P. The phytate-P was colorimetrically determined by absorption at 660nm using a modified Technicon method. Sorghum varieties analyzed showed phytate-P levels of 0.17-0.36% (dry wt. basis) accounting for 80-87% of the total phosphorus level. The bran fraction showed the highest phytate-P levels with lesser amounts in the germ and endosperm. Overall error for the method was 5%. This method was also applied to cottonseed, soybean and some sorghum based food products.

0830 EARP, C.F., AKINGBALA, J.O., RING, S.H., and ROONEY, L.W. 1981. Evaluation of several methods to determine tannins in sorghums with varying kernel characteristics. Cereal Chemistry 58(3):234-238. 20 ref.

Polyphenols in 21 sorghum cultivars with differing pericarp color and presence or absence of a pigmented testa were analyzed by seven methods. Subtraction of blanks in the V-HCl and MV-HCl procedures reduced the overall level of polyphenols measured without changing the relative quantities. Significant levels of polyphenols and amylase inhibition were found only in those cultivars with a spreader gene and a phenotypically brown pericarp, whether the pericarp was genetically red or white. The V-HCl method with or without blanks was recommended as the most reliable for analyzing polyphenols in sorghum because they had the next highest F values and lowest CV. The method with the highest F value should be the most sensitive to detecting levels of polyphenols due to genetic variation.

0831 EARP, C.F., FAUBION, J.M., and ROONEY, L.W. 1981. Fluorescence microscopy of the pericarp, aleurone cells and endosperm in sorghum using multiple fluorochromes. Cereal Foods World 26(9):486. (Abstract).

Several fluorochromes were used to microscopically locate components of the sorghum pericarp, aleurone layer and endosperm. Varieties of white sorghums with and without a testa layer, brown sorghums with thick and thin pericarps and a red sorghum without a testa were studied. Blue autofluorescence was observed in the aleurone cell walls of all varieties and in the pericarp of some varieties. Alkaline pH caused an increase in autofluorescence intensity.

0832 ERB, N., ZINSMEISTER, H.D., and NAHRSTEDT, A. 1981. The cyanogenic glycosides of triticum, secale and sorghum. (De). Planta Medica 41(1):84-89. 31 ref. (Summary: En).

The cyanogenic glucosides obtained from seedlings of Triticum aestivum ssp. spelta, the inflorescences of Secale montanum and the caryopses of Sorghum bicolor were identified by chromatographic and spectroscopic techniques. In all cases the cyanogenic principle is 2-beta-u -glucopyranosyloxy-2-(4-hydroxyphenyl) -2S-acetonitril (dhurrin). According to thinlayer chromatographic investigations the cyanogenic glucoside of Secale cereale seems to be dhurrin.

0833 FABRE, H.C., ARINGOLI, E.E., and TORRE, M.A.G. DE LA. 1981. Chemical evaluation of grain sorghum hybrids. (Es). Revista del Instituto de Tecnologia de Alimentos 3(1):39-45. 7 ref. (Summary: En).

Twenty-four kinds of grain sorghum hybrids taken from 1977-1978 crop in Santa Fe Province were analysed. Protein, fat, fiber, ash and starch were determined by standard methods and tannin by FAS method. Fat contents oscillated between 2.59 and 4.02%, being 92% hybrids in the range of 3 to 4%. Most of the hybrids had a protein content between 10 and 13% with an average value of 11.60%. Tannin was in the range between 0.69 and 2.79% and hybrids were classified according to low, medium and high tannin content. The various grain

components did not show significant correlation among them. As to nutritive value, hybrids with low tannin content showed good protein content.

0834 GLENNIE, C.W. 1981. Preharvest changes in polyphenols, peroxidase, and polyphenol oxidase in sorghum grain. *Journal of Agricultural and Food Chemistry* 29(1):33-36. 25 ref.

At various stages of preharvest development, "bird-resistant" Sorghum bicolor grain was analyzed for tannin content and polyphenol oxidizing enzymes. Tannins appeared first at the milk stage, reached a maximum at the hard dough stage, and thereafter declined by 25%. Polyphenol oxidase (PPO) and peroxidase activities were detected during the flowering stage. PPO activity declined rapidly as the grain began to develop while the decline of peroxidase WAS slower. Both enzymes were characterized and PPO behaved as a catechol oxidase. It appeared that these enzymes were not responsible for tannin deposition in sorghum grain. The decrease in extractable tannin was attributed to the high molecular weight tannin complexing with cellular components to become insoluble.

0835 GLENNIE, C.W., KALUZA, W.Z., and VAN NIEKERK, P.J. 1981. High performance liquid chromatography of procyanidins in developing sorghum grain. *Journal of Agricultural and Food Chemistry* 29(5):965-968. 17 ref.

Bird-resistant sorghum grains were collected at various stages of maturity, and their procyanidins were monitored by using high-performance liquid chromatography on silica gel with anhydrous organic solvents. The melting point depression of camphor was used for molecular weight determination of the acetylated procyanidins. During the flowering stage, catechin was detected, but as the grain matured, several low molecular weight procyanidins were present. They reached a maximum concentration at the soft dough stage. As the grain matured, the low

molecular weight procyanidins could no longer be detected, indicating the end of the period of their synthesis. By the melting point depression of camphor, one dimer and two trimer of procyanidin were identified in immature sorghum grain.

0836 GLENNIE, C.W., TAYLOR, J.R.N., MORRALL, P., and HARRIS, J. 1981. Some techniques for the study of cereal structure and composition by SEM. *Electron Microscopy Society of Southern Africa Proceedings* 11:33-34. 3 ref.

The merits of several techniques of preparing cereal grains for study using SEM are discussed. The work was done to determine the structural integrity of sorghum grain and to better understand the fate of this integrity when the grain is malted. It appeared that each technique contributed to an understanding of structural integrity but no single technique could embrace all aspects of structure.

0837 HAHN, D.H., FAUBION, J.M., and ROONEY, L.W. 1981. Analyses of benzoic and cinnamic acid derivatives of sorghum by HPLC. *Cereal Foods World* 26(9):505-506. (Abstract).

A high performance liquid chromatographic method was developed for the separation and identification of benzoic and cinnamic acid derivatives occurring in sorghum grain. These acids were separated from ground grain by shaking in methanol. The method was applied to sorghum varieties with varying degrees of resistance to fungus attack. Resistant varieties contained both a greater variety and amount of benzoic and cinnamic acids than did susceptible varieties.

0838 HOSHINO, I., and DUNCAN, R.R. 1981. Factors contributing to variation in the vanillin-HCl analysis method for sorghum grain tannin. *Bulletin of the Chugoku National Agricultural Experiment Station A* 29:71-80. 7 ref. (Summary: Ja).

Several environmental and mechanical factors in which maximum sorghum tannin was extracted by a corrected vanillin hydrochloric acid (Cv-HCl) method, were examined. The optimum extraction time was 3 hours, and the reagent reaction time needed to reach maximal absorbance was 40 minutes. Grain dried at mild temperatures gave maximum tannin. The portion of sorghum flour between 60 and 100 mesh and grain ground to pass 35 mesh screen contained highest tannin. Tannin content decreased with time between grinding and analysis. Only Cv-HCl method (using absorbance based on a logarithmic scale) provided the accurate estimation of sorghum grain tannin.

11758 than in CSV-5. The lower rate of protein accumulation in IS 11758 was not due to a limitation of free amino-N. CSV-5 had a higher proportion of prolamine. A major part of the prolamine in CSV-5 was deposited in a relatively short period from 24 to 31 days. In this period much less prolamine was synthesized in IS 11758. RNA content was higher in IS 11758. DNA content, however, was higher in CSV-5 than IS 11758 during early stages of development. RNase activity at maturity was lower in IS 11758. Amylase activity/grain in both was similar, however, on a fr. wt basis it was higher in CSV-5. Protease level/grain was higher in IS 11758.

0839 JAMBUNATHAN, R., SINGH, U., and SUBRAMANIAN, V. 1981. Grain quality of sorghum, pearl millet, pigeonpea and chickpea. Presented at the Workshop on Interfaces between Agriculture, Nutrition, and Food Science, 10-12 November 1981, ICRISAT, Patancheru, Andhra Pradesh, India. 16 pp. 17 ref.

Results of analyses of sorghum, pearl millet, pigeonpea, and chickpea for their chemical composition including protein content and essential amino acid composition are discussed. The distribution patterns of various protein fractions in these grains and the levels of some of the antinutritional factors present in pulses are presented. The results of a survey conducted in India to study the utilization of these crops and the relationships between certain physicochemical characteristics and cooking quality are discussed.

0840 JOHARI, R.P., DONGRE, A.B., and MEHTA, S.L. 1981. Protein, nucleic acids and enzyme levels during development in a high lysine sorghum grain. *Phytochemistry* 20(4):569-573. 23 ref.

Dry wt was higher in CSV-5 throughout development. Protein accumulation/grain was lower in the later stages of development of IS

0841 LAI, F.S., POMERANZ, Y., MARTIN, C.R., DIKEMAN, E., and MILLER, B.S. 1981. Mineral components of grain dust. *Cereal Chemistry* 58(5):417-421. 9 ref.

Particle size distribution patterns, protein and ash contents, and P, K, Mg, Ca, Zn, Fe, Mn, Cu levels were determined in bin, belt, and cyclone grain dusts collected during handling of wheat, corn, grain sorghum, and soybeans in four commercial grain elevators. In the 2-125 micro m particle size range, Gaussian size distribution was skewed, with particles in the 10-22 micro m range making up the single largest fraction. Dusts were relatively low in P and high in other minerals. Wheat cyclone dust contained less protein, ash and less of most mineral components than did bin or belt wheat dusts. Several statistically significant associations between dust components were recorded.

0842 MONTGOMERY, C.R., NELSON, B.D., BRACY, R., and SCHILLING, P.E. 1981. Evaluation of sorghum for tannin level 1981. Pages 192-201 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Four varieties, each representing bird-resistant and bird-susceptible grain sorghum, forage sorghum and corn hybrid were grown to determine tannin content in grain and forage. Data revealed that tannin content was higher in grain and whole plant of bird-resistant than in bird-susceptible varieties. Grain harvested at milk stage were richer in tannin levels than at the hard-dough or mature stage for both resistant and susceptible varieties. In forage-type sorghum, tannin content was higher in grain harvested at milk stage than at hard-dough or mature stage except Dekalb FS-1a. In forage of forage-type sorghum tannin levels were lower than that of the grain. Grain harvested at milk stage exhibited the highest crude protein percentages in bird-resistant grain sorghum varieties and forage-type sorghum.

0843 MORRALL, P., LLEBENBERG, N.V.D.W., and GLENNIE, C.W. 1981. Tannin development and location in bird-resistant sorghum grain. Scanning Electron Microscopy 3:571-576. 14 ref.

Small tannin containing vesicles appeared at the inner integument cells just after fertilization and, at the milk stage of grain development, tannins were rapidly being deposited along the periphery of the central vacuole. The tannins developed until there was little evidence of cell structure and the testa consisted of a continuous layer of tannin. In the mature kernel the tannins extended from the testa through the cross and tube cells into the mesocarp, but they were not found in the aleurone layer. The tannins appeared very dense and amorphous on electron micrographs. Besides being strongly osmiophilic, the tannins stained with vanillin-HCl reagent. Once deposited, the tannins did not appear to decrease as the grain matured.

0844 O'DONNELL, D.J., ACKERMAN, J.J.H., and MACIEL, G.E. 1981. Comparative study of whole seed

protein and starch content via cross polarization magic angle spinning carbon-13 nuclear magnetic resonance spectroscopy. Journal of Agricultural and Food Chemistry 29(3):514-518. 16 ref.

A series of nuclear magnetic resonance (NMR) spectra of whole seeds of various types was obtained by using cross polarisation-magic angle spinning (CP/MAS) techniques. Select signals in the spectra provided a means of comparing the protein content relative to the starch content within a group of seed varieties. Seeds obtained from legumes were found to be high in protein content, with different legumes showing, a range of protein NMR signal intensities. A series of sorghum varieties and a series of grain types were analysed, and the protein content of these series was compared to that of the legumes and to that of one another. The potential of <sup>13</sup>C CP/MAS NMR for the study of seeds and other intact plant materials is indicated.

0845 SAVITRI, A. 1981. Composition and cooking quality of high yielding sorghum varieties. M.Sc. thesis, University of Agricultural Sciences, Bangalore, Karnataka, India. 128 pp.

0846 SCHELLING, G.T., ROONEY, L.W., and ELLIS, W.C. 1981. The complete order of limiting amino acids in sorghum grain. Presented at the Meeting of the American Society of Animal Science, Southern Region, 1-4 February 1981, Atlanta, Georgia, USA. (Abstract).

The complete protein evaluation (CPE) procedure, was used to determine the order and degree of limitation of each essential amino acid in sorghum grain (hybrid variety TAM 680). The grain and combinations of amino acids were added to purified dietary ingredients to provide the only nitrogen sources in the 13 dietary treatments used in the rat gain bioassay which constitutes the CPE procedure. The results of the trial are expressed in terms of relative

percent excess (RPE). The descending order of limiting amino acids for sorghum grain and their RPE values were, lys, 0; his, 55; phe, 56; met, 59; thr, 61; trp, 67; leu, 72; arg, 72; val, 77 and iso, 100. A subsequent gain trial using the RPE values to balance the sorghum grain with supplemental amino acids resulted in a 105% gain response which was in close agreement with the predicted 100% response. Lysine was also verified as the first limiting amino acid in a subsequent trial. This study indicated the reliability and efficiency of the CPE procedure for evaluating dietary proteins.

0847 SOUTHERN, L.L., and BAKER, D.H. 1981. Bioavailable pantothenic acid in cereal grains, and soybean meal. *Journal of Animal Science* 53(2):403-408.

0848 THAKRE, S.K. 1981. Chemical composition of fodder of several sorghum varieties. *Journal of Maharashtra Agricultural Universities* 6(1):62-63. 3 ref.

Twelve grain and 6 fodder varieties of sorghum were sown to study their nutritive value. At 50% flowering, Ramkel (13.58% W.S.C. and 23.90% fibre) and SL-44 (11.05% W.S.C. and 25.50% fibre) were found better. The crude protein content ranged from 4.81% to 7.88%. At the grain harvesting Ramkel (22.85% fibre and 10.80% sugars) was again found best. In comparison to fodder of grain varieties, it was at par with No-370, CS-3541, Swarna, SPV-106, SPV-102 and superior to others.

0849 TRIPATHI, D.P., MEHTA, S.L., and RAO, N.G.P. 1981. Amino acids in anthers of milo and in cytoplasmic genetic male sterile sorghums (*Sorghum bicolor* L. Moench) of Indian origin. *Theoretical and Applied Genetics* 59(2):113-116. 11 ref.

Amino acid composition of proteins from anthers of milo and male steriles of Indian origin were determined. Comparison of amino acid

between A and B lines showed lower contents of histidine, threonine, glutamic acid, glycine, leucine and phenylalanine and higher contents of alanine, serine, proline and tyrosine in line A compared to line B. Alanine content in anthers of A line 6 two fold higher than that in the anthers from B lines. Marked differences in amino acid composition of anthers of A and B lines are suggestive of their involvement in male sterility. Cytoplasmic male steriles of Indian origin M35-1A and M31-2A showed greater similarity but differed from milo, VZM2A and B.

0850 WILKINSON, R.E., and CUMMINS, D.G. 1981. Epicuticular fatty acid, fatty alcohol, and alkane contents of bloom and bloomless sorghum 'redbine 60' leaves. *Crop Science* 21(3):397-400. 18 ref.

Waxes were extracted with chloroform, esterified, separated into classes via thin-layer chromatography, and quantitated via gas-liquid chromatography utilizing polar and non-polar columns and relative response curves from pure standard compounds. In leaves of equal density, leaves of the bloomless near-isogenic line had epicuticular fatty acid, fatty alcohol, and alkane contents that were 73, 118, and 1%, respectively, of those constituents on bloom leaves. There was a 57% reduction on the bloomless leaf of total fatty acids + fatty alcohols + alkanes compared to the bloom leaf. Fatty alcohols longer than C20 were absent from the epicuticular wax of the bloom line. Alkane contents longer than C32 were essentially absent from the bloomless line while the most prevalent alkanes present on the bloom line were C35-C37.

0851 WOODHEAD, S. 1981. Environmental and biotic factors affecting the phenolic content of different cultivars of *Sorghum bicolor*. *Journal of Chemical Ecology* 7(6):1035-1047. 18 ref.

Levels of phenolic acids in



healthy plants of Sorghum bicolor differ considerably with cultivar and always decrease as the plant matures. Laboratory- and field-grown plants showed significant differences in phenolics. Environmental factors, particularly light intensity, influenced the concentration of phenolics in sorghum. Attack by insects and pathogenic fungi also increased the phenolic content of the plants to varying degrees depending on the cultivar and the stage of growth of the plant.

0852 WOODHEAD, S., GALEFFI, C., and BETTOLO, G.B.M. 1981. p-Hydroxybenzaldehyde as a major constituent of the epicuticular wax of seedling Sorghum bicolor. Phytochemistry 21(2):455-456. 7 ref.

p-hydroxybenzaldehyde is present in concentrations upto 30% in the wax of Sorghum bicolor seedlings. It is highly deterrent to locusts, reducing their normal feeding by 90%.

0853 ZINSMEISTER, H.D., and ERB, N. 1981. Cyanogenic glycoside in cereal species of different climatic zones. (De). Lebensmittelchemie und gerichtliche Chemie 35:55. 6 ref.

## POSTHARVEST OPERATIONS

0854 ABDELRAHMAN, A.A., and FARRELL, E.P. 1981. Note on rate of water penetration into sorghum during tempering. Pages 185-191 In Improvement of pearl millet: third annual report 1979-80. Manhattan, Kansas, USA: Kansas State University.

To study the rate at which water penetrates sorghum kernels during tempering, autoradiographic technique and an electrical conductance moisture meter were used. Grain with initial moisture content of 10.8% absorbed more water than did grain with 12.5%. Rate of water absorption was higher in the beginning, and after 3 hrs. most of the water was absorbed into kernel.

Thereafter, water uptake was slow. The autoradiograms suggested that the rate of penetration through the bran and the germ was the same.

0855 ABDELRAHMAN, A.A., and FARRELL, E.P. 1981. Use of an electrical conductance moisture meter to study tempering rates in grain sorghum. Cereal chemistry 58(4):307-308. 17 ref.

The rate at which water penetrated sorghum kernels during tempering was affected by the initial moisture content of grain. Grain with an initial moisture content of 12.5% absorbed water faster than did grain having an initial moisture content of 10.8%. After 3 hours, water penetration was slow and not affected by initial grain moisture content. Initially all added water was at the surface of kernels which was absorbed into kernels as time progressed. Autoradiograms suggested that the rate of penetration through the bran and germ was the same.

0856 ABDELRAHMAN, A.A., and FARRELL, E.P. 1981. Grits from grain sorghum dry milled on roller mills. Cereal Chemistry 58(6):521-524. 10 ref.

Dry milling sorghum with a prebreak system produced grits with lower fat and ash contents than those in grits produced without a prebreak. As temper moisture increased, the yields of bran and fines (-30LW) increased and the quantity of grits decreased. The optimum tempering treatment for the production of grits with maximum yield and low fat content was 17% moisture and 8 hr of tempering.

0857 BULL, K.L., SCHAKE, L.M., and BYERS, F.M. 1981. Economic evaluation of corn and grain sorghum processing. Presented at the Joint Meeting of the Canadian Society of Animal Science, Western Branch, and American Society of Animal Science, Western Section, 23-25 June 1981, Vancouver, BC, Canada. 3 pp. 1 ref.

0858 CARVALHO, W.T.DE, GARCIA, J.A.,

and COELHO DA SILVA, J.F. 1981. The effect of heating, fermentation and grinding of sorghum and maize on in vitro carbohydrate and dry matter digestibility. (Pt). Revista da Sociedade Brasileira de Zootecnia 10(2):295-313. 42 ref. (Summary: En).

0859 DAVIS, W.L., SCHAKE, L.M., and LICHTENWALNER, R.E. 1981. Module storage of grain sorghum head chop silage for cattle. Progress Report, Texas Agricultural Experiment Station 3758/3830:57-59.

0860 DE FRANCISCO, A. 1981. Milling and cooking quality of pearl millet and grain sorghum. Ph.D. thesis, Kansas State University, Manhattan, Kansas, USA. 102 pp.

0861 DE FRANCISCO, A., SHEPHERD, A.D., HOSENEY, R.C., and VARRIANO-MARSTON, E. 1981. Decortication of pearl millet and grain sorghum in a laboratory abrasive mill. Pages 160-174 In Improvement of pearl millet: third annual report 1979-80. Manhattan, Kansas, USA: Kansas State University. 20 ref.

To determine whether decortication behavior could be used to differentiate millet and sorghum germplasm samples, microscope studies were conducted. Based on scanning electron micrographs, it was concluded that sorghum and millet follow different patterns due to inherent structural dissimilarities.

0862 DE FRANCISCO, A., VARRIANO-MARSTON, E., and HOSENEY, R.C. 1981. Hardness of pearl millet and grain sorghum. Pages 143-159 In Improvement of pearl millet: third annual report 1979-80. Manhattan, Kansas, USA: Kansas State University. 11 ref.

The hardness of various populations of pearl millet and cultivars of grain sorghum was determined by particle size analysis after milling the grains on attrition and roller mills. Millets grown in

Sudan were, softer than Kansas grown ones. However, kernel vitreosity did not parallel grain hardness as determined by particle size analysis. Furthermore, tempering either millet or sorghum before milling shifted the particle distribution to larger sizes compared with nontempered samples.

0863 DEFAY, G.H. 1981. Sorghum yield processing. (Fr). Thesis, Faculte d'Agronomie et de Medecine Veterinaire, Port-au-Prince, Haiti. 35 pp.

0864 GOLOB, P. 1981. A practical appraisal of on-farm storage losses and loss assessment methods in Malawi. I. The Shire Valley agricultural development area. Tropical Stored Products Information 40:5-13. 3 ref. (Summaries: Es, Fr).

Describes a survey of farm-level grain storage losses in southern Malawi and the practical problems of such surveys. The limitations of two different loss-assessment methods are discussed with regard to observed discrepancies but it is concluded that losses up to 10 months storage were 3% or less for maize and less than 2% for sorghum. Such losses demonstrate the suitability of the grain varieties stored in the area to conservation during the characteristic dry season. The considerable likelihood of greater losses with high-yielding but more susceptible varieties, if these were introduced to the area, is indicated.

0865 MANGARANG, C.C. 1981. Post-production technology of sorghum. Grains Journal 6(3):17-26. 15 ref.

An overview of grain sorghum postharvest losses, and postproduction technologies-indigenous as well as introduced in the Philippines is given. Long and short term research needs are outlined and recommendations are made to reduce the magnitude of the problems of postharvest handling and processing of sorghum.

0866 OOMAH, B.D., REICHERT, R.D., and YOUNGS, C.G. 1981. A novel,

multi-sample, tangential abrasive dehulling device (TADD). Cereal Chemistry 58(5):392-395. 13 ref.

The laboratory tangential abrasive dehulling device (TADD) described can process eight 10g. samples at a time to provide a measure of grain hardness and an extraction rate based on flour colour. When barley and grain sorghum were tested with TADD, coefficients of variation ranged from 1.0 to 3.8 for the percent kernel removed at a given time. For 31 samples of sorghum, the abrasive hardness index ranged from 5.0 to 12.8 and extraction rates from 69 to 98%.

0867 OOMAH, B.D., REICHERT, R.D., and YOUNGS, C.G. 1981. Quantitative comparison between carborundum stones and resinoid disks in dehulling cereal grains. Cereal Chemistry 58(6):492-496. 8 ref.

Three dehullers, one with coarse-grit carborundum stones, one with fine-grit carborundum stones, and one with medium-grit resinoid discs, were quantitatively compared using barley and sorghum as test grains. Power consumption, abrasion rates, and flour colour were measured at various speeds and times, and these factors were used to calculate throughputs and extraction rates. The resinoid discs and fine-grit stones gave a more selective removal of the outer layers of the kernels than the coarse-grit stones.

0868 PERTZ, G. 1981. Sorghum decortication. (Es). Pages 35-49 In Research on compound maize in Nicaragua. Managua, Nicaragua: Centro Nicaraguense de Informacion Tecnologica.

0869 PUSHPAMMA, P., and RAO, K.C. 1981. Varietal preference, marketing, storage, processing and utilization of sorghum and millets in Andhra Pradesh. Hyderabad, Andhra Pradesh, India: Andhra Pradesh Agricultural University, College of Home Science. 81 pp. 10 ref.

Forms a part of the report of the

Operational Research Project on "Stimulating rural women towards better utilization of local foods for combating malnutrition". Information collected from 2160 households of Andhra Pradesh during 1977-1980 has been analysed and presented in 5 chapters- varietal preferences; marketing and purchasing patterns; storage practices; processing and utilization of sorghum and millets in six districts of Andhra Pradesh.

0870 SCHAKE, L.M., and BULL, K.L. 1981. Estimates of corn and grain sorghum processing cost in commercial feedlots. Progress Report, Texas Agricultural Experiment Station 3758/3830:115-118. 1 ref.

0871 SCHAKE, L.M., ELLIS, W.C., SUAREZ, W.A., and RIGGS, J.K. 1981. Preservation of sorghum plant portions harvested at ten stages of maturity. Progress Report, Texas Agricultural Experiment Station 3758/3830:59-64.

0872 SHEPHERD, A.D. 1981. How a typical sorghum peels. Cereal Chemistry 58(4):303-306. 5 ref.

To elucidate the flaking phenomenon in an idealized situation, a combination of sorghum variety and milling conditions that were well suited to produce and preserve flakes, was chosen. Funk G-766W sorghum was selected for its endosperm hardness. Data showed that total, fine, and flake had a short induction period. Flakes were produced only once from surface, and therefore the amount was more limited than that of other fractions. In all the sorghums examined, flakes appear to result from cleavage in the mesocarp.

0873 SHEPHERD, A.D. 1981. Laboratory abrasive decorticating mill: influence of machine and operating variables. Cereal Chemistry 58(5):463-466. 1 ref.

A laboratory decorticating mill was studied to determine the effects of machine variables and an operational variable on decortication

## SEED AND SEED PRODUCTION

of a corneous white grain sorghum, Funk G-766V. Sample size had no significant effect on breakage when milling was to a constant 10% removed. When degree of decortication was fixed at about 10%, using coarse rather than fine abrasive, the amount of broken grain decreased. Breakage was lowest and nearly constant at low speed, regardless of blade count. Breakage increased as speed was raised but increased most with two blades and least with twelve.

0874 SHIRKIE, R. 1981. Making sorghum simpler. Mazingira 5(3):84-86.

0875 SOBRINHO, I.L., GARCIA, J.A., and COELHO DA SILVA, J.F. 1981. The effect of heating, fermentation and grinding of sorghum and maize on in vitro protein digestibility. (Pt). Revista da Sociedade Brasileira de Zootecnia 10(2):275-294. 39 ref. (Summary: En).

0876 TOURTE, R. 1981. Post-harvest intermediary technology does not include cereals: millet and sorghum. (Fr). Machinisme Agricole Tropical 75:46-52. 12 ref. (Summaries: En, Es).

Considers the economic and food role of millet and sorghum in Ldc's (70,000000 h). Reviews the reasons of the low yields achieved which could be doubled by applying mechanization (animal-drawn implements) and allowing the cost prices revaluation as presently decided by many countries. Another reason of the millet and sorghum stagnation- as compared with rice, wheat and maize- results from the constraints regarding the postharvest technology involved which are still totally traditional and manual. In addition to the traditional process, some postharvest channels are examined.

0877 TYLER, P.S. 1981. Reducing post-harvest grain losses by improving the traditional technology. Industry and Environment 4(1):14-16. 5 ref.

0878 DABHOLKAR, A.R., and TIKKA, S.B.S. 1981. Seed production in jowar. Indian Farming 31(6):5-9.

Guidelines are given for seed production in hybrids and improved varieties of Sorghum bicolor. A sowing plan of seed plot and isolation distance (in metres) from other crops including forage sorghum and Sorghum halepense are given to avoid cross fertilization. Parents of hybrids, flowering time, plant height and other features of parents used for hybrids CSH-1, CSH-5, CSH-6, CSH-9, CSH-7R, and CSH-8R are also listed.

0879 LIKHACHEV, B.S. 1981. Methods for determining sowing qualities of sorghum seeds. (Ru). Sel Semenovod 7:39.

0880 MAZZINI, N. 1981. Production techniques of sorghum and hybrid maize seeds. (Es). Agropecuaria 43-44:8-18.

0881 MENDOZA-CASTILLO, M., MENDOZA-RODRIGUEZ, M., and CARBALLO, A. 1981. Production of ecological hybrid seed of sorghum (Sorghum bicolor (L.) Moench). (Es). Chapingo 31-32:25-31. 8 ref.

0882 PALANIYAPPAN, K. 1981. Problems related to seed production and supply of breeder/foundation seeds. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 5 pp.

The developments in seed production techniques, the problems of availability of breeder/foundation seeds, and technological constraints are highlighted.

0883 POLUIAN, I.V. 1981. Experience of producing hybrid seed of sorghum crops. (Ru). Selektiya i Semenovodstvo 11:34-35.

0884 SINGH, A.R., and KATARE, R.A.

1981. Yield and quality of feed as influenced by the planting ratio and growing conditions in 2077A genotype of sorghum. Seed Research 9(1):32-34. 4 ref.

The field experiment conducted during rabi 1977-78 revealed that in the seed production of sorghum 2077A, the total yield as well as the production of standard graded seed were limited by the pollen abundance and the growing conditions.

0885 TENG, Y.T. 1981. The effect of storage conditions on the viability, vigour and storability of maize (*Zea mays* L.), sorghum (*Sorghum vulgare* L.) and soybean (*Glycine max* (L.) Merrill) seeds. MARDI Research Bulletin 9(1):24-34. 9 ref.

0886 TOY, J.J., GORZ, H.J., and HASKINS, F.A. 1981. Sorghum-sudangrass seed production by single and three-way crosses. Agronomy Abstracts 73:75.

A Sorghum bicolor x *S. sudanense* hybrid seed production study was conducted to compare the performance of male-sterile sorghum lines versus male-sterile sorghum F1 hybrids. A mixture of sudangrass cultivars and lines was utilized as the pollen source in these studies which were conducted at Mead, Nebraska, in 1979 and 1980. Nine different sorghum A-line6 and 36 sorghum male-sterile F1 hybrids were evaluated for several variables. In both years, the F1 hybrids had significantly higher grain yields than the individual lines. The average difference for both years was 28%. In both years, the F1 plants were significantly taller and earlier blooming than the lines, while the lines were significantly higher in percentages of crude protein and oil. Non-significant differences between F1 hybrids and lines were found in one of the two years for number of heads per row and 100-seed weight. These data indicate that the use of F1 hybrid male steriles in sorghum-sudangrass seed production may be advantageous. Additional study will be necessary to

determine whether the 3-way hybrids also have an advantage in forage production.

## UTILIZATION

### Feeds

0887 ANONYMOUS. 1981. Bovine feeding: trials with dried citrus pulp and grain sorghum (Es). Informacion Agropecuaria 3(15):40-45.

0888 AMERIO, M., SANTI, E., CERIOLI, C., and FIORENTINI, L. 1981. Nutritive value of sorghum grain: research on the possibility of increasing sorghum value at medium tannin level. (It). Zootechnica e Nutrizione Animale 7(4):1-20. 27 ref. (Summary: En).

Preliminary trials were carried out to increase the nutritive value of grain sorghum. Wet sorghum grains were ensiled in the small Siles with sodium hydroxide, ammonium hydroxide or formaldehyde. Tannin level, protein digestibility in vitro, rumen degradability of proteins, were reduced by formaldehyde treatment.

0889 ANDERSON, G.D., and RICHARDSON, C.R. 1981. Digestibility and feedlot performance of reconstituted or sodium hydroxide treated grain sorghum in ruminants. Journal of Animal Science 53(suppl 1):379. (Abstract).

Two experiments were conducted to determine the effects of feeding reconstituted or sodium hydroxide (NaOH) treated grain sorghum on digestibility and feedlot performance in lambs. The treatments used in both trials were; 1) sorghum, dry ground; 2) sorghum, reconstituted and rolled; 3) sorghum, NaOH-treated and rolled; and 4) sorghum, NaOH-treated whole. The results suggest that treating sorghum with sodium hydroxide may be a promising processing method for ruminant grain rations.

0890 BALIEIRO, E.D.S., SILVA, H.M., CARNEIRO, G.G., and SALVO, A.E.W.

1981. Reproductive efficiency in milking zebu guzera. 2. Calving interval. (Pt). Arquivos da Escola de Veterinaria Universidade Federal de Minas Gerais 33(3):489-496.
- 0891 BAXTER, H.D., MONTGOMERY, M.J., and OWEN, J.R. 1981. A preliminary report on a comparison of soybean-grain sorghum silage with corn-silage for lactating cows. Tennessee Farm and Home Science 120:2-5. 5 ref.
- Silage made from a non-bird resistant type grain sorghum and soybeans does not appear to be a suitable alternative crop to corn silage for dairy cows in two tests conducted at the Dairy Experiment Station. Differences noted were: 1) the yield of soybean-sorghum silage per acre was less than corn silage each year, 2) the cost per ton of silage was greater for soybean-sorghum silage than corn silage, 3) fat-corrected-milk production per cow was from 3.4 to 4.3 lbs. less per day on soybean-sorghum silage than on corn silage, 4) voluntary intake of soybean-sorghum silage was lower than for corn silage, and 5) weeds are a greater problem in the soybean-sorghum crop.
- 0892 BOLSEN, K.K. 1981. Cold-flo (NPN) and NaOH additives for maize and sorghum silages. Proceedings, Sixth Silage Conference, 1981, Edinburgh, UK. Edinburgh, UK: Edinburgh School of Agriculture.
- 0893 BOLSEN, K.K., and ILG, H.J. 1981. Inoculant enzyme nonprotein nitrogen or sodium hydroxide additives for corn and sorghum silages: cattle performance. Journal of Animal Science 53(suppl 1):382. (Abstract).
- 0894 BOLSEN, K.K., and ILG, H.J. 1981. Inoculant enzyme nonprotein nitrogen or sodium hydroxide additives for corn and sorghum silages: fermentation and aerobic stability. Journal of Animal Science 53(suppl 1):382-383.
- 0895 BOLSEN, K.K., WRIGHT, V.F., ILG, H.J., MILLS, R.B., and LAYTIMI, A. 1981. Feeding value of insect and fungal damaged sorghum grain for lambs. Journal of Animal Science 53(suppl 1):383-384. (Abstract).
- 0896 BONNEFOY, D., DIDIER, G., and HEBRARD. 1981. Study of the effect of rationing whole plant sorghum silage on young "Friesian" bulls. (Fr). Paris, France: Institut Technique de l'Elevage Bovin. 20 pp.
- 0897 BRETHOUR, J.R. 1981. Response to a methane inhibitor fed with monensin or lasalocid to steers. Journal of Animal Science 53(suppl 1):385. (Abstract).
- A methane inhibitor, ICI 11/075 (ICI), was fed with or without monensin (M) or lasalocid (L) to 260 kg steers in two trials. Trial 1 ration included 64% sorghum silage, 30% sorghum grain, 4% soybean meal, 0.5% urea, 0.5% ammonium sulfate and 0.6% ground limestone. In trial 2 more silage (82%) and less grain (12%) were fed. Results for 22 head per treatment were pooled. Gains were 6% less when ICI was added alone but 7% more when it was fed with M or L. Feed efficiency was improved 1% by ICI alone but 12% when it was combined with M or L.
- 0898 BURRIS, W.R., HOVERMALE, C.H., MCKIE, J.W., and ESSIG, H.W. 1981. Corn or sorghum silage diets fed at two energy levels for finishing steers. Research Report, Mississippi Agricultural and Forestry Experiment Station 6(11):1-4. 12 ref.
- A trial of 140 days was conducted to compare the value of corn silage and sorghum silage for finishing steers in confinement. Results indicated that though the corn silage was better than sorghum silage for finishing steers, sorghum could be produced under a variety of conditions unlike corn. Sorghum silage gave good results when supplemented with adequate amount of corn.

0899 BYERS, F.M. 1981. Energy value of forages in grain diets. Progress Report, Texas Agricultural Experiment Station 3758/3830:50-51. 6 ref.

A split phase system of feeding forage before feeding grain resulted in an 8.4% improvement in efficiency of feedstuff energy use when compared to a system of feeding a constant proportion of forage and grain daily throughout the total feeding period. This system could save the equivalent of 1/2 ton of corn silage per animal fed. Overall average daily gain was identical with either system. These data, in concert with other recent research, document the need to consider feeding system alternatives in scheduling the time and level of forage or grain feeding to realize the full potential of energy conversion from harvested forages (corn silage, sorghum silage) to beef.

0900 CARTER, E.G.A., and CARPENTER, K.J. 1981. Bound niacin in sorghum and its availability. Nutrition Research 1(6):571-579. 27 ref.

Two varieties of Sorghum bicolor, milo and jowar, were studied. Samples cooked at neutral pH gave total niacin values of 46 and 29 mg/kg, respectively, on an air-dry basis. In extracts made from these at neutral pH and fractionated after gel-filtration, most of the niacin was in high molecular weight (i.e., bound) forms. In a bioassay for niacin, the boiled milo gave a growth response equivalent to 34% of its total niacin being available to young rats. Sorghum has behaved similarly to other mature cereal grains in these tests of niacin availability.

0901 CERVATO, G. 1981. Sorghum for fodder. (It). Terra e Vita 22(42):48.

0902 COUSINS, B.W., TANKSLEY, T.D., Jr., KNABE, D.A., and ZEBROWSKA, T. 1981. Nutrient digestibility and performance of pigs fed sorghums varying in tannin concentration. Journal of Animal Science

53(6):1524-1537. 40 ref.

Four sorghums, ranging widely in tannin content, and yellow corn were evaluated in two 5 x 5 Latin square digestion trials and a growth trial. All grains were grown in the same field under similar conditions. The sorghums and their tannin contents were: Ga615, 3.40; NK300, 3.17; TAM680, 0.83, and G766-W, 0.88. Diets were supplemented with casein to provide 0.70 and 0.60% lysine in digestion trials 1 and 2, respectively. In trial 1, digestibilities of dry matter, gross energy and N averaged for the low tannin sorghums were higher ( $P^{1/4}0.01$ ) than the corresponding digestibilities averaged for the high tannin sorghums. In trial 2, digestibilities of dry matter, gross energy, N and all amino acids again averaged higher ( $P^{1/4}0.01$ ) for the low tannin sorghums, whether measured at the end of the small intestine or over the total digestive tract. Among the amino acids, digestibilities of glycine, proline and histidine appeared to be the most depressed in the high tannin sorghums. Digestibilities of most nutrients were higher for NK300 than Ga615, suggesting a difference in type of tannin, or other compound, between the grains. Corn and the low tannin sorghums, averaged together, had similar digestibilities for most nutrients.

0903 COUTINO A., J.L., and RIQUELME V., E. 1981. Use of cocoa husks as a sorghum substitute in supplements for grazing cattle. (Es). Chapingo 31/32:74-78.

0904 CRAMER, D.A., and MCKEAN, M.C. 1981. Long-term storage stability of forage fed beef and grain fed beef. Journal of Animal Science 53(suppl 1):512.

0905 DAVIS, G.V. 1981. Nutritive value of ammoniated residues of wheat corn and grain sorghum for growing feed lot steers. Journal of Animal Science 53(suppl 1):393. (Abstract).

Three feedlot trials with a total of 480 growing steers compared ammoniated residues of wheat straw (WS), corn stover (CS) and grain sorghum stover (SS) fed at 25 or 40% of the diet (dry basis). Results showed that diets containing 25% ammoniated residues of (1) WS or (2) CS increased ADG and F1, and reduced F/G, respectively: (1) 21, 8 and 11%; (2) 10, 7 and 3%. Ammoniation of SS did not improve its nutritive value. The AWS diet that contained 10.5% CP (excluding CP from AWS) gave the best animal performance.

0906 DENNIS, S.M., NAGARAJA, T.G., and BARTLEY, E.E. 1981. Effect of lasalocid or monensin on lactate production from in vitro rumen fermentation of various carbohydrates. Journal of Dairy Science 64(12):2350-2356. 24 ref.

Lasalocid and monensin effectively reduced the lactate produced during in vitro fermentation of various sugars and ground grain B with rumen fluid from either hay- or grain-fed cattle. The minimum effective dose was 6 micrograms/ml which reduced the fermentation rate of glucose, fructose, galactose, sucrose, lactate, mannose, ground corn, ground sorghum, and ground wheat, and raised the pH and substantially lowered lactate concentration compared with controls. Although both antibiotics decreased total lactate production, the proportion of D(-) lactate to L(+) lactate increased. Both were less inhibitory to the formation of D(-) than to L(+) lactate isomer. Lasalocid was more effective than monensin in inhibiting lactate production except when rumen fluid from grain-fed cattle was used in fermentation.

0907 DESHMUKH, A.P., and CHAVAN, I.G. 1981. Raising murrah buffalo calves on a limited quantity of whole milk and milk substitute. Journal of Maharashtra Agricultural Universities 6(2):134-137. 6 ref.

An experiment was conducted on 10

male and 10 female Murrah buffalo calves to study the effect of feeding limited quantity of whole milk supplemented with milk substitute on their growth rate from birth to 26 weeks of age. The control groups of male and female (5 each) calves received 194.54 and 186.75 lit. of whole milk, 484.19 and 467.83 lit. separated milk each, respectively. The experimental groups of male and female (5 each) calves received 69.79 and 62.98 lit. of whole milk, 136.700 and 126.410 lit. of separated milk alongwith 75.25 kg milk substitute each, respectively. In addition to above, the control and experimental groups of both the sexes received 63.0 kg concentrate mixture, 100.0 kg dry jowar kadbi and 70.0 kg green lucerne. It was observed that the difference in gain in body weight, heart girth, height and body length of control and experimental calves was not significantly affected by two different feeding regimes. The average cost of one kg gain in body weight in male and female calves in control group was Rs.10.87 and Rs.10.33 while it was Rs.5.64 and Rs.5.44 in experimental male and female calves, respectively.

0908 ELY, L.O., SUDWEEKS, E.M., and MOON, N.J. 1981. Inoculation with Lactobacillus plantarum of alfalfa, corn, sorghum, and wheat silages. Journal of Dairy Science 64(12):2378-2387. 26 ref.

Alfalfa, corn, sorghum, and wheat forages were harvested for ensiling. Effects of inoculation of the forages with Lactobacillus plantarum 10 million/g silage) were studied in small experimental 55 kg drum silos. Control and treated silages were prepared, and drums from each treatment were opened on days 1, 2, 4, 8, 16, and 33. Proximate analysis, pH, neutral detergent fiber, acid detergent fiber, soluble carbohydrate, lactic acid, and volatile fatty acid contents were measured. Total facultative anaerobic microflora, lactobacilli, lactic acid cocci, yeasts, and mold populations were



measured. Total facultative anaerobic microflora were increased in all silages by addition of *L. plantarum*, and numbers of lactobacilli were increased in all but corn silage. Yeasts and molds were lower only in inoculated alfalfa and wheat silages. The effect of the inoculum was observed on chemical composition only for alfalfa and wheat silages. These treated silages had a lower pH, higher lactic acid content, and greater recovery of dry matter, crude protein, and detergent fiber (alfalfa) and nitrogen-free extract (wheat). Inoculation has an effect on microflora in all silages and a positive beneficial effect on nutrient recovery in alfalfa and wheat silages.

0909 FARRELL, D.J. 1981. An assessment of quick bioassays for determining the true metabolizable energy and apparent metabolizable energy of poultry feedstuffs. World's Poultry Science Association Journal 37(2):72-83. 47 ref. (Summaries: De, Fr, Ru).

Critical assessment is made of the validity of the true metabolizable energy (TME) method of determining the energy content of feed ingredients. Data are presented which indicate that the endogenous excreta output of adult cockerels is influenced by the neutral detergent fibre (NDF) content of the diet. For individual diets, values varied from 12.4 to 21 kcal/32 hours. Diets containing either 100% rice hulls, or a mixture containing 20% rice hulls and 80% sorghum, had similar endogenous excreta outputs of about 20 kcal/32 hours; it appears that about 21 kcal/32 hours is a ceiling value for endogenous excreta of fed adult cockerels. This value is achieved at a NDF of about 12%. Thus use of starved birds to provide the endogenous excreta correction to the excreta of the force-fed birds may be inappropriate for some feedstuffs and lead to incorrect TME values.

0910 FRESNILLO M., O., and ALCHUNDIA Z., H.A. 1981. Correlation between

quality and quantity of milk and components of three silages: maize (*Zea mays* L.), sorghum (*Sorghum vulgare* Pers.), sudax (*Sorghum vulgare* Pers. x *Sorghum vulgare* var. *sudanensis*). (Es). Page 194 In XVII informe de investigacion, 1979-80. Monterrey, Nuevo Leon, Mexico: Instituto Tecnologico de Monterrey, Division de Ciencias Agropecuarias y Maritimas.

0911 FRESNILLO M., O., and KIPPER L., G. 1981. Digestibility of sorghum straw treated with sodium hydroxide when dry. (Es). Page 198 In XVII informe de investigacion, 1979-80. Monterrey, Nuevo Leon, Mexico: Instituto Tecnologico de Monterrey, Division de Ciencias Agropecuarias y Maritimas.

0912 GALYEAN, M.L., WAGNER, D.G., and OWENS, F.N. 1981. Dry matter and starch disappearance of corn and sorghum as influenced by particle size and processing. Journal of Dairy Science 64(9):1804-1812. 15 ref.

Processed corn or sorghum grain was sieved to obtain particle size fractions and incubated ruminally, by nylon bag technique, to assess the effect of particle size and processing on dry matter and starch disappearance. Studies demonstrate that processing by steam flaking or high moisture harvesting produces additive effects beyond those of particle size alone. Furthermore, particle size appears to have more influence on dry matter and starch disappearance of unprocessed than processed corn, especially steam flaked corn. Interactions of processing method were with both particle size and incubation time. Processing and particle size effects appear to be important during shorter (2 to 8 h) as well as longer incubation (12 or 24 h).

0913 GARDINER, E.E. 1981. Substitution of sorghum for wheat in laying hens diets. Pages 2-3 In Research review. Agassiz, BC, Canada: Research Station.

0914 GARDINER, E.E., DUBETZ, S., and MAJOR, D.J. 1981. Sorghum, wheat and corn in diets for broiler chicks. Canadian Journal of Animal Science 61(2):511-513. 8 ref. (Summary: Fr).

Sorghum, wheat or corn in soybean meal-based diets with four levels of supplemental methionine were compared for broiler chick growth from 0 to 28 days of age. Wheat and corn supported more rapid weight gains and lower feed-to-gain ratios than did, sorghum, regardless of added methionine. A response in rate of gain and feed-to-gain ratios was obtained with the added levels of methionine with each of the three grains.

0915 GATICA RAMIREZ, O., RIQUELME VILLAGRAN, E., and RINCOREYES, R.M. 1981. Utilization of sorghum and maize hays and silages and of maize stubble by holstein calves. (Es). Chapingo 29/30:61-65. 10 ref.

0916 GERA, K.L., NANDAN, D., NIGAM, J.M., and TYAGI, R.P.S. 1981. Effect of feeding Triticum aestivum and Sorghum vulgare on the excretion of some biochemical constituents in the urine in bovine calves. Haryana Veterinarian 20(1):19-21. 17 ref.

0917 GHEBRIEL, A.W., KELLOGG, D.W., and MILLER, D.D. 1981. Effect of sodium hydroxide treatment of sorghum silage on lactation of cows and on in vitro digestion. Journal of Dairy Science 64(5):792-797. 28 ref.

About 40t of chopped sorghum forage (silage variety) was treated with 4% (by weight dry) sodium hydroxide at ensiling in a plastic bag. Another 40t of the forage was ensiled without treatment in the same bag. Early in fermentation pH was higher in treated forage, but by day 21 pH was about 4.0, and amounts of acid were similar in treated and control silage. In a feeding trial eight cows receiving treated silage after 6-wk ensiling produced 21.2 kg milk with 2.83% fat; eight cows fed

control silage produced 19.9 kg milk containing 2.77% fat. Mean in vitro dry matter disappearance was 58.8 and 52.1% for weekly samples of treated and control silage. Freeze-dried samples of both treated and control silages were treated with an additional 4% sodium hydroxide and 1% nitrogen from urea (by weight dry) in a 2 x 2 factorial arrangement. Laboratory treatment with alkali increased in vitro dry matter disappearance of dried sorghum silage and interacted significantly with nitrogen supplementation. Apparently treatment of wet sorghum forage with 4% dry sodium hydroxide produced a satisfactory feed but did not achieve maximum improvement in in vitro dry matter disappearance of the silage.

0918 GROSSU, D., BURLACU, G., and STAVRI, J. 1981. Energetic nutritive value of the wheat, maize and sorghum administered in fowls feed. (Ro). Lucrari Stiintifice ale Institutului de Cercetari Pentru Nutritia Animalelor 9-10: 175-183. 19 ref. (Summaries: De, En, Fr, Ru).

0919 GUPTA, P.C., SINGH, P., and SHARDA, D.P. 1981. Use of sorghum in the ration of livestock. Livestock Adviser 6(7):5-8. 11 ref.

0920 GUTIERREZ, G., SCHAKE, L.M., and BYERS, F.M. 1981. Effect of whole-plant grain sorghum silage processing methods and lasalocid sodium on stocker calf performance. Progress Report, Texas Agricultural Experiment Station 3758/3830:52-54. 5 ref.

Two experiments were conducted to determine the effects of processing whole-plant grain sorghum silage on stocker calf performance and in vivo digestibilities and to evaluate different lasalocid sodium levels on calf performance and rumen fermentation. Two silage treatments and three levels of lasalocid were compared in a growth trial. Dry matter intake and animal weight gains were greater for the whole-plant grain

sorghum silage with whole grain than for grain sorghum silage with pre-ensiled rolled grain. No significant differences in rumen fermentation were found between silage treatments. Lasalocid sodium significantly depressed feed intake and improved feed efficiency at 33 parts per million (ppm).

0921 HATHCOCK, B.R., and CULVAHOUSE, E.W. 1981. In vitro dry matter digestibility of bird resistant and non-bird resistant sorghum grain. Tennessee Farm and Home Science 119:7-8. 10 ref.

Reports a study to estimate the in vitro dry matter digestibility (lVDMD) of grain from 10 non-bird resistant (NBR) and 10 bird resistant (BR) sorghum varieties and to compare them to the digestibility of no.2 yellow corn. No significant difference was observed among the NBR varieties for lVDMD. Corn and NBR varieties were higher in digestibility than BR varieties. lVDMD among BR varieties ranged from 69.9% to 58.6%.

0922 HEJDKER, J.I., 11G, H.J., BEHNKE, K., and BOLSEN, K.K. 1981. High moisture grain sorghum for finishing cattle. Journal of Animal Science 53(suppl 1):123. (Abstract).

0923 HENNESSY, D.W., WILLIAMSON, P.J., LOWE, R.F., and BALGENT, D.F.. 1981. The role of protein supplements in nutrition of young grazing cattle and their subsequent productivity. Journal of Agricultural Science, Cambridge 96(1):205-212. 25 ref.

The effects of supplements of protein or sorghum grain given to young cattle for 140 days during their first winter and spring post-weaning, were recorded over 560 days for cattle grazing on low quality pastures in subtropical Australia. At the end of first spring, first summer, and second summer the live weight of steers supplemented daily and twice-weekly with proteins was found heavier than the sorghum-supplemented or control steers. It was concluded that the

improved growth of the steers due to protein supplements is associated with an increased availability of specific essential amino acids.

0924 HEROLD, I., and PALAGYI, A. 1981. Comparison of nutritive value of feeding grains on basis of chemical analysis and feeding trials. (Hu). Allattenyesztes es Takarmanyozas 30(2):133-139. 1 ref. (Summary: En).

The crude composition and amino acid composition of 2 barley, 2 oat and 3 sorghum breeds and also the digestibility of their nutrients and utilization of their protein content was determined in comparative studies. The feeding trials were carried out on white rats and wethers. From feeding point of view GK-59 barley, the Szeged early-spring oat and the Hybar 456 sorghum showed the best results. The better quality was generally associated with higher yield per ha. However the Hyber 242 and GK-Tisza sorghum breeds had inverse ratio between yield and feeding value. This controversion should be eliminated by further genetic work.

0925 HEROLD, I., and PALAGYI, A. 1981. Comparative evaluation of nutritive value of several barley, oat and sorghum breeds. (Hu). Allattenyesztes es Takarmanyozas 30(5):461-466. 6 ref. (Summary: En).

Examinations were carried out with 3 barley, 4 oat and 5 sorghum breeds. Both in the field of selection and nutrition the exclusive endeavour for obtaining increasing quantities should be given up, the authors suggest. The nutritive value and nutrient production per unit area of the breeds should be taken into consideration. The importance of this conclusion is underlined by the results of the present investigation which indicated considerable variations in the crude composition, nutritive value, amino acid composition, essential amino acid content and productivity of breeds.

0926 HIBBERD, C.A., HINTZ, R.L., and WAGNER, D.G. 1981. Effect of stage of maturity or reconstitution on sorghum chemical composition and in vitro dry matter disappearance. Journal of Animal Science 53(suppl 1):405-406. (Abstract).

0927 HIJIKURO, S., and TAKEMASA, M. 1981. Studies on the palatability and utilization of some whole grains for finishing broilers. (Ja). Japanese Poultry Science 18(5):301-306. 2 ref. (Summary. En).

0928 HOMB, T., MATRE, T., and BREIRRM, K. 1981. A comparison of four grain species as feeds for growing-finishing pigs, with special emphasis on oats. (No). Aas, Norway: Norges Landbrukshoegskole, Institutt fuer Husdyrernaering. 25 pp. 39 ref. (Summary: En).

Growing-finishing pigs were fed meal of maize, grain sorghum, barley, and oats. These feeds have been compared in growth experiments with 18 individually fed pigs in each group. Digestibility of organic matter in average for four pigs (Latin square) was 91, 93, 87 and 71 for maize, grain sorghum, barley and oats respectively. Though the fat quality of the pork from oat-fed pigs is not fully solved, it was concluded that 50% of the grain may be oats, besides barley, in feeding growing pigs.

0929 ILG, H.J., BOLSEN, K.K., and MORRISON, E. 1981. Sorghum silage and commercial taste supplement rations for feeder lambs. Journal of Animal Science 53(suppl 1):110-111. (Abstract).

0930 KARAU, P.K. 1981. The effect of fiber modification in sorghum silage on chemical composition and animal utilization. Ph.D. thesis, Mississippi State University, Mississippi, USA. 89 pp.

0931 KEMM, E.H., DAIBER, K.H., and RAS, M.N. 1981. A comparison between formaldehyde treated and untreated

birdproof grain sorghum in a pig growth diet. (Af). South African Journal of Animal Science 11(1):7-10. 16 ref. (Summary: En).

An experiment was conducted (1) to determine the effect of formaldehyde treatment on the protein digestibility, nitrogen retention and energy digestibility of birdproof grain sorghum, and (2) to evaluate the effect of treated grain, when used as a grain component in a growth diet, on the growth rate and ability of baconers to utilize feed. Formaldehyde treatment significantly ( $P^{1/4} 0.05$ ) improved protein digestibility from 55.7 to 73.2%. Pigs fed treated grain excreted significantly ( $P^{1/4} 0.05$ ) more urinary nitrogen, resulting in a small insignificant difference in N-retention, which suggests a low protein availability in treated grain. Energy digestibility was significantly ( $P^{1/4} 0.05$ ) improved from 81.8 to 84.2% while a highly significant improvement was observed in the DE content of the grain from 15.0 MJ/kg DM to 15.52 MJ.

0932 KLOPFENSTEIN, C.F. 1981. Effects of pearl millet and sorghum diets on growth rates and cholesterol levels in guinea pigs. Pages 175-184 In Improvement of pearl millet: third annual report 1979-80. Manhattan, Kansas, USA: Kansas State University. 10 ref.

After about 40 days of the experiment, animals eating sorghum and sorghum endosperm diets were growing poorly, were lethargic, and had poor coats. It was assumed that the animals had pellagra, and 1 mg nicotinic acid/day for 11 to 16 day6 was administered. The nicotinic acid alleviated most of the symptoms but did not significantly improve growth rate. Animals on the ascorbic acid-supplemented sorghum diets did not exhibit the symptoms described above and remained healthy throughout the experiment. This study confirmed that ascorbic acid-supplemented sorghum diets exert a cholesterol-lowering effect in guinea

pig serum and liver.

0933 KLOPFENSTEIN, C.F., HOSENEY, R.C., and VARRIANO-MARSTON, E. 1981. Effects of ascorbic acid in guinea pigs fed millet and sorghum grain diets. Nutrition Reports International 24(6):1099-1107. 17 ref.

Pearl millet, sorghum bran, and whole-sorghum grain diets supplemented with 60 mg ascorbic acid/day produced healthy guinea pigs that grew well throughout the experiment. Whole-sorghum grain and sorghum endosperm diets supplemented with 20 mg ascorbic acid/day produced poor growth and unhealthy appearing animals, which nicotinamide supplementation improved. If animals fed whole-sorghum grain or sorghum endosperm diets grew poorly because the grain's high leucine content led to niacin deficiency, then supplementing the diets with high levels of ascorbic acid appeared to have a niacin-sparing effect. After 62 days, serum cholesterol was lower in the whole sorghum plus high ascorbic acid-fed animals than in those fed whole sorghum, sorghum endosperm, or sorghum bran diets with low ascorbic acid. Thus, the cholesterol-lowering effect apparently was not associated with any specific chemical component in a particular anatomical portion of the grain, but depended on ascorbic acid supplementation level.

0934 KLOPFENSTEIN, C.F., VARRIANO-MARSTON, E., and HOSENEY, R.C. 1981. Cholesterol-lowering effect of sorghum diet in guinea pigs. Nutrition Reports International 24(3):621-627. 34 ref.

Guinea pigs fed grain sorghum diets had lower liver cholesterol concentrations than animals fed whole wheat, rolled oats, or pearl millet, diets ( $P < 0.01$ ). None of the animals became hypercholesterolemic when fed 0.1% cholesterol, but liver cholesterol values were elevated when wheat, oats, and millet diets were

fed. Values were within the normal range for control (nongrain diet) animals and lower than average for sorghum-fed animals. Liver weight-animal weight ratios were higher in pearl millet-fed animals than in control-fed animals. Growth rates of guinea pigs in all groups were statistically equivalent.

0935 KLOPFENSTEIN, C.F., VARRIANO-MARSTON, E., and HOSENEY, R.C. 1981. Effects of ascorbic acid in casein vs. sorghum grain diets in guinea pigs. Nutrition Reports International 24(5):1017-1028. 32 ref.

During the first three weeks of feeding a casein-based diet, growth rates of guinea pigs were enhanced by supplementing the diets with 40 mg ascorbic acid (AA)/day. During that same period, equal growth rates were obtained for animals fed casein diets supplemented with 2 mg AA/day and sorghum-based diets supplemented with 2 or 40 mg AA/day. Conversely, after the third week, growth rates of sorghum fed animals receiving 2 mg AA/day were less than for animals receiving 40 mg/day. Animals fed casein diets supplemented with 40 mg AA/day had higher cholesterol levels after 40 days than animals fed other diets. Supplementing a casein-based diet with 40 mg ascorbic acid/day elevated liver cholesterol. Both ascorbic acid supplementation level and type of diet influenced liver and serum copper and zinc concentrations.

0936 LEE, P.K., and YANG, Y.F. 1981. Study on digestibility of crude protein and energy with pigs fed on diets containing locally produced maize meal, sorghum grains, sweet potato chips or cassava meal. (Ch). Taiwan Livestock Research 14(1):65-74. 22 ref. (Summary: En).

Reports study to determine the digestion coefficients of crude protein and energy with the pigs fed on diets containing corn meal, sorghum grains, sweet potato chips or cassava meal locally produced which contained

crude protein, crude fiber, gross energy 2.28% 3385 Kcal/kg, 7.53%, 2.34%, 3609 Kcal/kg; 4.95%, 2.43%, 3547 Kcal/kg; 1.41%, 2.22%, 3420 Kcal/kg respectively. Results showed that the corn meal had the highest crude protein content with the highest digestibility of crude protein, sorghum grains the second; sweet potato chips the third; cassava meal, the lowest. It also showed that the sweet potato chips had the highest energy digestibility with the highest digestible energy content; followed by corn meal, cassava meal, sorghum grains in order. Sweet potato chips and corn meal had higher total digestible nutrients than cassava meal and sorghum grains according to the results of the swine digestion trial.

0937 LIPPKE, B. 1981. Digestibility and selective intake of ryegrass and sorghum silages by yearling steers. Progress Report, Texas Agricultural Experiment Station 3758/3830:16-17. 1 ref.

Ryegrass and sorghum silages were offered in various proportions to 14 yearling steers to determine intake and digestibility of diets selected. Intake and digestibility increased as the proportion of ryegrass in the diet increased and reached a maximum when intake was 2.8 percent of body weight and digestible organic matter was about 65 percent.

0938 MCCULLOUGH, M.E., WORLEY, E.E., and SISK, L.R. 1981. Evaluation of sorghum silage as a feedstuff for growing cattle. Research Report, Georgia Agriculture Experiment Stations no.366. 17 pp. 2 ref.

Seven experiments were conducted to evaluate sorghum silage in comparison to corn silage as a feedstuff for growing cattle. Results showed that sorghum harvested before head formation was complete and had a dry matter digestibility above 60%. At best, sorghum silage will have 80% to 85% of the digestibility of good corn silage. To compensate for lower energy value, addition of feedstuff or

appropriate fermentation at ensiling will improve the digestibility. Feed additives such as rumensin, vita-ferm and Bospro have resulted in improved animal performance.

0939 MCKEAN, M.C., and CRAMER, D.A. 1981. Production of cross bred steers on 3 pasture treatments with and without subsequent concentrate feeding. Journal of Animal Science 53(suppl 1):489-490. (Abstract).

0940 MELOTTI, L., and CAIELL, E.L. 1981. Nutritive value of two sorghum silages Funk's 77F and Funk's 788A evaluated with sheep. (Pt). Boletim de Industria Animal, Nova Odessa, SP 38(1):77-83. 17 ref. (Summary: En).

The averages digestion coefficients for Funk's 77 and 788A were, dry matter 48.81% and 49.82%, organic matter 49.42% and 52.98%, crude protein 52.24% and 41.98%, crude fiber 49.88% and 64.25%, ether extract 83.79% and 77.86%, nitrogen free extract 51.73% and 54.41%, grass energy 49.77% and 56.70% respectively. TDN values were 54.93% and 59.72% respectively for Funk's 77 and 788A.

0941 MOLLAH, Y., and ANNISON, E.F. 1981. Prediction of metabolizable energy of wheat, maize, and sorghum in poultry diets from chemical composition. Proceedings of the Nutrition Society of Australia-Annual Conference 6:137. 4 ref.

Stepwise regression analysis of the metabolizable energy (ME) and chemical composition of seven samples of maize, six of wheat and six of sorghum showed that ME could be predicted accurately from chemical composition only in the case of maize. With wheat and sorghum, ME was not well-correlated with starch content, suggesting incomplete digestion of starch in the bird.

0942 MORDANT, D.G. 1981. The utilization of agricultural and industrial by-products by the non ruminants in South Africa. South African Journal of Animal Science

11(2):153-157.

Describes feed production in South Africa, industrial processes involved and their by-products used as feed. Annual production of by-products, their percentage utilization by different categories of non-ruminants, and their contribution to the supply of crude protein and lysine to non-ruminant feeding is also outlined. Brewer grains prepared as by-products of sorghum beer production process is one among the important feeds used in South Africa.

0943 MORGAN, E.B., NELSON, B., ZERINGUE, L., SCHILLING, P.E., and MONTGOMERY, C.R. 1981. Response of holstein cows fed either sorghum or corn silage with concentrate rations of different protein content 1980-81. Pages 106-121 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Silages of bird-susceptible grain sorghum, bird resistant grain sorghum, and forage-type sorghum were compared with two corn silages to measure their milk production potential when fed to lactating Holstein cows receiving grain rations containing 20, 32 or 40% crude protein. Milk production of individual cows was recorded twice daily and averaged by 10-day period. Results indicated that the silages did not differ significantly in actual or 4% FCM production potential nor in milk butter fat content. Only when milk production was expressed as a percentage of beginning level, significant differences were evidenced. Dekalb XL-80 corn silage was superior to silages of Funk's G-4611 corn, Dekalb BR-64 grain sorghum, and Funk's 622GBR grain sorghum.

0944 MUDRIK, Z., BLAHA, J., and CHRISTODOULOU, V. 1981. Replacement of maize by sorghum in feed mixtures for broilers. (Cs). Krmivarstvi a Sluzby 17(12):263-265.

0945 MUINDI, P.J., and THOMKE, S. 1981. Metabolic studies with laying hens on Tanzanian sorghum grains of different tannin contents. Swedish Journal of Agricultural Research 11(1):17-21. 21 ref.

Studies with laying hens were conducted to determine the digestibility of nutrients and the content of metabolizable energy (ME) of three sorghum grain varieties grown in Tanzania with tannin contents of 0.5, 0.7 and 1.3% of dry matter. The experiments were performed with diets containing 40% of a commercial concentrate premixture and 60% of the test grains. The digestibility of crude protein (CP) (but not of other nutrients) was significantly ( $P^{1/4}$  0.01) lowered by increasing tannin content. The ME contents of the three sorghum varieties corrected for N-retention were 15.3, 15.3 and 15.3 MJ/kg dry matter respectively.

0946 MUINDI, P.J., and THOMKE, S. 1981. The nutritive value for rats of high- and low-tannin sorghums treated with magadi soda. Journal of the Science of Food and Agriculture 32(2):139-145. 28 ref.

Grain sorghums containing 1.3, 0.7 and 0.5% tannins were treated with unrefined Magadi soda (37.5 g/litre) for 3 days at 25 deg C and evaluated in a bioassay with male weanling rats. The alkaline treatment of the samples containing 1.3 and 0.7% tannins was found to significantly increase the digestibility of crude protein, crude carbohydrates and energy and to improve the biological value (BV) of the protein. Such an effect was not found for the third sorghum cultivar (0.5% tannins).

0947 NARKHEDE, P.N., KADUSKAR, M.R., and THATTE, V.R. 1981. Replacement of maize by jowar (grain sorghum) in layer rations. Indian Journal of Poultry Science 16(4):403-405.

0948 NEITZ, M.H., VAN ZYL, J.R., and HARTMAN, C.L. 1981. The nutritive value of sorghum hay, supplemented by

concentrates in different ratios, and fed to high and low producing Friesland cows and first calf heifers. South African Journal of Animal Science 11(1):1-6. 11 ref. (Summary: Af).

The possible use of sorghum hay in the production of milk by high and low yielding Friesland cows and first calf heifers was investigated and its influence on milk composition was determined. The animals were divided into four production groups, and 12 lactating cows and 12 first calf heifers were subjected to a trial having an extra period Latin Square rotating changeover design. Three complete rations with varying sorghum hay (S) to concentrate (C) ratios were fed, viz. 20S:80C, 40S:60C and 60S:40C. Whereas a higher milk production was obtained by decreasing the ratio of sorghum hay to concentrate from 60S:40C to 40S:60C, similar improvement could not be obtained by decreasing the ratio further to 20S:80C. An overprovision of metabolisable energy (ME) from the 20S:80C and 40S:60C ratios was aggravated by decreased production. Viewed from an ME intake and production point of view, the 20S:80C ratio cannot be recommended for high and low yielding cows and first calf heifers.

0949 NELSON, B.D., MONTGOMERY, C.R., and MORGAN, E.B. 1981. Nutritional evaluation of corn and sorghum silages 1981. Pages 124-127 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Nutrient and dry matter digestion values of two corn silages- Dekalb XL-80 and Funk's G-4611 and three sorghum silages- Dekalb BR-64, Funk's G-622GBR, and Northrup King 300, were determined using sheep taking silage diet. Composition and digestion coefficients of the five silages were recorded. Percentage dry matter of Funk's G-4611 corn silage (41.0%) was

highest followed by Dekalb BR-64 grain sorghum silage (36.0%). Neutral-detergent fiber content varied from 58.5% for Dekalb XL-80 corn to 62.2% for Funk's G-622 grain sorghum. Acid detergent fiber and crude protein content in Funk's G-622 GBR grain sorghum was higher ( $P^{1/4} 0.05$ ) than all other silages. Digestible dry matter value of sorghum silages averaged 54.0%. Funk's G-622 GBR grain sorghum silage had the highest ( $P^{1/4} 0.05$ ) crude protein digestion coefficient (55.8%).

0950 NITSAN, Z., DVORIN, A., and NIR, I. 1981. Availability of amino acids from soybean, corn and milo for goslingB. Poultry Science 60(12):2724-2725. 5 ref.

0951 NOLAND, P.R., CAMPBELL, D.R., and JOHNSON, Z.B. 1981. Use of grain sorghum in swine feeds. Bulletin, Arkansas Agricultural Experiment Station no.853. 34 pp. 16 ref.

Summarizes the results of 28 different swine feeding and digestion experiments in which sorghum grains were used as the primary source of carbohydrates for pigs. Brown pericarp cultivars of grain sorghum (BSM) had lower digestibility of energy and protein than cultivars with a yellow pericarp (YSM). A mixture of corn and BSM resulted in superior gains and feed utilization than a BSM ration supplemented with 0.07% lysine and 3% fat.

0952 OJEDA O., M.A., CAMPO, H.R.M.DEL, ROCHA HERNANDEZ, A.E., CASARIN VALVERDE, A., and AVILA GONZALEZ, E. 1981. Effect of L-threonine supplementation in sorghum and soya diets suboptimal in proteins for leghorn pullets. (Es). Veterinaria Mexico 12(3):147-151. 17 ref. (Summary: En).

An experiment with White Leghorn pullets of a commercial strain was conducted to compare sorghum + soya diets with 13% of protein supplemented with different levels of total threonine (0.4, 0.5 and 0.6%) vs. a



sorghum + soya diet containing 16% of protein. All the diets were calculated to have equal amounts of lysine, methionine and metabolizable energy. Results after 294 days showed no significant differences ( $P^{1/2} 0.05$ ) among treatments in egg production, egg weight, feed consumption and feed conversion. These data indicated that sorghum + Boya diets supplemented with lysine and methionine and containing 13% of protein supported a high egg production and threonine supplementation did not improve the performance of laying hens.

0953 OSTLIE, S.C., WAGNER, D.G., and SIMS, P 1981. Finishing steers on a conventional high grain diet or sorghum sudan pasture plus 1 percent of body weight in grain with and without monensin. *Journal of Animal Science* 53(suppl1):419. (Abstract).

0954 OWSLEY, W.F., KNABE, D.A., and TANKSLEY, T.D. 1981. Effect of sorghum particle size on digestibility of nutrients at the terminal ileum and over the total digestive tract of growing-finishing pigs. *Journal of Animal Science* 52(3):557-566. 48 ref.

0955 PASIERBSKI, Z., and STARCZEWSKI, M. 1981. Effect of high levels of sorghum and maize grains on fattening performance of young cattle. (Po). *Polish Journal of Animal Science and Technology* 8(2):133-141. 10 ref. (Summaries: De, En, Ru).

The effect of feeding high-energy complete mixtures containing sorghum and maize grains and the SOMB mixture (control) on fattening performance of young cattle was studied. The highest gains and nutrient conversion were observed in the bulls fed concentrate containing maize (1510 g). Lower gains by (11% and 47%) showed the bulls in the groups receiving sorghum and SOMB mixture, respectively. The mixtures compared did not affect carcass quality. Due to lower cost of sorghum the profit of fattening bulls was similar in the groups receiving sorghum and maize.

0956 PATEL, P.M., NETKE, S.P., GUPTA, B.S., and DABADGHAO, A.K. 1981. Survey of oilcakes and some feeds for the presence of aflatoxin. *Indian Journal of Animal Sciences* 51(4):402-407. 13 ref.

Various oilcakes and feeds were analysed qualitatively and quantitatively for aflatoxins. About 64 and 80% samples of groundnut-cake and cottonseed-cake, respectively, contained aflatoxin B<sub>1</sub>; 25% of the positive samples of groundnut-cake and cottonseed-cake had aflatoxin concentration between 0.2 and 0.52 ppm. More than 50% of the samples of maize, sorghum, rice and wheat contained aflatoxin B<sub>1</sub>. The screening of proprietary compounded feeds showed that 14 out of 20 samples of poultry feeds, and 4 out of 4 samples of cattle feeds were positive for aflatoxin B<sub>1</sub>.

0957 RAKES, A.H., BURNS, J.C., CASSEL, D.K., and DAVENPORT, D.G. 1981. Comparison of silage from a sorghum-small grain double cropping system with alfalfa haylage plus maximum grazing for lactating dairy cattle: long- and short-term lactation trials. *Bulletin, North Carolina State University Agricultural Research Service* no.462. 31 pp.

A study was initiated to compare silage from a double cropping system consisting of forage sorghum grown in sequence with small grain and fed in dry lot with a second system consisting of alfalfa haylage fed during the winter, and cows were allowed to maximum grazing in the spring, summer and fall. This bulletin provides lactation data and information on soil characteristics from a 3-year study of above two systems. Six short term sorghum silage experiments and a laboratory experiment on silage preservatives are presented in Section I of Part II, and a grazing lactation trial is presented in Section II. These short-term trials were conducted within the two appropriate main forage systems to determine specific management

practices to obtain higher daily milk production from the forage evaluated.

0958 RUST, S.R., and OWENS, F.N. 1981. Effect of roughage source on digestibility of corn diets in feedlot steers. *Journal of Animal Science* 53(suppl1):426-427. (Abstract).

Twenty four steers of mixed breeding were utilized in six 4 x 4 latin squares to study the influence of roughage sources on starch digestion. Four steers were randomly allocated to one of six roughages which included alfalfa hay, prairie hay, cottonseed hulls, sorghum silage and two types of corn silage. A 2 x 2 factorial arrangement of treatments included two levels of intake (1 and 2% of initial body weight) and two levels of roughage (10 and 50%). Diets included chromic oxide and were fed twice daily. Each period was 21 days in length with fecal grab samples collected the last 5 days. The source of roughage influenced digestion of organic matter and starch ( $P^{1/4} 0.10$ ) and ADF ( $P^{1/4} 0.01$ ). Starch digestion was greatest (95.6%) with cotton seed hull diet and least (82.6%) with sorghum silage diet. Starch digestion was greater ( $P^{1/4} 0.10$ ) with the 50% inclusion of cotton seed hulls, alfalfa hay, sorghum silage and the grain variety of corn silage. Results suggest that various types of roughage exert different effects on starch digestion.

0959 SAXENA, V.P., and PRADHAN, K. 1981. Mortality in broilers on maize and sorghum diets at various levels of energy and protein during starting and finishing periods in summer months. *Indian Veterinary Journal* 58(1):53-57. 14 ref.

Sixteen experimental diets with four levels of protein (20%-17%, P1; 22%-19%, P2; 24%-21%, P3; and 26%-23%, P4), two metabolizable energy; protein ratios (130:1-155:1, E1 and 145:1-170:1, E2) and two types of grains (maize and sorghum) were formulated for starting-finishing phase. During starting period, the

mortality was higher for sorghum than for maize diets ( $P^{1/4} 0.01$ ). Mortality was higher for both the grains, on high-protein high-energy (P4E2) or low protein (P1E1 or P1E2) diets. There was no incidence of mortality in chicks fed P2E1 or P3E1 maize diet. During finishing period again, rearability was higher for maize ( $P^{1/4} 0.01$ ) compared to sorghum diets. Mortality was higher on high energy (E2) diets, while the P3E1 diets offered the highest rearabilities. The effect of high ambient temperature during summer on the mortality pattern was very much evident on the high energy (E2) diets.

0960 SAXENA, V.P., and PRADHAN, K. 1981. Energy metabolizability in broilers on maize and sorghum diets at various energy and protein levels in summer months. *Indian Veterinary Journal* 58(5):407-410. 17 ref.

An experiment was conducted in 4 x 2 x 2 factorial arrangement to test 16 diets with four dietary protein levels (20%-17%, P1; 22%-19%, P2; 24%-21%, P3; and 26%-23%, P4) and two ME/P ratios (130:1-155:1, E1; 145:1-170:1, E2) during starting-finishing growth period with two cereals (maize and sorghum). Balance trials for energy metabolizability at 5th and 9th week of age were conducted. The percent metabolizabilities increased consistently as the protein level increased. The metabolizability values for diets based on sorghum ranked lower than those based on maize. The rate of metabolizability in 5th and 9th week of broilers were different.

0961 SCHAKE, L.M., BYERS, F.M., and GUTIERREZ, G.G. 1981. Effects of whole plant grain sorghum silage processing methods and lasalocid sodium leaves on stocker calf performance and rumen fermentation. Presented at the Meeting of the American Society of Animal Science, Southern Region, 1-4 February 1981, Atlanta, Georgia, USA.

- 0962 SCHAKE, L.M., RUFF, J.F., and BUICE, C.W. 1981. Whole-plant grain sorghum for growing and finishing beef cattle. Progress Report, Texas Agricultural Experiment Station 3758/3830:55-56.
- 0963 SCHAKE, L.M., RUFF, J.H., and BUICE, C.W. 1981. Regrowth whole plant sorghum silage for stocker calves. Progress Report, Texas Agricultural Experiment Station 3758/3830:175. (Abstract).  
Seventy-two Beefmaster steers were fed three whole plant grain sorghum silage rations during a 50-day growth trial. Whole plant silages contained either whole grain or pre-ensiled rolled grain from an initial or regrowth crop. Average daily gain for steers was greatest ( $P^{1/4} 0.05$ ) for the whole grain treatment, followed by the regrowth, and rolled grain treatments. Conversion of silage, which represented 92 percent of the rations, to liveweight gain was 4.75, 5.14 and 5.50 pounds of dry matter for whole grain, rolled grain, and regrowth treatments, respectively. When these same silages were fed as 60 percent of the ration to lactating dairy cows, starch and gross energy digestibilities were highest ( $P^{1/4} 0.10$ ) for regrowth, followed by ground and whole grain treatments. These data indicate that whole plant grain sorghum silage containing whole grain was equal or superior to pre-ensiled rolled grain sorghum silage for stocker calves.
- 0964 SELL, D.R., ROGLER, J.C., and FEATHERSTON, W.R. 1981. Comparisons of high and low tannin sorghums fed at 2 protein levels on the performance of laying hens maintained under 2 constant environmental temperatures. Poultry Science 60(7):1727-1728.
- 0965 SELL, D.R., ROGLER, J.R., and FEATHERSTON, W.R. 1981. The effect of DL methionine supplementation to high and low tannin sorghum soybean meal diets on the performance of laying hens maintained under 2 constant environmental temperatures. Poultry Science 60(7):1728. (Abstract).
- 0966 SERRANO, J.M.E. 1981. Haymaking: standard methods of making hay. (Pt). Divulgacao, Direccao-Geral de Extensao Rural no.8. 21 pp.
- 0967 SHUKLA, D.C., ANJARIA, J.V., and HERANJAL, D.D. 1981. Sorghum vulgare (jowar) poisoning in sheep. Gujarat Agricultural University Research Journal 7(1):23-25. 5 ref.  
Sorghum bicolor poisoning due to grazing of its ratoon crop is reported in seven sheep, three of which were saved by intravenous administration of sodium nitrate (2%) and sodium thiosulphate (5%) in 50 ml dose. Acute toxic symptoms aided by autopsy findings and sodium picrate paper test indicated poisoning by hydrocyanic acid; which was isolated from ratoon crop of sorghum consumed by the sheep and also from the ruminal contents collected at autopsy.
- 0968 SIMPSON, E.J., Jr., SCHAKE, L.M., and BYERS, F.M. 1981. Effects of short-term grain sorghum soaking, reconstitution, processing on finishing steer performance and rumen fermentation. Journal of Animal Science 53(suppl 1) : 481 - 482. (Abstract).
- 0969 SIMPSON, E.J., Jr., SCHAKE, L.M., and BYERS, F.M. 1981. Short term, reconstitution of grain sorghum for finishing steers. Progress Report, Texas Agricultural Experiment Station 3758/3830:175. (Abstract).  
To evaluate alternative techniques for shorter term reconstitution on grain, a 138-day growth trial with 72 steers compared grain sorghum rolled prior to feeding with 88 percent grain rations prepared as follows: dry, soaked for 24 hours (hr), soaked for 24 hr plus 24 hr of aerobic fermentation, or soaked for 24 hr plus 24 hr of aerobic fermentation followed by 5 days of anaerobic

fermentation. Grain sorghum in the soaked treatments contained about 35-percent moisture. One hundred thirty-eight day results indicated that steers fed any of the soaked grain treatments resulted in 12- to 15-percent improvement in conversion of grain dry matter to weight gain with similar improvements in rate of gain compared to dry rolled grain controls. The 5-day reconstituted grain treatment indicated the most favorable improvement in feed conversion. These preliminary results suggest that numerous alternatives may exist for conventional reconstitution that may require less than the usual 2-to 3-week interval.

0970 SIMPSON, E.J., Jr., SCHAKE, L.M., and BYERS, F.M. 1981. Short term soaking and reconstitution of grain sorghum for finishing steers. Presented at the Joint Meeting of the Canadian Society of Animal Science, Western Branch and American Society of Animal Science, Western Section, 23-25 June 1981, Vancouver, BC, Canada. 3 pp. 10 ref.

0971 SPICER, L., THEURER, B., and NOON, T.H. 1981. Protein digestion of sorghum grain, barley and corn based diets by beef steers. Proceedings, Western Section, American Society of Animal Science 32:32-34. 13 ref.

Abomasally-fistulated steers were used to determine digestibility of protein in barley, corn and sorghum grain based diets. These diets averaged 81.4% grain and contained 10.7% crude protein (dry matter basis). The respective grains furnished 81, 64 and 72% of the dietary crude protein. Mean daily dry matter and crude protein intakes for the three trials were 6.6 kg, and 0.71 kg, respectively. Mean dry matter digestion coefficients for barley, corn and sorghum grain based diets were 78.3, 81.0 and 77.6%, respectively. Digestibility of crude protein in the total tract was lower for the sorghum grain based diet than

for corn or barley ( $P^{1/4}0.05$ ) based diets. Crude protein digestibility coefficients averaged 68.4, 66.6 and 62.4% for the barley, corn and sorghum grain based diets, respectively. The total tract digestion of organic matter and crude protein in sorghum grain as compared to that in barley or corn may be due to the lower ruminal digestion of these components in sorghum grain compared to the other grains.

0972 STANCIOIU, N., CEAUSESCU, S., DEXAMIR, A., and CAPRARIN, A. 1981. The value of some biochemical constants in the serum of layers fed with rations on the basis of maize and sorghum. (Ro). *Lucrari Stiintifice ale Institutului Agronomic "Nicolae Balcescu" Bucuresti Seria D* 24:65-68. 9 ref. (Summary: En).

0973 STEPHENSON, R.G.A., EDWARDS, J.C., and HOPKINS, P.S. 1981. The use of urea to improve milk yields and lamb survival of merinos in a dry tropical environment. *Australian Journal of Agricultural Research* 32(3):497-509. 29 ref.

Urea supplementation of lambing Merino ewes increased milk yield and lamb growth and survival rates in both pen and paddock studies. In pens, urea supplements fed to lactating ewes at the rate of c.12 g/day stimulated intake of poor quality pasture hay (0.9% nitrogen) by c.30% and increased total nitrogen intake by c.100%. Milk yield was improved by c.50% and lamb growth rate by c.140%. Sorghum grain supplements stimulated milk yield and lamb growth to a lesser extent than urea.

0974 SZENTMIHALYI, S. 1981. Feeding value of sorghums. (Hu). *Magyar Mezogazdasag* 36(17):11.

0975 TAVERNER, M.R., HUME, I.D., and FARRELL, D.J. 1981. Availability to pigs of amino acids in cereal grains. 2. Apparent and true ileal availability. *British Journal of Nutrition* 46(1):159-172. 37 ref.

Pigs prepared with re-entrant ileal cannulas were used to determine the ileal availability of amino acids in five wheats, sorghum, maize, barley, and triticale. The average true availability of amino acids in these grains was 0.88 but there were consistent differences in availability among amino acids. Lysine and threonine were among the least available ones while glutamic acid and arginine were among the most available ones.

ratings for these properties. Waxy sorghum produced ogi with poor, undesirable consistency. The brown high tannin sorghum produced ogi with undesirable brownish-red color, poor consistency and texture, and low in vitro starch and protein digestibility. Ogi prepared with TAM680 and Funk G776W most closely resembles Nigerian Ogi.

0976 VERGARA RUBIN, V.J. 1981. Effects of the addition of digestive enzymes in diets based on maize (*Zea mays*) and sorghum for broilers. Thesis, Universidad Nacional Agraria, Lima, Peru. 76 pp.

0980 ALIYA, S., and GEERVANI, P. 1981. An assessment of the protein quality and vitamin B content of commonly used fermented products of legumes and millets. *Journal of the Science of Food and Agriculture* 32(8):837-842. 13 ref.

0977 WILLIAMS, J.E., WAGNER, D.G., BULGERIN, L.E., GUENTHER, J.J., WALTERS, L.E., HORN, G.W., and WALLER, G.R. 1981. Lipid and fatty-acid composition of fat tissues in forage vs. grain finished cattle. *Journal of Animal Science* 53(suppl 1):445. (Abstract).

Fermented products of *Cicer arietinum*, *Phaseolus aureus*, *Pennisetum typhoideum*, *Sorghum bicolor* and *Eleusine coracana* were analysed for protein quality and vitamin-B content. Fermentation reduced total crude protein by 6-8% in the legume products and 4-6% in millets. No reduction in crude protein was observed in sorghum products. The true digestibility of fermented sorghum increased significantly ( $P^{1/2}$  0.05) but not that of millets and the legume products. Biological value and net protein utilization of both sorghum and finger millet products increased significantly on fermentation ( $P^{1/2}$  0.05) but not that of pearl millet. The thiamin and riboflavin contents of both the legumes and millets products increased with increase in fermentation time. Steaming and cooking after fermentation reduced the thiamin and riboflavin content.

0978 WRONA, J., BIENKOWSKA, B., and LOVELL, R. 1981. Sorghum in feeding one-year-old and marketable carps. (PI). *Polish Journal of Animal Science and Technology* 8(1):255-266. 10 ref. (Summaries: De, En, Ru).

## Food Products

0979 AKINGBALA, J.O., ROONEY, L.W., and FAUBION, J.M. 1981. Physical, chemical and sensory evaluation of ogi from sorghum of differing kernel characteristics. *Journal of Food Science* 46(5):1532-1536. 8 ref.

Seven sorghums were processed into ogi, a Nigerian fermented porridge. The color, taste, texture, aroma, and consistency of the ogis were evaluated to determine which sorghum had the best properties for ogi preparation. In general, **nonwaxy**, white sorghum gave ogi the highest

0981 AU, P.M., and FIELDS, M.L. 1981. Nutritive quality of fermented sorghum. *Journal of Food Science* 46(2):652-654. 15 ref.

The relative nutritive value (% RNV) of sorghum fermented at 25 deg C and at 35 deg C increased significantly ( $P^{1/2}$  0.05) over the % RNV of the control. During the consecutive 7-day fermentation at 25 deg C, time had no effect on the %

RNV. The highest % RNV (56.45%) was achieved at the end of 1 day. Fermentation at 35 deg C was influenced by the time, with the highest % RNV (61.11%) obtained at the end of 7 days. Available lysine and methionine increased substantially ( $P^{1/4}0.01$ ) over the control when sorghum was fermented at 25 deg C or 35 deg C for 4 days. Sorghum fermented at 25 deg C and at 35 deg C had methionine contents of 25.68 and 26.79 mg/g N, respectively, whereas the control contained only 11.25 mg/g N. Lysine levels were 33.2 and 34.5 mg/g N in sorghum fermented at 25 deg C and at 35 deg C, respectively, whereas the control contained 9.1 mg/g N. None of the available B-vitamins studied was altered significantly in the fermented samples.

0982 AXTELL, J.D., KIRLEIS, A.W., HASSEN, M.M., MASON, N.D., MERTZ, E.T., and MUNCK, L. 1981. Digestibility of sorghum proteins. Proceedings of the National Academy of Sciences of the United States of America 78(3):1333-1335. 8 ref.

Grain samples of low tannin sorghum varieties, viz. IS-11778 (Ethiopian high-lysine), 954063 (Ethiopian normal), P-721 opaque (high lysine), and P-721 normal were analysed for protein digestibility using porcine pepsin in vitro. Uncooked sorghum proteins have a high digestibility (78-100%), which drops to a range of 45-50% after cooking. Two fermented sheet-baked sorghum products (kisra and abrey) from Sudan gave pepsin digestibility values of 65-86%. In contrast, unfermented cooked gruels from the same flours gave pepsin values of only 44-56%. Therefore, fermentation improves pepsin digestibility of sorghum.

0983 BLEIBERG, F., BRUN, T.A., GOIHMAN, S., and LIPPMAN, D. 1981. Food intake and energy expenditure of male and female farmers from Upper Volta. British Journal of Nutrition 45(3):505-515. 25 ref.

The energy balance of eleven male

and fourteen female adult farmers was measured for 6 d after the harvest, in December-January. Their energy intake was recorded by weighing their food consumption and their energy expenditure was determined using indirect calorimetry. The staple foods were Sorghum bicolor and millet; carbohydrates, fat and protein supplied approximately 80, 13 and 12% of the total energy of the diet respectively. In the male group, the mean energy intake [9.0 MJ (2148 kcal)] was in good agreement with the average energy output [8.91 MJ (2130 kcal)]. But, in the female group, the mean energy expenditure [8.11 MJ (1941 kcal)] exceeded the mean energy intake [6.3 MJ (1515 kcal)] and the deficit was statistically significant. The energy deficit similar to that reported in other developing countries emphasizes the need for a better understanding of the regulation of energy balance in such conditions.

0984 BRANDTZAEG, B., MALLESHI, N.G., SVANBERG, U., DESIKACHAR, H.S.B., and MELLANDER, O. 1981. Dietary bulk as a limiting factor for nutrient intake with special reference to the feeding of pre-school children. III. Studies of malted flour from ragi, sorghum, and green gram. Journal of Tropical Pediatrics 27(4):184-189. 28 ref.

To evaluate the effect of malting on important qualities of grain, comparative amylolytic activity during germination of finger millet and sorghum, and formulation of a blended weaning food containing a mixture of germinated finger millet and green gram was attempted. Analysis of data indicate that malted mixtures have 12% protein and well balanced pattern of amino acids. Digestibility, net protein utilization and biological value of both mixtures were almost similar and there was no significant difference in minerals and vitamin content. Chemical, biological and viscosity data indicate that malting has a high potential for increasing the energy and nutrient density per feed of infants and small children.

0985 CHANDRASEKHER, G., RAJU, D.S., and PATTABIRAMAN, T.N. 1981. Natural plant enzyme inhibitors, alpha-amylase inhibitors in millets. *Journal of the Science of Food and Agriculture* 32(1):9-16. 13 ref.

Twelve varieties of Sorghum bicolor, 14 varieties of pearl millet, 12 varieties of Setaria, 4 varieties of finger millet, 11 varieties of Echinochloa millet, 13 varieties of Proso, 11 varieties of Kodo and 11 varieties of miliare were screened for inhibitory activity against human salivary amylase. Two strains of sorghum and one strain of pearl millet did not show alpha-amylase inhibitory activity. All other seeds had activity, the highest being observed in sorghum. Sorghum inhibitor did not act on bovine and porcine pancreatic amylases. Setaria and sorghum inhibitors were relatively thermolabile compared to finger millet and pearl millet inhibitors.

0986 CORNU, A., and DELPEUCH, F. 1981. Effect of fiber in sorghum on nitrogen digestibility. *American Journal of Clinical Nutrition* 34(11):2454-2459. 27 ref.

Digestibility measurements were carried out on a population of 12 Cameroonians whose diet was based on consumption of sorghum meal. Over an 11-day period 12 subjects received successive diets of 3.3, 4.8, and 5.4 g of crude fiber/100 g of dry matter. The increase in fiber intake resulted in rise in quantity of fecal matter excreted including nitrogen and formic insoluble substances. The highest urinary nitrogen losses were obtained from the diet least rich in fiber. The digestibility of nitrogen dropped from 65.4% to 56.9%. Intestinal disappearance of crude fiber augmented significantly and then stabilized when switching from diet least rich in fiber to the two others, i.e. 15.1 to 19.9 g/day and then 19.8 g/day. This population was able to breakdown large quantities of fiber and to reduce urinary nitrogen loss when fecal nitrogen output arose.

0987 HOSENEY, R.C., VARRIANO-MARSTON, E., and DENDY, D.A.V. 1981. Sorghum and millets. *Advances in Cereal Science and Technology* 4:71-144. 441 ref.

In this comprehensive review information of the literature available on sorghum and millets is presented under structural characteristics; proteins, carbohydrates, lipids, enzymes, vitamins and minerals, polyphenolics, nutritional quality, milling, and food uses.

0988 JOFFE, B.I., ROACH, L., BAKER, S., SHIRES, R., SANDLER, M., and SEFTEL, H.C. 1981. Failure to induce reactive hypoglycaemia by drinking a starch-based alcohol beverage (sorghum beer). *Annals of Clinical Biochemistry* 18(1):22-24. 11 ref.

The ability of sorghum beer to induce reactive hypoglycaemia was compared with 'gin and tonic' in eight non-obese healthy African men. After an overnight fast, each subject drank, in random sequence on three different occasions, 2 litres of sorghum beer (carbohydrate content approximately 5% and alcohol concentration 2.24 g/d 1-2.8% v/v), the same volume of a control solution providing a similar carbohydrate load, or a gin and standard tonic water mixture. No evidence of reactive hypoglycaemia was apparent during the 5 hours after the beginning of the sorghum beer tolerance tests, despite a mean peak blood alcohol level reaching 80 mg/dl. Both the peak and total plasma insulin responses were significantly reduced ( $P^{1/4} 0.05$ ) when compared to the brisk responses elicited by the carbohydrate solution alone and the gin and tonic drinks, with consequent hypoglycaemia. These data suggest that African home-brews are not potent causes of reactive hypoglycaemia, although they may be implicated in the development of ethanol-induced hypoglycaemia in the fasting state.

0989 KAURA, M.B. 1981. The usefulness of palatability tests in

determining consumer selection of improved food crop varieties. Pages 158-161 In Proceedings, Fifth NAFPP Workshop, 27-30 April 1981, Samaru, Zaria, Nigeria. Samaru, Zaria, Nigeria: Ahmadu Bello University. 3 ref.

Palatability tests are essential for farmers in the course of preference and acceptability evaluation of the improved varieties. Such tests viz. taste, colour, texture, aroma, tenderness, and juiciness, are made through the use of sensory organs of the body, which should be functional. A method of organizing palatability test and preference rating control is outlined.

0990 KAZANAS, N., and FIELDS, M.L. 1981. Nutritional improvement of sorghum by fermentation. *Journal of Food Science* 46(3):819-821. 29 ref.

A natural lactic fermentation of ground grain sorghum produced significant increase ( $P^{1/4}$  0.001) in available lysine/leucine, isoleucine, and methionine. The protein quality, expressed as relative nutritive value, increased significantly ( $P^{1/4}$  0.001) as a result of fermentation. Niacin and thiamin increased significantly ( $P^{1/4}$  0.001) and riboflavin also increased ( $P^{1/4}$  0.05) during the fermentation. Protein and carbohydrate appeared to be more available after the fermentation than before the fermentation. Although the fermentation produced increased availability of nutrients, it did not produce change in the proximate analyses.

0991 KELKAR, S.S., and INAMDAR, A.N. 1981. Studies on hybrid varieties of jowar (*Sorghum vulgare*). *Indian Journal of Biochemistry and Biophysics* 18(4):76.

Pellagra amongst sorghum eaters is attributable to the high leucine content of the grain. The excess of dietary leucine interferes with the synthesis of NAD by inhibiting the activity of certain key enzymes in the tryptophan-niacin pathway. Biological

studies using albino rats fed various supplemented and unsupplemented sorghum diets, were conducted and the activity of leucine amino transferase, and the niacin levels in the blood were estimated.

0992 MACLEAN, W.C.Jr., LOPEZ DE ROMANA, G., PLACKO, R.P., and GRAHAM, G.G. 1981. Protein quality and digestibility of sorghum in preschool children: balance studies and plasma free amino acids. *Journal of Nutrition* 111(11):1928-1936. 29 ref.

The protein quality and digestibility of two high lysine (2.9-3.0 g/100 g protein) and two conventional varieties (lysine content 2.1-2.2 g/100 g protein) of whole grain sorghum milled as flour were assessed through balance studies in 13 children 6-30 months of age. Sorghum protein provided 6.4 or 8.0% of dietary energy. Control diets contained 6.4% kcal protein as casein. Children consumed 100-150 kcal/kg body weight/day. Sorghum consumption was associated with weight loss or poor weight gain. Mean absorption and retention of nitrogen (+SD) from 26 six-day sorghum dietary periods were 46+ 17% and 14 + 10% of intake, respectively. Stool weight and energy losses during sorghum periods averaged 2.5 to 3 times control values. Total concentration of essential amino acids (TEAA) was low as were concentrations of lysine (Lys) and threonine (Thr). Analysis of postprandial changes of the Lys/TEAA and Thr/TEAA molar ratios confirmed that Lys was the first limiting amino acid.

0993 MUINDI, P.J., THOMKE, S., and EKMAN, R. 1981. Effect of magadi soda treatment on the tannin content and in vitro nutritive value of grain sorghums. *Journal of the Science of Food and Agriculture* 32(1):25-34. 21 ref.

Studies were conducted to investigate the possible use of raw Magadi soda (RMS), a sodium sesquicarbonate salt in the detoxification of the tannins



associated with high- and low-tannin sorghum grains and to establish the relative in vitro nutritive value of the treated grains. Treatment of grains with concentrations as low as 4 g/litre of RMS for 3 days, reduced the level of the assayable tannins in the grains by 40 to 57%. This reduction was accompanied with an increase in the in vitro digestibility of the organic matter and starch. Treatment of the high-tannin sorghums increased the in vitro protein digestibility while no increase was observed for the low-tannin sorghums. Use of solutions containing more than 37.5 and 9 g RMS/litre, resulted in reduced protein digestibility of the high- and low-tannin containing sorghums, respectively.

0994 MURTY, D.S., PATIL, H.D., and HOUSE, L.R. 1981. Sorghum roti quality tests at ICRISAT. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 19 pp. 1 ref.

A survey of sorghum roti consumers belonging to different income groups in urban, semi-urban and rural areas was conducted to collect information on (i) genotypic differences between cultivars for various quality attributes of the grain, dough and roti, (ii) effect of environmental factors on quality attributes, and (iii) properties of grain and flour affecting roti quality. Results indicate that roti quality is influenced by several grain, flour and dough properties. It is suggested that early maturing high yielding sorghum genotypes with desirable roti quality for cultivation in kharif season should be identified.

0995 ODUM, P.K., ADAMSON, L.A., MORAGNE, L., and EDWARDS, C.H. 1981. A weaning food from locally grown grains in Nigeria: formulation and organoleptic evaluation. Nutrition Reports International 23(6):1005-1019. 4 ref.

A Nigerian vegetable protein

mixture as a supplement to the diets of infants, young children, and other vulnerable groups was developed from readily available local Nigerian food sources, such as cowpeas, maize, peanut and sorghum. The Nigerian Vegetable Protein Supplement (NVPS) was selected from 8 such products and compared with other commercially available supplements, human milk and cow's milk. The NVPS mixture proved acceptable to the taste panel. The results indicated that this new product (NVPS) was well accepted while the standard product was highly accepted.

0996 OSINUBI, O.A., and EKA, O.U. 1981. Effect of cooking on the nutritive value of Koko/Kosai: a traditional breakfast meal of the Hausas in northern Nigeria. Food Chemistry 7(3):181-187. 24 ref.

0997 SIWAWET, S., RONGWISIT, C., and SAMPHANTHARAK, K. 1981. Utilization of sorghum grain flour for baking sorghum cakes. (Thai). Warawan Witthayasatkaset 14(1):49-57.

0998 SPILKA, W., Jr., and GREEN, R.C. 1981. Food, seed and industrial uses of feed grains. Staff Report, US Department of Agriculture, Economics Research Service no. AGES 810925. 19 pp.

0999 SUBRAMANIAN, V., and JAMBUNATHAN, R. 1981. Physicochemical characteristics of sorghum and pearl millet flours and their relationships to roti quality. Presented at the Second Indian Convention of Association of Food Scientists and Technologists, 19-20 February 1981, Mysore, Karnataka, India. (Abstract).

1000 THAKRE, S.K. 1981. Nutritive values of grain of some sorghum cultivars. Journal of Maharashtra Agricultural Universities 6(1):60-61. 6 ref.

A field trial with 12 high yielding cultivars was conducted for

## Industrial Uses

their nutritive value. Results revealed that varieties in general had more proteins than hybrids which were more starchy. Water soluble carbohydrates which accounts for sweetness was found highest in NJ-156 (1.35%). Varieties No.148, Ramkel, No.168 had more fat content. Mineral, potassium and phosphorus contents were higher in No.302 (2.14%), CSH-1 and No.370, and Ramkel and CS-3541 (0.25%) respectively.

1001 THAKRE, S.K. 1981. Nutritive values of some hurda varieties of sorghum. Journal of Maharashtra Agricultural Universities 6(1):61-62. 4 ref.

Sixteen samples of hurda varieties from a trial under sorghum breeding were obtained for analysis. Results revealed that in comparison to grain varieties at the harvesting stage, all the hurda varieties had more proteins, fat and water soluble carbohydrates and less starch. Varieties Malkapur Wani, Bhatgaonela Wani, Gorwani and Wani-11 are recommended for hurda as their protein and water soluble carbohydrate contents were found higher.

1002 WU, Y.V., and STRINGFELLOW, A.C. 1981. Protein concentrate from air classification of flour and horny endosperm from high-lysine sorghum. Journal of Food Science 46(1):304-305. 10 ref.

Flour and shorts from a high-lysine sorghum were finely ground and air classified. The protein contents of the original flour and horny endosperm were 9.9 and 18.6%, respectively, and the protein contents of the combined high-protein fractions after air classification were 18.6 and 23.6%. These fractions accounted for 18 and 15% of the flour and horny endosperm weights and for 31 and 19% of the total protein. Protein shifts were 39% for flour and 23% for horny endosperm.

1003 ANONYMOUS. 1981. New package for sorghum beer. Food Engineering International 6(2):32-34.

1004 ANONYMOUS. 1981. Sorghum and sugar-beet for the production of alcohol. (Pt). Dirigente Rural 20(9):12-13.

1005 CREELMAN, R.A., ROONEY, L.W., and MILLER, F.R. 1981. Sorghum. Pages 395-426 In Cereals, a renewable resource: theory and practice (eds. Y.Pomeranz, and L.Munck). St. Paul, Minnesota, USA: American Association of Cereal Chemists. 46 ref.

Sweet sorghum, grain sorghum and high energy sorghum are all members of Sorghum bicolor and represent tremendous variability. Because of the variability among cultivars, plant breeders can "custom build" a sorghum to fit the need of industry. Energy economics can aid in the development of a sorghum valued not only for a high yield, but also for carbohydrate components easily extracted and converted into convenient energy forms. This concept will make renewable energy sources, like sorghum, more favorable than they have been in the past.

1006 DALE, B.E., and MATSUOKA, M. 1981. Protein recovery from leafy crop residues during biomass refining. Biotechnology and Bioengineering 23(6):1417-1420. 7 ref.

Since it was known that three-fourth of true protein (TCA-precipitable nitrogen x 6.25) is contained in the leaves and stalk of sorghum and corn, experiments were conducted to extract the protein from their residues. Dried residue samples under mild conditions were soaked and stirred at 25 and 50 deg C in the solutions of pH 4.0, 7.0 and 10.0. Results revealed that percentage of

protein recovered at pH 10.0 at 50 deg C was high.

1007 DE SCHAEPPDRIJVER, P., WATSON, T.G., and JOUSTRA, S.M. 1981. Sorghum beer. UK Patent Application no. GB 2072 218A. 3 pp.

This invention relates to a method of making sorghum beer with longer useful shelf life. It includes the steps of interrupting the fermentation to give a sterile partially fermented wort and starting the fermentation again by adding a suitable brewers' yeast preparation to the partly fermented beer either immediately or after a period of time. This method enables the beer to be transported in a sterile state.

1008 MILLER, F.R., and CREELMAN, R.A. 1981. Sorghum: a new fuel. Pages 219-232 In Proceedings, Thirty-fifth Annual Corn and Sorghum Industry Research Conference, 9-11 December 1980, Chicago, Illinois, USA. Washington, DC, USA: American Seed Trade Association. 3 ref.

To develop sorghum varieties which produce more alcohol, sorghum with sweet stem was compared to high energy sorghum. It was found that if sweet stem characteristic is added to high energy types, grain yield will not be reduced and high energy sorghum can produce 75 to 100% more carbohydrate per day than the sorghum with just sweet stem.

1009 OGUNDIWIN, J.O., and TEHINSE, J.F. 1981. Fermentation tests on malted sorghum wort. Brewing and Distilling International 11(8):42-43. 9 ref.

Describes laboratory fermentations at different temperatures of malted sorghum worts using cultures of both baker's and brewer's yeast and of palm wine tub. The quality of the resulting otika were evaluated for acidity, alcohol content, colour changes and taste; in the latter case a trained taste panel gave the highest scores for products fermented at 20 deg C.

1010 SHIGEHIRO, M. 1981. Method of producing milo starch. United States Patent no. 4 302 475.

1011 YAWALAK SURAPUNPISIT. 1981. A study of alcohol production from sorghum by loog-pang and some strains of mold and *Saccharomyces cerevisiae* (Y-90). (Thai). Thesis, Kasetsart University, Bangkok, Thailand. 130 pp. 97 ref. (Summary: En).

Alcohol production from sorghum by loog-pang required a pretreatment procedure of soaking the sorghum for ten hours. The ratio was 55% water of total weight of sorghum. This was then autoclaved at 15 psi for 15 minutes. By mixing autoclaved sorghum with loop-pang Loa, 7.7% volume of alcohol was produced on the fourth day of fermentaton. To produce alcohol from sorghum by using Loog-pang Loa and Loog-pang Khoamaro, each of these was mixed separately with autoclaved sorghum for 2 days. The 2 parts of autoclaved sorghum fermented with Loog-pang and 1 part of autoclaved sorghum fermented with Loog-pang Khoamarg were mixed. Results showed that 8.8% alcohol by volume was produced after 4 days of fermentation.

## ECONOMICS AND MARKETING

1012 BARAH, B.C., BINSWANGER, H.P., RANA, B.S., and RAO, N.G.P. 1981. The use of risk aversion in plant breeding: concept and application. Euphytica 30(2): 451-458. 12 ref.

Variance analysis was used to measure stability and adaptability components of variance with multilocation-multiyear sorghum yield data from India. Adaptability and stability were highly correlated. Only the stability component is relevant for farmers in their adoption decision. Measures of farmer's risk aversion were used to rank genotypes according to preferences which took account both of yield and stability. Since yield differences were large and

risk aversion moderate, preference based ranking did not differ significantly from yield based rankings.

1013 BASAIL, J.O. 1981. Estimated operative costs and returns for summer crops during 1981/82. (Es). Pergamino, Buenos Aires, Argentina: Universidad de Buenos Aires, Facultad Agronomia. 5 pp. (Economia Agricola, Costos, 40).

1014 GHODAKE, R.D. 1981. The potential of mathematical programming for the analysis of yield gaps in semi-arid tropical agriculture. Patancheru, Andhra Pradesh, India: ICRISAT. (ICRISAT Economics Program Progress Report, 24).

The first section of the paper deals with existence of yield gaps in different crop production activity in the Akola district of Maharashtra (India). The highest percentage yield gap was observed for local cotton and the lowest for sorghum-chickpea rotation. Gaps in sorghum and sorghum mixtures ranged from 26 to 53%. In the second section, the proposed models and concepts are discussed. The third section demonstrates the use of a mathematical programming technique in breaking yield gap into components by using actual input-output data and by considering existing resource and other constraint levels.

1015 HOSKIN, R.L., and GRANT, W.R. 1981. Estimated impact of key supply and market variables on the demand for sorghum. Feed Situation, US Department of Agriculture, Economic Research Service 283:12-13.

1016 HUBBARD, E.E., and FLETCHER, S.M. 1981. First stage marketing of some minor crops in Georgia: small grains and grain sorghum, kay and cotton. Research Report, Georgia Agriculture Experiment Stations no.384. 23 pp. 4 ref.

This study revealed that first buyers of small grains and grain

sorghum were located within a reasonable distance of most producers, and in most cases more than one market outlet was available to the producer. Most of the movement of small grains and grain sorghum from farm to first buyers was in farm operators' vehicles, and convenience was the predominant reason for choice of market. The major first buyers for small producers were other farmers while feed mills in North Georgia and buying points in South Georgia were the major first buyers for large producers. More small producers reported receiving their asking price than did large producers. First buyers were the leading source of price information for producers. Very little use was made of contracting as a tool of marketing.

1017 JAIN, R.P., MAHMOUD, M.A., and FARIS, M.A. 1981. Potential of sorghum and millet production in Sudan. Pages 43-50 In Proceedings, Third General Conference of the Association for the Advancement of Agricultural Sciences in Africa, 9-15 April 1978, Ibadan, Nigeria. v.3. Ibadan, Nigeria: Association for the Advancement of Agricultural Sciences in Africa.

Presents the situation of food production in Sudan and compares the area and production of sorghum and millet with other main crops of the country. Traces the history of agricultural research in general and research on these two crops in particular. The attention has been shifted from developing high yielding varieties of sorghum to high yielding hybrids. Major constraints limiting the productivity of these crops in Sudan are highlighted.

1018 KUNZ, J.J., and PURCELL, J.C. 1981. Value of production and value added in Kansas agriculture (USA). IR-6 Information Report, Interregional Cooperative Publication, State Agricultural Experiment Stations (USA) no.38. 13 pp. 8 ref.

1019 KUNZ, J.J., and PURCELL, J.C. 1981. Value of production and value added in Nebraska agriculture (USA). IR-6 Information Report, Interregional Cooperative Publication, State Agricultural Experiment Station (USA) no.37. 13 pp. 7 ref.

1020 KUNZ, J.J., and PURCELL, J.C. 1981. Value of production and value added in Texas agriculture (USA). IR-6 Information Report, Interregional Cooperative Publication, State Agricultural Experiment Stations (USA) no.33. 14 pp. 9 ref.

1021 LASSITER, G.C. 1981. Cropping enterprises in eastern Upper Volta. East Lansing, Michigan, USA: Michigan State University, Department of Agricultural Economics. 44 pp. (African Rural Economy Program, Working Paper, 35).

This report provides 1978 technical and economic data for six crop enterprises including sorghum and millets for different agroclimatic zones of the east ORD to design and evaluate future development interventions. Crop enterprise budget for sorghum/millet indicate that the returns to these crops production are low. Yields are both low and unstable due to variability in rainfall patterns. Suggests that farmers must concentrate heavily on sorghum/millet production being major crop enterprise in EORD.

1022 LEATH, M.N., HILL, L.D., and FULLER, S.W. 1981. Sorghum movements in the United States: interregional flow patterns and transportation requirements in 1977. Urbana-Champaign, Illinois, USA: University of Illinois, College of Agriculture. 58 pp. (North Central Regional Bulletin, 272, Southern Cooperative Series, 250, and Illinois Bulletin, 765).

This study was conducted to determine the volume of sorghum moving between various origins and destinations, and to determine the extent to which the various

transportation modes are employed in the movement of sorghum in the United States. Data from 31 ports were collected from country elevators, feed manufacturers, export elevators, commercial feedlots, and processing firms. Information has been analyzed and discussed on shipments and receipts by state, movements to ports, foreign destinations for U.S. exports, and receipts and shipments by area.

1023 LIVEZEY, J. 1981. Trends and location shifts in sorghum production. Feed Situation, US Department of Agriculture, Economic Research Service 283:10-11. 1 ref.

1024 MACKEY, J. 1981. Cereal production. Pages 5-23 In Cereals, a renewable resource: theory and practice (eds. Y.Pomeranz, and L.Munck). St.Paul, Minnesota, USA: American Association of Cereal Chemists. 27 ref.

Reviews world cereal production, cereal acreage, and trends in world and national grain yield. Biological yield potential of cereals and constraints limiting yield are discussed. Approaches and ways are suggested to achieve higher yield with better nutritional quality of cereals to keep pace with population growth.

1025 MCINTIRE, J., and MATLON, P.J. 1981. Hypothesis in the village studies of ICRISAT's West Africa Economics Program. Ouagadougou, Upper Volta: ICRISAT, West Africa Economics Program. 38 pp. 37 ref.

1026 MIELKE, M.J., and HARPER, S.R. 1981. Argentine trade matrix tables for wheat, corn, sorghum, and soybeans. Staff Report, US Department of Agriculture, Economics and Statistics Service no. AGES 810128. 80 pp.

1027 MILLER, F.R. 1981. Grain sorghum: Sorghum bicolor. Pages 43-50 In CRC handbook of biosolar resources (ed. O.R.Zaborsky). v.2.

Boca Raton, Florida, USA: CRC Press.  
12 ref.

A brief account of sorghum production, economic importance, and composition is given. The production, distribution, and culture data of sorghum throughout world, the United States and the highest producing areas within United States are presented. Market classes, grades and grade requirements for all classes of sorghum, and average proximate analysis, and chemical composition data are presented in tabular form.

1028 MRUTHYUNJAYA. 1981. Enterprise budgets of dry land crops and policy implications. Indian Journal of Agricultural Economics 36(1):82-88. 20 ref.

Presents enterprise budgets for pearl millet, sorghum, cotton, wheat, and groundnut which cover nearly 92% of the total cultivated area in the Bijapur taluk of Karnataka state in India. Also examines the policy implications of these budgets on resource use, resource development and output growth in these crops in dryland areas.

1029 OLIVA, L.P., HOLLANES, L.A., and MOTE, S.R. 1981. Baseline data for corn, sorghum, rubber, coffee, cacao and sugarcane for North Cotabato. SMARC Monitor 2(4):22-23, 29.

1030 ROTOR, A.V. 1981. Corn and sorghum marketing in the Philippines. Grains Journal 6(1):34-42. 17 ref.

Reviews the marketing situation of sorghum and corn in Philippines in relation to market channels, market records, and government grain marketing policies. Suggests the establishment of farmers cooperatives to play financing and marketing roles, and an effective intelligence network to monitor supply and prices to minimize fluctuations.

1031 SAKO, B., and COTTERILL, R.W. 1981. An econometric analysis of supply responsiveness in traditional agriculture: millet, sorghum and rice

farmers in Mali. East Lansing, Michigan, USA: Michigan State University, Department of Agricultural Economics. 85 pp. 36 ref. (African Rural Economy Program, Working Paper, 36).

Reviews recent grain marketing policies in Mali, predicts domestic production of millet/sorghum and rice and their respective amounts sold to the "Office des Produits Agricoles du Mali (OPAM), and evaluates the impact of government policy on rice and millet/sorghum economies. Several economic factors that influence the amount of millet/sorghum and rice produced and the amount officially marketed were identified. Models were specified and tested using time series data from secondary sources for the period 1960 to 1979. Major findings suggest that millet/sorghum production and sales are both positively responsive to government determined policies. The price elasticities at the mean for millet/sorghum production varied between 0.006 and 0.563 while higher elasticities varied between 0.198 and 1.832. The government program of subsidized imports had a definite adverse effect on producers.

1032 SARUP, S., and RAI, S.C. 1981. Trends in productivity of jowar, maize, bajra. Eastern Economist 76(26):1498-1502. 4 ref.

The data on area and productivity of sorghum, maize and pearl millet have been analysed from the year 1968-69 to 1978-79 for various states in India to find out the impact of the Fourth and the Fifth-Five Year Plans on these crops. In case of sorghum, an annual significant increase of about 5% was observed in the productivity during the period of 11 years, indicating that the Plan efforts succeeded in increasing the productivity of sorghum. The states of Gujarat, Karnataka and Maharashtra showed much better performance as compared to other states. Comparing the productivity of sorghum between the Fourth and the Fifth Plans, it was observed that the Fifth Plan

performance was better than that of Fourth Flan in most of the states.

1033 UNITED STATES DEPARTMENT OF AGRICULTURE, FOREIGN AGRICULTURAL SERVICE. 1981. Production and export prospects for southern hemisphere exporters of corn and sorghum. Foreign Agriculture Circular, US Department of Agriculture, Foreign Agricultural Service no. 22-81. 17 pp.

## SWEET SORGHUM

1034 ACCORSI, C.A., BARTOLUCCI, R., and ZAMA, F. 1981. Experimentation on sweet sorghum: cultivation and processing. (It). Industria Saccarifera Italiana 74(5):117-125. 43 ref. (Summary: En).

Tests carried out in 1980 and 1981 both in laboratory and pilot plants are described, showing schemes providing an extraction either by pression or by diffusion. The results are discussed pointing out the difficulties and the inconveniences met in the various steps of the processing.

1035 BORDOVSKY, J.P., and LYLE, W.M. 1981. Sweet sorghum irrigation study, Lubbock-halfway. Progress Report, Texas Agricultural Experiment Station no.3874. 9 pp.

1036 BROADHEAD, D.M. 1981. A comparison between primary and tiller sweet sorghum plants for juice brix and sucrose. Agronomy Abstracts 73:130-131.

Tiller and primary stalks of four sweet sorghum cultivars, with and without bagged panicles, were compared for stalk weight, juice brix, and sucrose. The number of tillers produced per plant by each cultivar were 1.2, 0.34, 0.86, and 0.36 by Brandes, Dale, Rio, and Wray, respectively. Average stalk weight of the tiller was 56% of that of the primary stalk. Juice brix and sucrose

of primary and tiller stalks from Brandes, Rio, and Wray were similar. Brix and sucrose from tillers of Dale were higher than that from primary stalks. Bagging the panicle of tillers did not affect juice brix and sucrose of the primary stalks of any cultivars except Wray. The juice quality of the tillers was equal or superior to that of primary stalks. In a breeding program, bagging the panicle of the tiller stalk for seed and evaluating the unbagged primary stalk for juice quality would eliminate the error caused by bagging the primary panicle for seed and then evaluating the stalk for juice quality.

1037 BROADHEAD, D.M. 1981. Sorghum: research at the U.S. Sugar Crops Field Station. Sugar Journal 44(7):20-21.

Research was conducted to improve growing and handling techniques for sweet sorghum varieties with superior yield, juice quality and disease resistance for syrup and granulated sugar production. Twelve superior sweet sorghum varieties were released to southern farmers. Six sweet sorghum varieties were developed for syrup production. Five high sucrose sweet sorghum varieties were developed and released for sugar production. A new sweet sorghum variety with high biomass and syrup yield had also been released for syrup production having good potential for energy production.

1038 BROADHEAD, D.M., FREEMAN, K.C., and ZUMMO, N. 1981. M 81E: a new variety of sweet sorghum. Information Sheet, Mississippi Agricultural and Forestry Experiment Station no. 1309. 4 pp.

A new sweet sorghum variety- M81E was developed for syrup and fermentable sugar production at the U.S. Sugar Crops Field Station. A late maturing variety M81E is highly resistant to leaf anthracnose and stalk red rot and has good resistance to downy mildew. Test results showed that M81E was superior to This in

yield of gross and stripped stalks, syrup and fermentable sugar per acre.

1039 BRYAN, W.L., MONROE, G.E., NICHOLS, R.L., and GASCHO, G.J. 1981. Evaluation of sweet sorghum for fuel alcohol. Presented at the 1981 Winter Meeting of American Society of Agricultural Engineers, 15-18 December 1981, Chicago, Illinois, USA. 12 pp. 8 ref.

1040 CARRIERE, B. 1981. Sweet sorghum for liquid fuel. Agricultural Research 30(1):16.

Since it is estimated that 500 to 800 gallons of alcohol per acre could be produced from sweet sorghum, attempt is made to stress the importance of crop for USA to help to reduce oil imports. Grains could be utilized for other purposes because the 95% alcohol is produced from the stalks and stalk fibres of sweet sorghum.

1041 CHEN, J.C.P. 1981. Can sugar be made out of sweet sorghum? (Ch). Sugar Journal 44(6):12.

1042 COBLE, C.G., HILER, E.A., SWEETEN, J.M., O'NEAL, H.P., REIDENBACH, V.G., LEPORI, W.A., ALDRED, W.H., SCHELLING, G.T., and KAY, R.D. 1981. Small scale ethanol production from cereal feed stocks. Pages 611-632 In Cereals, a renewable resource: theory and practice (eds. Y.Pomeranz, and L.Munck). St.Paul, Minnesota, USA: American Association of Cereal Chemists. 10 ref.

Research at Texas was initiated to (1) develop a reasonable scheme for on-farm alcohol production from grain, (2) develop a method for production of alcohol from sweet sorghum that does not require a large investment in juice removal equipment, and (3) develop a procedure for use and/or disposal of stillage from small scale production units. Results revealed that the alcohol plant can convert one tonne of corn and grain sorghums into 387 and 372 litres of 182-proof alcohol respectively. The production cost/litre was very low (i.e. \$0.59)

when produced at large scale (i.e. 550,000 litres/year). Wet solids fraction of stillage was found highly palatable to cattle and crude protein was more concentrated in it. Fermentation of grain for alcohol production improved amino acid content and protein quality of fermentation products. To get higher recovery of alcohol per tonne of sweet sorghum, it was suggested to ferment the whole stalk instead of removing juice and then fermenting.

1043 DAESCHEL, M.A., MUNDT, J.O., and MCCARTY, I.E. 1981. Microbial changes in sweet sorghum (Sorghum bicolor) juices. Applied and Environmental Microbiology 42(2):381-382. 7 ref.

Juice freshly expressed from Sorghum bicolor for making sweet sorghum syrup contained 100 million microorganisms per ml. The dominant bacterium was Leuconostoc mesenteroides, followed by gram-negative rods. Lactobacilli, yeasts, and nonfecal coliform bacteria each comprised about 1% of the microbial population. Spoilage of juice, manifested by a sour odor, discoloration, and foaming, occurred between 5 and 12 h at ambient temperatures. Spoilage was correlated with a drop in pH from 4.9 to 4.5. L. mesenteroides was the dominant spoiling agent at 20 deg C, and Lactobacillus plantarum was the dominant spoiling agent at 32 deg C, as determined by pure culture studies. Juice may be stored for 14 days at 4 deg C if promptly refrigerated.

1044 ERMOLAEV, V. 1981. Resources of feed sugar: feeding milking cows with pellets of plants with high content of feed sugar (sugarbeet and sugar sorghum) and its effectiveness. (Ru). Zhivotnovodstvo 12:54-55.

1045 FERRARIS, R. 1981. Early assessment of sweet sorghum as an agro-industrial crop. 1. Varietal evaluation. Australian Journal of Experimental Agriculture and Animal



Thirty-seven sweet sorghum cultivars were evaluated for sugar, solubles, grain, fibre and leaf production in first and ratoon crops under irrigation at Ayr, North Queensland, over the winter-summer period. Highest sugar yields were from cv. Rio, which produced 3.6 and 1.6 t/ha over 145 and 79 days from first and ratoon crops, respectively. Highest solubles (brix) yields of 7.6 and 4.8 t/ha were produced by cv. Italian over 141 and 81 days. The highest grain yield was 5.7 t dry matter/ha in the first crop by cv. FS26. Stem fibre yields of about 9 t dry matter/ha were realised from the higher yielding cultivars. In the first crop, sugar and solubles yields were found to be negatively correlated with grain yield, early development rate and fibre yield. They were positively correlated with time to maturity, plant leaf area and leaf area index at anthesis, a low position of the largest leaf on the stem, dry matter yield of plant fractions, high stem-juice extraction rates, and degree days and accumulated radiation received. In the ratoon crop, age and environmental variables showed a weaker association with yields. Productivity of fermentables appeared to be comparable with that of sugar cane for the region.

1046 FERRARIS, R. 1981. Early assessment of sweet sorghum as an agro-industrial crop. 2. Maturity factors. Australian Journal of Experimental Agriculture and Animal Husbandry 21(108):83-90. 14 ref.

Two experiments were carried out at Ayr, North Queensland, to examine maturity factors on sweet sorghum juice characteristics and yields. In experiment 1, four commercially available forage cultivars were harvested at anthesis, milk dough and mature grain stage, and 10 days after maturity. Sucrose and soluble solids concentration and yields in stems were highest at or near grain maturity. In experiment 2, harvests of the cv. Rio

were taken at milk dough or mature grain stages on plants that had been left intact, had the panicle removed at anthesis, or had the panicle and subsequent shoots removed. Induced barrenness resulted in a higher concentration of soluble solids and sucrose in the stem over that in intact plants. The sucrose yield of stems of barren plants (up to 3.2 t/ha) equalled the carbohydrate yield as stem sucrose and grain starch in intact plants. In barren plants, leaves remained greener for longer and stems were less prone to lodging.

1047 FERREIRA, M.T.R., and BORGONOV, B.A. 1981. Bibliography of saccharine sorghum. (Pt). Brasilia, DF, Brazil: Empresa Brasileira de Pesquisa Agropecuaria. 79 pp. 125 ref.

1048 GOMES, C.S., and GOMES, L.S. 1981. Modern, innovative and economic rural biodigestors for production of biogasses from sugarcane juice, sugar sorghum, sugar beetroot or from amylaceous substances such as potato, cassava, maize etc. with use of treatment techniques for diluted organic sewer. (Pt). Informe Tecnico, Organizacao das Cooperativas do Estado do Parana no. 30. 18 pp.

1049 HILLS, F.J., JOHNSON, S.S., GENG, S., ABSHAHI, A., and PETERSON, G.R. 1981. Comparison of high-energy crops for alcohol production. California Agriculture 35(11-12):14-16.

Corn, sweet sorghum, fodderbeet and sugarbeet were grown on raised planting beds to compare their productivity and high content of fermentable carbohydrates. Fodderbeet and sugarbeet produced far more alcohol than corn and sweet sorghum but the corn had the lowest production coBt per unit of alcohol, followed by sweet sorghum. A potential disadvantage of sweet sorghum was that it should be used before winter frosts which can cause considerable loss of stalk sugars.

- 1050 HOSHIKAWA, K. 1981. Sweet sorghum, *Sorghum vulgare*, as biomass: a proposal for investigation of possibility to produce it in Japan. (Ja). Agriculture and Horticulture 56(4):497-503.
- 1051 KHANTIKHUN, N. 1981. Progress of ethanol production from sweet sorghum. (Thai). Warasan Namtan 17(2):1-6.
- 1052 KING, C.C., Jr., and GRANADE, G. 1981. Sweet sorghum varieties evaluated for fuel grade alcohol. Highlights of Agricultural Research 28(3):6.
- Seeds of 25 sweet sorghum varieties were planted to determine biomass yield potential and sugar content in 1980. Green and dry weights were determined for stripped stalks, leaves and the seed heads. Juice was extracted using sorghum mill and juice yields were measured. Sugar content of juice was estimated by refractometer. Yields indicated good biomass production potential. One or two more years of testing to identify varieties that will consistently produce high yields of juice with high brix reading needs is suggested.
- 1053 KRESOVICH, S. 1981. Sweet sorghum: *Sorghum bicolor* (Saccharatum group). Pages 147-155 In CRC handbook of biosolar resources (ed. O.R.Zaborsky). v.2. Boca Raton, Florida, USA: CRC Press. 17 ref.
- 1054 LIMA, E. 1981. The response of sweet sorghum to different sources and rates of phosphate fertilizers under greenhouse conditions. (Pt). M.Sc. thesis, Escola Superior de Agricultura "Luiz de Queiroz", Piracicaba, SP, Brazil. 116 pp. 54 ref. (Summary: En).
- 1055 NICHOLS, R.L., BRYAN, W.L., GAINES, T.P., GASCHO, G.J., and MONROE, G.E. 1981. Effect of weed control, plant population, and row spacing on sweet sorghum. Proceedings Southern Weed Science Society 34:227. (Abstract).
- 1056 OLLALA MERCADE, L., MURIEL FERNANDEZ, J.L., MORILLO VELARDE, R., NAVARRO CARRILLO, E., and MIRA BELDA, A. 1981. Contribution to the study of crops for energy production in Andalusia: sweet sorghum and sugarcane 1981. (Es). Comunicaciones I.N.I.A. Serie General no.10. 39 pp. 34 ref. (Summary: En).
- Sweet sorghum and sugarcane were studied as energy crops in the experimental plots of INIA at Cordoba and Sevilla, and Malaga in Spain. The results revealed that the sugar and fibre yields of both the crops were almost same at Cordoba and Sevilla. In Malaga, sugar yield of sugarcane was almost double than that of sweet sorghum due to climatic conditions.
- 1057 REIDENBACH, V.G. 1981. Sugarcane or sweet sorghum processing technique for production of alcohol by fermentation. Ph.D. thesis, Texas A and M University, College Station, Texas, USA. 171 pp.
- 1058 RICAUD, R., MARTIN, F.A., and COCHRAN, B.J. 1981. Sweet sorghum for biomass and alcohol production. Louisiana Agriculture 24(4):18-19.
- To determine the yield potential of sweet sorghum, Wray, Mnl500, and Mer.71-1 varieties were tested in one, two, and three drills in 1979. In 1980 Wray, Theis and Mn 1500 varieties were planted in two drills on April and May with or without Ethrel growth regulator treatment. In 1979, Wray was lowest and Mn 1500 was highest in stalk height and weight. In 1980 also, Wray was lowest and Mn 1500 was highest in each yield component. Early planting produced lower stalk population but higher weight. The Wray variety was highest in percentage of sugar and Mn 1500 was highest in sugar and alcohol yields per acre in 1979. In 1980 early planted Wray produced highest percentage of sugar and highest yields of sugar and alcohol.

1059 RODRIGUES, A.N.A. 1981. Corrective and maintenance fertilization in saccharine sorghum (*Sorghum bicolor* (L.) Moench). (Pt). Thesis, Universidade Federal de Paraiba, Areia, Brazil. 37 pp. 36 ref. (Summary: En).

1060 ROSOLEM, C.A., MALAVOLTA, E., and MACHADO, J.R. 1981. Comparative effects of nitrogen, phosphorus and potassium fertilization on two sweet sorghum cultivars. 1. Effects on grain and stalk production. (Pt). Revista Brasileira de Ciencia do Solo 5:124-128. 11 ref. (Summary: En).

Two sweet sorghum cultivars (Rio and Brandes) were sown on a Dusky Latosol (clay) and a Dark Red Latosol-sandy phase (loamy sand) to study the effects of N, P and K on grain and stalk production. The treatments were: 0-200-100, 75-200-100, 150-200-100, 150-0-100, 150-100-100, 150-200-0, 150-200-50, and 150-200-100 + micronutrients, in kg/ha of N, P205 and K2, respectively, and in the clay soil a treatment was included without fertilizers. An increase in grain production was noted due to N, P and K on clay soil and due to N and K on sandy soil for cv. Brandes, but the same didn't occur for cv. Rio. There was an increase on stalk production due to N and P fertilization on the clay soil and due to N and K fertilizations on the sandy soil, for cv. Brandes. On the other hand cv. Rio presented an increase in stalk production only in sandy soil due to P fertilization.

1061 SCHENONI, P. 1981. Sweet sorghum for fodder in alcohol production. (It). Terra e Vita 22(43):43.

1062 SHIH, S.F., GASCHO, G.J., and RAHI, G.S. 1981. Modeling biomass production of sweet sorghum. Agronomy Journal 73(6):1027-1032. 16 ref.

A field study on sweet sorghum was conducted to investigate the relationships among stalk length, leaf area index, and dry biomass. Cultivar

Mer 71-7 was planted using two row configurations of single rows on 71-cm centers and double rows on 142 cm centers on Pahokee muck (Lithic Medisaprist). The spacing between double rows was 30 cm. Leaf area, stalk length, and dry leaf biomass were periodically monitored. The relationships developed appeared to be useful for estimating sweet sorghum biomass. Further testing is suggested to evaluate the effects of diverse growing conditions and varieties and to determine the utility of the method in comparison to determining the mean plant weights and populations.

1063 SILVA, J.F. 1981. Brazil's gasoline replacement program increases pace as alcohol mix goes on sale. Foreign Agriculture 19(5):12-13.

Brazil's program to replace gasoline with alcohol includes boosting sugarcane production, seeking alternative plant materials for alcohol production, manufacturing alcohol-fueled cars, and converting gasoline-driven autos to alcohol power. Since sugarcane is the only feed stock now being used for alcohol production, efforts were made to use sweet sorghum as a raw material for alcohol production. Government plans to utilize the processing plant for 4-6 month when sugarcane is not available, because sweet sorghum can be processed by much the same process and it is possible to extract 70 litres of alcohol from a ton of sorghum stalks.

1064 SMITH, B.A., and REEVES, S.A., Jr. 1981. Sweet sorghum biomass. Part III. Cultivars and plant constituents. Sugar y Azucar 76(10):37-50. 17 ref.

Evaluations of sweet sorghums as biomass sources of fermentable carbohydrates initiated in South Texas in 1977, were extended by trials conducted in 1978 and 1979 to include five cultivars viz, MN 1500 in three trials, Rio in two and Sart, Wray, and Mer 71-1 in one trial each. The basis for these evaluations was the yield of

- total sugars/ton of fresh stalks. Data revealed that Rio at 151 kg (1977) and 135 kg (1978), and Wray at 135 kg (1979) were outstanding. Effects of harvest date and row spacing on total sugars are also discussed.
- 1065 SOEJOTO. 1981. Sweet sorghum. (En, In). Majalah Gula Indonesia 7(3):495-501. 9 ref.
- 1066 STANCILL, M. 1981. Alternative directions for agriculture. Pages 12-17 In Brazil: agricultural and trade policies. US Department of Agriculture, Foreign Agricultural Service no.M-305.
- Outlines the Brazilian National Alcohol Program (PROALCOOL) which aims at increasing alcohol production to gradually replace oil derivatives. Since only sugarcane has been used for alcohol production which is equally important as a source of sugars, attempts were made to identify alternative sources to produce alcohol. Manioc, sweet sorghum, babassu palm, and wood have been suggested as alternate raw materials. Costs and prices, exports, and impact of the alcohol program on Brazilian agriculture have also been discussed.
- 1067 TELYATNIKOV, N.YA., and KIKHAL'CHEVSKIJ, B.M. 1981. Feeding qualities of sugar sorghum green mass evaluated by its chemical composition. (Ru). Kormoproizvodstvo 12:19-20.
- 1068 TOKHTAROV, V.P. 1981. Mineral fertilizers, sugar sorghum yielding capacity and feed quality. (Ru). Kormoproizvodstvo 12:21-22.
- 1069 ZUMMO, K., FINDLEY, W.R., FREEMAN, K.C., BITZER, M.J., and ARMSTRONG, G. 1981. Resistance of sweet sorghum cultivars and lines to maize dwarf mosaic in Kentucky, Ohio and Mississippi. Plant Disease 65(3):241-242. 17 ref.
- Sweet sorghum lines MN 960, Mer.75-6, Mer.76-1, Mer.77-2, and Mer.77-7 showed good levels of resistance to maize dwarf mosaic in the field over 10 yr when susceptible control varieties had more than 90% infection. However, when MN 960 was inoculated mechanically in the greenhouse with five strains of sugarcane mosaic virus, 70% of the inoculated plants became infected. Mer. lines 75-6, 76-1, 77-2, and 77-7 are all unreleased breeding lines with Brandes as one common parent.
- 1070 ZUMMO, N., and FREEMAN, K.C. 1981. Brandes: a source of resistance to maize dwarf mosaic in sweet sorghum. Phytopathology 71(8):914. (Abstract).
- Four sweet sorghum lines, Mer.75-6, Mer.76-1, Mer.77-2, and Mer.77-7, each showing good resistance to maize dwarf mosaic under field conditions in Mississippi, Ohio, and Kentucky, are derived from crosses involving 'Brandes'. Brandes exhibits good resistance to mosaic in the field with a range normally of 1 to 5% infection under conditions of high mosaic spread. In 1971, a year of exceptionally high mosaic incidence, Brandes showed 30% infection in Ohio. Brandes is a selection from a cross of 'Collier 706C' x 'MN 1500'. Both Collier 706C and MN 1500 are susceptible to high levels of mosaic in the field. With the current interest in sweet sorghum for alcohol production in the United States as well as in many other countries, it is important that sources of resistance to this widespread disease be identified and made available to sorghum breeders.

## WEED SORGHUM

- 1071 ARGENTINA: UNIVERSIDAD DE BUENOS AIRES, FACULTAD DE AGRONOMIA. 1981. Ecological basis for invasion strategies of Sorghum halepense. (Es). Buenos Aires, Argentina: Universidad de Buenos Aires, Facultad de Agronomia. 25 pp.

1072 AVELLANEDA, J.J., SANTOS URIBILARREA, and SEMINARIO, E. 1981. Johnson grass control on maize and soybean modifying tillage systems. (Es). Revista de los CREA, Consorcios Regionales de Experimentacion Agricola 15(87):10-11.

1073 AZLIN, W.R., and MCWHORTER, C.G. 1981. Johnsongrass (Sorghum halepense) control in soybeans (Glycine max) with metriflufen applied postemergence. Weed Science 29(1):139-143. 5 ref.

Over-the-top applications of metriflufen at 0.6 to 2.2 kg/ha were highly toxic to Sorghum halepense but caused little visual injury to soybeans. Directed applications of metriflufen at 0.8 to 3.4 kg/ha provided equal and, in a few comparisons, better control of johnsongrass than did some rates of the herbicide applied over-the-top. Application of metriflufen at 0.8 and 1.7 kg/ha in directed sprays resulted in higher soybean yields than did comparable treatments applied over-the-top: yields of directed vs. over-the-top applications of metriflufen at 3.4 kg/ha resulted in statistically equal soybean yields. The research suggested that metriflufen entered johnsongrass plants through shoots and leaves and also through roots. Johnsongrass control was excellent following applications of metriflufen at 1.7 and 2.2 kg/ha without soybean injury and with greatly increased soybean yields.

1074 BALYAN, R.S., MALIK, R.K., KAMBOJ, R.K., SINGH, S.P., and BHAN, V.M. 1981. Studies on the chemical control of Johnson grass. Pages 259-263 In Proceedings, Eighth Asian-Pacific Weed Science Society Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.1. Bangalore, Karnataka, India: Asian-Pacific Weed Science Society. 10 ref.

The effect of glyphosate at 2, 4 and 6 kg/ha, bromacil at 4, 6 and 8 kg/ha, dalapon at 8, 12 and 16 kg/ha

on control of Sorghum halepense and its persistence through wheat, barley and mustard was evaluated. Application of glyphosate at 4 and 6 kg/ha reduced the reproductive potential (sprouts/sq m) and controlled the Johnson grass. This was followed by dalapon. Oil content in the rhizomes was not influenced significantly. The total sugar in the rhizome was maximum in untreated control and in mechanical shoot cut treatments. Lower doses of all herbicides did not exhibit any significant effect on total sugar but at high doses sugar content was significantly reduced by all herbicides. Protein content in rhizome was significantly reduced at 4 and 6 kg glyphosate and asulum per hectare respectively. The germination and growth of wheat, barley and mustard revealed adverse effect on growth by application of bromacil at all the doses. Glyphosate did not influence the germination and growth of any crop in the study.

1075 BENNETT, H.W., 1981. Johnsongrass: Sorghum halepense. Pages 251-257 In CRC handbook of biosolar resources (ed. O.F.Zaborsky). v.2. Boca Raton, Florida, USA: CRC Press. 16 ref.

1076 DALE, J.E. 1981. Control of johnsongrass (Sorghum halepense) and volunteer corn (Zea mays) in soybeans (Glycine max). Weed Science 29(6):708-711. 15 ref.

Rhizome Sorghum halepense in late-planted soybeans was effectively controlled with glyphosate applied twice by a rope-wick applicator at 0.1 kg/ha each time. At crop maturity, wick-applied glyphosate controlled an average of 92% of the johnsongrass over a 2-yr period as compared to 51% where 2.2 kg/ha of glyphosate was applied conventionally to rhizome johnsongrass prior to planting. There was no difference in soybean yields and no visible injury to soybeans. Rhizome johnsongrass and volunteer corn were effectively controlled in

soybeans planted at the proper time with glyphosate applied by either the rope-wick applicator or recirculating sprayer.

1077 DALE, J.E. 1981. Wick-applied glyphosate reduces johnsongrass population. Proceedings Southern Weed Science Society 34:297-299. 1 ref.

1078 FAWCETT, R.S. 1981. Today's weed-shattercane. Weeds Today 12(1):11-14.

1079 GAUSMAN, H.W., MENGES, R.M., RICHARDSON, A.J., WALTER, H., RODRIGUEZ, R.R., and TAMEZ, S. 1981. Optical parameters of leaves of seven weed species. Weed Science 29(1):24-26. 14 ref.

Absorption coefficient (K), infinite reflectance, and scattering coefficient (S) were tabulated for five wave lengths and analyzed for statistical differences for seven weed species. The infinite reflectance of common infinite reflectance lambsquarters, Sorghum halepense, and annual sowthistle leaves at the 0.85 micro m wave length were higher than for sunflower, ragweed parthenium or London rocket. Johnsongrass, ragweed parthenium or London rocket had the largest 'S' values among the five wave lengths, whereas annual sowthistle and Palmer amaranth had the lowest.

1080 JEFFERY, L.S., ENGLISH, J.R., and CONNELL, J. 1981. The effects of fall application of glyphosate on corn (Zea mays), soybean (Glycine max), and johnsongrass (Sorghum halepense). Weed Science 29(2):190-195. 9 ref.

Glyphosate was applied at various stages of maturity to corn, soybeans, and Sorghum halepense. Glyphosate applied over-the-top of corn before the grain moisture level decreased to 30%, caused various seed and subsequent progeny abnormalities. Depending on grain moisture level at the time of glyphosate application, seed weight was sometimes reduced and progeny seedling emergence, vigor, and weight were reduced. Also, abnormal

seedlings, albino or straited, occurred. Glyphosate applied 2 1/2 weeks or more before soybean maturity reduced seed weight, caused seed discoloration, and drastically reduced progeny seedling emergence, vigor, and weight. Glyphosate applied in September or early October controlled semimature johnsongrass. Later applications were less effective because of advanced senescence.

1081 KEELEY, P.E., and THULLEN, R.J. 1981. Control and competitiveness of johnsongrass (Sorghum halepense) in cotton (Gossypium hirsutum). Weed Science 29(3):356-359. 18 ref.

Four field experiments conducted over 3 yr indicated that cultivation alone failed to prevent Sorghum halepense from reaching densities that severely reduced yields of cotton. Density of johnsongrass in plots cultivated four times and hoed weekly for 8 weeks after emergence was reduced to 1 shoot/sq m at harvest compared to 74 shoots/sq m for plots that were only cultivated. In addition to a 60% average yield loss of seed cotton, yield losses ranging from 40 to 76%, ginning losses were also greater from cultivated than from hand-weeded plots. Compared to cultivated plots, supplementing cultivation with two post-emergence applications of 3.0 kg/ha of DSMA (disodium methanearsonate) increased the average yield of cotton by 20% and reduced perennial johnsongrass densities by 64% at harvest. Although yields were improved by applying DSMA, they averaged 40% less than those of hand-weeded plots. The temporary weed control obtained with DSMA was profitable in terms of the additional lint and seed obtained, but insufficient cotton was produced to pay expenses for producing the crop by any of the methods of weed control. High labor costs for hoeing prevented this treatment from being profitable.

1082 KIMURA, F., NISHIYAMA, R., FUJIKAWA, K., YOKOMICHI, I., HAGA, T., and SAKASHITA, N. 1981.

Fluazifop-butyl: a new type of herbicide with selectivity between gramineous weeds and broad leaf crops. Pages 433-437 In Proceedings, Eighth Asian-Pacific Weed Science Society Conference, 22-29 November 1981, Bangalore, Karnataka, India. v.1. Bangalore, Karnataka, India: Asian-Pacific Weed Science Society. 2 ref.

A new selective herbicide Fluazifop-butyl, has been jointly developed by Ishihara Sangyo Company and Imperial Chemical Industries. This compound is characteristic mainly in the clear selectivity between gramineous weeds and broad leaf crops and in the distinguished translocation through leaves and roots. Fluazifop-butyl can be safely used for almost any broad leaf crops to control annual and perennial grasses by overall treatment as well as by soil surface treatment and soil incorporation. Its excellent translocatability through leaves and roots brings special effect for the control of perennial grasses quite tolerant to any herbicides now in use. The average application rates of Fluazifop-butyl are 0.125-0.25 kg a.i./ha and 0.5-1.5 kg/ha for annual and perennial grass control, respectively. In this paper, structure-activity relationship, selectivity between broad leaf crops and grasses, translocation through leaves and some field test results are presented.

1083 LAZARTE, A. 1981. Sorghum halepense in sugarcane (*Saccharum officinarum*): evaluation of competition and methods of control. (Es). Avance Agroindustrial 2(7):25-27.

1084 LEGUIZAMON, E.S., and LOMBARDO, A.P. 1981. Herbicide assessment for the selective control of nutgrass (*Cyperus rotundus* L.) and Johnson grass (*Sorghum halepense* L. Pers) in soybean. (Es). Oliveros Informe no.8. 9 pp.

1085 MCWHORTER, C.G. 1981. Effect

of temperature and relative humidity on translocation of <sup>14</sup>C-metribiflufen in johnsongrass (*Sorghum halepense*) and soybean (*Glycine max*). Weed Science 29(1):87-93. 14 ref.

Absorption and translocation of <sup>14</sup>C-metribiflufen in *Sorghum halepense* and soybean were evaluated under different environmental conditions. At 40% relative humidity (RH), an increase in air temperature from 18 to 35 deg C increased translocation of the <sup>14</sup>C in johnsongrass more than four-fold following application of <sup>14</sup>C-metribiflufen to an area on the third leaf. At 100% RH, translocation of the <sup>14</sup>C was twice as great at 27 deg C as at 18 deg C, but translocation at 35 deg C was intermediate. In the combined analysis, translocation in johnsongrass was no better at 100% RH than at 40% RH. Regardless of level of RH, most translocation in johnsongrass at 18 and 27 deg C was toward the distal half of the treated leaf, but at 35 deg C most translocation was toward the proximal half of the treated leaf.

1086 MCWHORTER, C.G., and ANDERSON, J.M. 1981. The technical and economic effects of johnsongrass (*Sorghum halepense*) control in soybeans (*Glycine max*). Weed Science 29(3):245-253. 11 ref.

The effect of *Sorghum halepense* on soybean yields, grades, and net returns were determined by regression analysis of data from 252 field research plots from 1971 through 1976. Johnsongrass control from 0 to 100% was achieved by various combinations of summer fallow, dalapon as a preplanting application at 8.3 kg/ha. or trifluralin at 0.8 to 1.7 kg/ha incorporated into the soil before planting. Repeated usage of trifluralin at 1.7 kg/ha, 'either with or without use of summer fallow, provided the most effective and most profitable soybean production. Foreign material in soybean seed samples was about 0.8% with 100% johnsongrass control and nearly 6%

with no control. At least 70% johnsongrass control was required to avoid deductions from gross harvested weights caused by seed moisture levels exceeding 13%. With 100% johnsongrass control, about 1.2% damaged soybean seed occurred, whereas, without johnsongrass control, about 1.7% seed damage occurred. The level of johnsongrass control had little effect on the level of split soybean seed at harvest. Failure to control johnsongrass resulted in predicted soybean grades of 4.1; whereas, nearly 100% johnsongrass control was necessary to provide U.S. No.1 grade soybeans. Soybean yields were increased 4.8 to 6.2% for each 10% increase in johnsongrass control when plots were not fallowed or after fallowing, respectively. Net returns in soybean production were nearly twice as great with 100% johnsongrass control as when johnsongrass was not controlled.

1087 MIKULAS, J. 1981. Allelopathy of *Sorghum halepense* (L.) Pers. on weeds and crop plants. (Hu). *Novenyvedelem* (Hungary) 17(10-11):413-418. 22 ref. (Summaries: De, En, Ru).

The allelopathy of *Sorghum halepense* was studied on *Amaranthus retroflexus* seeds and maize seeds and seedlings. *Amaranthus* seeds placed on *Sorghum halepense* rhizome sections, showed considerable germination inhibition, as reflected in the delay of germination and reduced percentage of germinated seeds. Germination inhibition was noted also in seeds treated with rhizome extracts; in serial dilutions of the extract, a corresponding reduction in inhibition was observed. Besides the effect on germination, the rhizome extracts influenced the growth of seedlings and caused distortions. The development of maize seedlings was strongly inhibited by the rhizome extract. In serial dilutions the effect decreased, but the shoot growth and dry weight data still showed significant differences from the normal plants.

1088 MONAGHAN, N.M., and MICHAEL, P.W. 1981. Variation in *Sorghum halepense*. Proceedings of the International Botanical Congress 13:220. (Abstract).

1089 OLAH, B. 1981. Analysis of the morphological characteristics of the panicle in four populations of *Sorghum halepense* (L.) Pers. *Acta Agronomica Academiae Scientiarum Hungaricae* 30(3-4):383-406. 20 ref.

The four *Sorghum halepense* populations were examined by taking morphological measurements on harvested, pressed panicles and their spikelets. It was concluded that many characters were strictly hereditary. In the Hungarian populations examined, the panicles differed mainly in quantitative characters, viz. number of flowers, number of spikelets, weight of panicle, width of panicle,. No evidence was found of a direct influence of qualitative composition of weed coenosis on the panicle data obtained. To reduce the considerable extent of variation within the populations it is suggested to compare the different phenophases with each other.

1090 PANAYOTOU, P.C. 1981. Maize dwarf mosaic virus in Greece. *Plant Disease* 64(8):803-804. 11 ref.

Maize dwarf mosaic virus was isolated from 9 corn and 27 johnsongrass plants in corn fields in Achaia county in northwestern Peloponnese. All the isolates were of maize dwarf mosaic virus, Strain-A. Effects of the virus on height and stalk diameter of 10 commercial corn hybrids were determined.

1091 POLLASTRO, L. 1981. Maize, sorghum: weeding of herbacious crops. (It). *Italia Agricola* 118(3):134-145. 18 ref.

1092 ROGERS, N.K., TALBERT, R.E., and OLIVER, L.R. 1981. Johnsongrass (*Sorghum halepense*) control in soybeans (*Glycine max*) with metriflufen. *Weed Science*



29(3):291-296. 12 ref.

Field experiments were conducted in 1977 and 1978 to determine susceptibility of rhizome Sorghum halepense to metriflufen applied as preplant- incorporated, preemergence, or postemergence treatments. Rates of metriflufen applied preplant incorporated and preemergence were 1.12, 2.24 and 3.36 kg/ha. Postemergence treatments consisted of 0.56, 1.12, and 1.68 kg/ha of metriflufen plus a non-ionic polyethylene glycol alkyl ester, each applied to johnsongrass at growth stages of 30 to 38 cm, 60 to 75 cm, and heading. Johnsongrass control increased with each increase in rate of soil-applied metriflufen with no differences in control between preplant incorporated and preemergence treatments. Johnsongrass density was reduced by increased rates of metriflufen, and 1978 soil-applied treatments reduced densities by 62%. Preplant-incorporated and preemergence applications of 3.36 kg/ha of metriflufen resulted in higher soybean yields than did the two lower rates. Results from treatments with trifluralin were similar to those with metriflufen at the same rate. Metriflufen applied to 30 to 38 cm johnsongrass reduced stands by 60% in 1978, but stands increased by 51 and 71% in plots treated at the 60 to 75 cm or heading stages of growth.

1093 SANCHEZ, R.A., GHERSA, G.M., and DE VALLA, L.G. 1981. Effect of the soil on the behaviour of johnsongrass seeds (Sorghum halepense). (Es). Buenos Aires, Argentina: Universidad de Buenos Aires. 17 pp. 13 ref.

1094 SARPE, N., and POPA, F. 1981. Losses caused by Sorghum halepense in maize crops and possibilities of its reduction using anti-gramineous herbicides before sowing and roundup before harvesting. (Ro). Productia Vegetala Cereale si Plante Tehnice 1:36-40. 3 ref.

1095 SARPE, N., POPA, F., DINU, C., OPREA, N., VLAD, I., DERMENGI, C.,

CIOACA, I., and PLETEA, V. 1981. New results on the efficiency of the Fusilade and Kusagard herbicides in the control of Sorghum halepense from rhizomes in soybean crops. (Ro). Productia Vegetala Cereale si Plante Tehnice 5:18-21.

1096 WINKLE, M.E., LEAVITT, J.R.C., and BURNSIDE, O.C. 1981. Effects of weed density on herbicide absorption and bioactivity. Weed Science 29(4):405-409. 3 ref.

Data from yield experiments in 1977 and 1979 indicated that more alachlor or metolachlor was required for equal control of a high than low density of forage sorghum (Sorghum bicolor) interseeded in maize. Rox orange sorghum was used to stimulate shattercane (Sorghum bicolor) a problem weed in Nebraska. At the higher Rox orange sorghum seeding rate used, both alachlor and metolachlor treatments decreased Rox orange sorghum populations but not yield.

1097 WU, C.H., and DERTING, C.W. 1981. Operational variables and glyphosate performance through ropewick applicators. Proceedings Southern Weed Science Society 34:301-304. 6 ref.

Glyphosate can be successfully used through a ropewick applicator to selectively control tall weeds which are growing above the crop. The criteria for good control of Sorghum halepense is: (1) select a rope with a high flow rate and high retention capacity, (2) under heavy weed infestation, reduce travel speed and make two passes, (3) rotate the ropes to 5-6 O'clock position and (4) keep reservoir full and vented to maximize capillary flow of the glyphosate solution.

## FORAGE SORGHUM

1098 AGHA, K.H., SOLANGI, G.Y., and RAJPUT, F.K. 1981. Effect of sowing

dates and manures on the yield of green fodder of early sown sorghum. Pakistan Journal of Agricultural Research 2(4):225-227. 9 ref.

The effect of different sowing dates and nitrogen levels on the growth and grain yield of Sorghum bicolor was studied under the agro-climatic conditions prevailing at Tandojam (Pakistan). The sorghum crop sown on March 31 produced taller and thicker plants, while April 15 sown crop produced highest number of leaves per plant and gave significantly more fodder yield per hectare than early sowings. The plant height, stem girth and fodder yield per hectare increased with an increase in N dose from 0 to 45-67 kg/ha. As such, 67 kg N/ha produced taller and thicker plants and gave more fodder yield than lower N dose or control. The March 15 sowing, with 67 kg N/ha or April 15 sowing, with 45 kg N/ha were the optimum treatments.

1099 AHLUWALIA, M. 1981. IARI evolves high yielding varieties of fodder sorghum. Seeds and Farms 7(10):5.

In view of high dry matter content, sorghum is used by dairy farmers as green fodder as well as in the form of hay. IARI scientists have evolved the varieties with high yield and seed production ability, which include Pusa Chari-1, Pusa Chari-6, Pusa Chari-7, Pusa Chari-9, and Pusa Chari-11. Some two cut varieties are Pusa Chari-21, Pusa Chari-23, Pusa Chari-28, Pusa Chari-29 and Pusa Chari-40. It is expected that with these improved fodder sorghum varieties the feed standards for dairy cattle can be improved.

1100 ANTONGIOVANNI, M., and GRIFONI, F. 1981. Maize and sorghum: two fodder crops compared. (It). Informatore Zootecnico 28(14):27-33. 8 ref.

1101 ARORA, S.K., LUTHRA, Y.P., and JOSHI, U.N. 1981. Chemical composition of newly evolved varieties

of forage sorghum and factors responsible for increasing the animal productivity. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 18 pp. 11 ref.

Forage sorghum varieties were screened in Haryana, India to study (i) structural carbohydrates influencing digestibility (ii) toxic contents like HCN and tannin, and (iii) genetic potential for increased animal production. Early variety IS 4776 yielded 9.63 and 92.05 q/ha of protein and digestible dry matter respectively, and showed low content of HCN. Late variety S-136 yielded 15.15 and 107.93 q/ha of proteins and digestible dry matter and showed low content of HCN and tannin. Suggestions are made to improve nitrogen deficiency in forage sorghum.

1102 BACIGALUPO, L.M., and MARTIN CIENCIA, M.J. 1981. Effect of three final forage sorghum availability on production, growth and quality of the crop and its use for beef cattle. (Es). Thesis, Universidad Nacional de Mar del Plata, Balcarce, Argentina. 131 pp.

1103 BELESKY, D.P., WILKINSON, S.R., DAWSON, R.N., and ELSNER, J.E. 1981. Forage production of a tall fescue sod intercropped with sorghum x sudangrass and rye. Agronomy Journal 73(4):657-660. 9 ref.

A multispecies no-tillage system was designed to produce supplemental forage for year-round grazing while maintaining a viable tall fescue sod for erosion control. This system offers the potential to improve forage quantity and quality for low yielding tall fescue pastures in the South. Sorghum x sudangrass hybrid, cv. 'Pennington's summergrazer', was seeded into tall fescue sod after the flush of spring growth, and rye seeded in early October after the end of the summer growing season for 3 consecutive years. A tall fescue sod monoculture yielded 7,405 kg dry

matter/ha annually (3-year average). Inclusion of SS hybrid and rye in the tall fescue system with 50% sod kill increased total average forage yield to 11,115 kg/ha and improved distribution of yield over the year. Sorghum x sudangrass hybrid accounted for 48% (5,283 kg dry matter/ha) of the average yearly total yield for 50% sod kill.

1104 BEREAU, M. 1981. On some fungal and bacterial diseases of tropical forage grasses in French Guyana. (Fr). *Agronomie* 1(10):877-885. 30 ref. (Summary: En).

An inventory of the fungal and bacterial diseases of forage crops in French Guyana was made from 1978 to 1980 and the symptoms are described. The different forage compartment in front of parasites are modified by soil type, weather, and harvest or grazing intervals. *Digitaria swazilandensis* appears as the more adapted plant to French Guyana conditions.

1105 BERTRAM), J.E., LUTRICK, M.C., EDDS, G.T., and WEST, R.L. 1981. Animal performance, carcass quality, and tissue residues with beef steers fed forage sorghum silages grown on soil treated with liquid digested sludge. *Soil and Crop Science Society of Florida Proceedings* 40:111-114. 13 ref.

Sorghum bicolor silages, grown on soil treated with Pensacola liquid digested sludge (LDS) were fed as the main ingredient in the diet of beef steers to determine the effects on animal performance, carcass quality, and concentrations of selected potentially toxic metals in liver, muscle, and kidney tissues. Inclusion of silages grown on soil treated with LDS in the diets had no effect on animal performance and carcass quality measurements of beef steers. The cadmium (Cd) concentrations were lower ( $P^{1/4} 0.05$ ) in the livers of steers fed the LDS 1 diet. The concentrations of copper (Cu) in livers of steers fed the LDS diets were lower ( $P^{1/4} 0.01$ )

than those of steers fed the control diet, while the concentrations of iron (Fe) in livers of steers fed the LDS 2 diet were lower ( $P^{1/4} 0.01$ ) than those of steers fed the control and LDS 1 diets.

1106 BOLSEN, K.K., and ILG, H.J. 1981. Sila-bac, cold-flo, and sodium hydroxide for forage sorghum silage. Pages 65-70 In *Cattlemen's day 1981: report of progress*, 394. Manhattan, Kansas, USA: Kansas Agricultural Experiment Station.

Inoculant (Sila-bac), non-protein nitrogen (Cold-flo), and alkali (NaOH) silage additives were evaluated with whole-plant forage sorghum silage. All three additives decreased ensiling temperatures. Calves fed Sila-bac or NaOH silages gained 12.0% faster but calves fed cold-flo silage gained 7.7% slower than those fed control silage. NaOH silage was consumed in the greatest amount; cold-flo silage, in the least. Calves fed Sila-bac silage were more efficient than calves fed any of the other silages.

1107 BOORA, K.S., and LODHI, G.P. 1981. Combining ability analysis in forage sorghum. *Forage Research* 7(1):19-25. 10 ref.

Heterosis and combining ability for ten forage characters were studied. In environment-1, heterosis of the order of 189.05 and 347.33% over better check was recorded for green fodder yield and dry matter yield, where as in environment-2, heterosis was upto 121.95 and 202.92% for green fodder and dry matter yield, respectively. The variance for specific combining ability was higher than that of general combining ability for most of the characters except days to flowering, plant height, stem thickness and stem weight showing the preponderance of additive genetic variance for these traits and non-additive gene action for other characters like the number of leaves/plant, leaf length, leaf breadth, leaf weight/plant, green fodder yield and dry matter yield.

1108 BRACY, R., MASON, L., and ALLEN, M. 1981. Performance of forage sorghum hybrids for silage production 1981. Pages 23-26 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Out of 16 forage sorghum hybrids evaluated, green forage yields of Northrup King 367 (31.4 tons/acre) and Funk's G-98F (27.9 tons/acre) were greater than the other 14 varieties. Dry matter content of the forage averaged 35.3% for all hybrids. Grain content was low in all hybrids with only four varieties having 20% grain. Over the years, forage yield and grain content were much higher in 1979 than in 1978, 1980 and 1981 seasons.

1109 BRACY, R., MASON, L., and ALLEN, M. 1981. Use of minimum tillage to produce corn and sorghum silages in permanent sod 1981. Pages 27-31 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Northrup King 300 forage sorghum was planted to evaluate possibilities and problems of growing sorghum for silage in warm-season pasture sods. Forage production was high in all treatment combinations. The roundup plot yielded the highest numerical tonnage. Percentage grain on a dry basis ranged from 25.1 to 28.4.

1110 BRACY, R., MASON, L., BRUPBACHER, R.H., MILLER, B.J., and MORRIS, H.F., Jr. 1981. Response of ryegrass and forage sorghum to applications of dolomitic limestone, 1980-81. Pages 69-76 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Study was initiated to determine the frequency and rate of limestone application for optimum yields in

intensive forage double-cropping system. NK300 forage sorghum was planted following ryegrass harvest and was harvested for silage evaluation at hard-dough stage of grain maturity. Data revealed that forage yield on green and dry-weight bases was numerically lowest in plots which had never been limed, but there were no significant differences in yields among any of the treatments. Effect of liming on grain content of the total harvest was also not significant. Laboratory analysis was made of soil to determine the effect of liming on levels of phosphorus, potassium, calcium, and organic matter of soil and its pH value.

1111 BURNS, J.C., and KIMBROUGH, E.L. 1981. Quality estimates and chemical characterization of fermented and unfermented summer annual forages. Agronomy Journal 73(6):921-928. 19 ref.

Ten cultivars of forage and grain sorghums, sorghum x sudangrass hybrids, and pearl millet which provide forage during or after midsummer, were evaluated for quality and fermentation characteristics. Chemical and bioassay measurements were compared prior to and after fermentation. Results showed that fermentation reduced differences in invitro dry matter disappearance (IVDMD) among cultivars in unfermented forage. Nitrogen (N) and crude fiber (CF) contents in oven-dried samples were higher in fermented than in unfermented forage. The water soluble carbohydrates (WSC) levels for unfermented forage and that fermented for 45 and 90 days were 16.7, 6.6 and 7.6% respectively. Total digestible nutrients computed from CF averaged 58.2, 57.0 and 56.9% for oven-dried unfermented and 45 and 90 day fermented silages respectively compared with IVDMD percentages of 52.6, 45.1 and 46.0.

1112 CARO-COSTAS, R. 1981. Effect of harvest interval on yields of four sudan grass sorghum crosses with irrigation on the South coast of

Puerto Rico. Journal of Agriculture of the University of Puerto Rico 65(2):108-113. (Summary: Es).

Yields of the sudan grass-sorghum hybrids Space Maker, Grazer A, Sordan 70, and Graze and Bale averaged 23028, 39815 and 54810 kg of dry forage/ha/yr when harvested every 30, 45 and 60 days, respectively, over a one year period with irrigation. Crude protein percentage of the forage averaged 9.0, 6.2 and 5.0% for the 30, 45 and 60, days cutting intervals, respectively. Sordan 70 and Grazer A were the highest yielders with 30- or 60-day harvest intervals. Sordan 70 outyielded all the other forages at the 45-day harvest interval. All the forages had similar crude protein contents at the various cutting intervals except Sordan 70 that had a lower protein content than the other forages at the 30- and 60-day cutting intervals but produced more protein than the other grasses at the 45-day harvest interval. The very high yields produced by these forages show that the semiarid irrigated region of Puerto Rico can be used to grow forage to supplement pastures in nearby grazing lands during the annual dry season.

1113 CASTELLANOS, J.Z., and PRATT, P.F. 1981. Nitrogen availability in animal manures and crop yields. *Agrochimica* 25(5-6):443-451. 15 ref. (Summaries: De, Es, Fr, It).

A 10-month greenhouse experiment with ten manures and two soils was conducted to determine the net mineralization of N and total available N. Greenhouse crops were barley followed by Sorghum sudanense. Crop yields and N removal in harvested crops indicated that available N was highest in chicken and pig manures, intermediate for sheep, feedlot and dairy manures and lowest in composted dairy manures. Composting reduced the availability of N in both chicken and dairy manures. Available N was not highly correlated with total N or C in manures. Mineralization of manure N was greater in the sandy as compared

to the clayey soil. Removal of N in harvested crops was highly correlated with the available N estimated from N balance in the 10-month cropping period.

1114 COSER, A.C., and MARASCHIN, G.E. 1981. Forage yield and quality of pearl millet var. Comum and sorghum cv. Sordan MK, under grazing. (Pt). *Pesquisa Agropecuaria Brasileira* 16(3):397-403. 33 ref. (Summary: En).

Pearl millet and Sorghum bicolor were evaluated under continuous grazing for dry matter production, dry matter percentage, crude protein content, in vitro dry matter digestibility and in vitro organic matter digestibility. Both were similar in dry matter production but sorghum produced 23% more dry matter than millet. The crude protein content of the two species did not differ significantly. However pearl millet showed higher values than sorghum. For the in vitro dry matter digestibility and in vitro organic matter digestibility, both species showed similar trends but pearl millet had higher average values than sorghum.

1115 CREEL, R.J., and FRIBOURG, H.A. 1981. Interactions between forage sorghum cultivars and defoliation managements. *Agronomy Journal* 73(3):463-469. 10 ref.

The extent of cultivar x management interaction was studied for 'Sweet Sioux III' (a leafy hig-producing cultivar), 'FS-531' (a silage-forage cultivar) and 'Super-Chowmaker 235' (several weeks later in maturity than most other forage sorghum cultivars) for 2 years. The soil was a Sequatchie sandy loam (fine-loamy, siliceous, thermic Humic Hapludults). Stubble height and defoliation managements designed to stimulate grazing, greenchop, hay or silage harvests, in various combinations, were used with each cultivar. The results suggested that, if the three different cultivars used

here had been entered in a yield trial where all entries were managed uniformly, the information on the potential performance of these forage sorghum cultivars could have been misleading. Harvests at early stages of growth would have penalized Super-Chowmaker 235 in comparison to Sweet Sioux III, and the reverse would have occurred if later stages of growth had been used to determine harvest time.

1116 CUMMINS, D.G. 1981. Yield and quality changes with maturity of silage-type sorghum fodder. *Agronomy Journal* 73(6):988-990. 9 ref.

To determine the effects of maturity in four height classes of sorghum hybrids and their interactions on dry forage yields and its composition, and to determine quality of heads, leaves, and stalks in terms of in vitro dry matter digestibility (IVDMD) and acid detergent fiber (ADF), four hybrids, representing height classes of 4.5, 5.5, 6.5, and 7.5 m, were grown under conventional production practices and harvested at the late milk, early dough, dough, and hard dough stages of grain maturity. The results showed the potential for improvement in quality of silage-type sorghum hybrids through selection of breeding lines that maintain high stalk quality late into maturity.

1117 DESHMUKH, V.M., TINGARE, S.B., and DESAI, R.T. 1981. Comparative study of some of the varieties of fodder jowar. *Livestock Adviser* 6(2):55-56.

1118 DEV, A.D., and DEV, D.V. 1981. Studies on the yields of green dry matter and crude protein from some fodder crops. *Indian Journal of Plant Physiology* 24(3):295-297. 5 ref.

Yields of vegetation, dry matter, and crude protein from some short duration cereal crops are reported. Three varieties of pearl millet, two varieties of sorghum, teosinte and local maize were studied. Teosinte (*Euchlena mexicana*) yielded maximum

green vegetation, dry matter and crude protein when harvested two times in 135 days. Sorghum yielded 37758 kg, 7669 kg and 948 kg of green, dry matter and crude protein respectively expressed in terms of kg/ha in 135 days.

1119 FALES, S.L., and CUMMINS, D.G. 1981. Effect of sample moisture on predicting acid detergent fiber with near infrared reflectance. *Agronomy Abstracts* 73:131.

This study was carried out to determine the extent to which moisture interferes with the ability of near infrared reflectance (NIR) to predict acid detergent fiber (ADF) content in silage-type sorghum. Comparisons were made between laboratory and predicted ADF on samples that were oven-dry or had been stored at 43% (low) 63% (medium) and 100% (high) relative humidities. Results showed no significant differences between laboratory and predicted ADF for samples that were dry or had been stored under conditions of low humidity. However, when samples were stored under medium or high relative humidities, a significant ( $P=0.05$ ) over-estimation of ADF resulted. Increasing sample moisture increased the standard error of estimate from 1.27 and 1.18 for dry and low moisture samples, to 2.28 and 4.15 for medium and high moisture samples, respectively. Consistently, repeatable ADF values were obtained when calibrations and NIR analyses were conducted on oven-dry material.

1120 FARIS, M.A., DE ARAUJO, M.R.A., and LIRA, M.DE A. 1981. Yield stability of forage sorghum in northeastern Brazil. *Crop Science* 21(1):132-134. 5 ref.

Ten forage sorghum selections, one commercial sorghum cultivar, and one local maize cultivar were grown in replicated trials at 12 locations in the semi-arid tropics of north-eastern Brazil for 3 years. Superiority of some of the new selections in forage dry matter production over the

commercial cultivar and corn check was demonstrated. The combined analysis revealed that entries (G), environments (E), and the G x E interaction were highly significant. However, some nonlinearity existed which necessitated transformation of the data to the logarithmic scale which gave better fitting regression lines. Two of the highest yielding entries possessed the greatest stability. The results showed that better data interpretation came from the log transformed data and that stability parameters should be considered in selection among high yielding cultivars.

1121 FRIBOURG, H.A., and CREEL, F.J. 1981. Selection of concomitant variates affecting regrowth, yield, and digestibility in forage sorghums. *Agronomy Journal* 73(3):443-445. 10 ref.

The sequential use of factor analysis and multiple regression techniques to decrease the number of independent variables without appreciable loss in the explanation for variability in the dependent variables is reported. Factor analysis was used first to reduce possibly redundant concomitant variables or select proxy variables for a whole dimension. Fifteen of the original 38 variates were selected. Multiple regression was then used to reduce further the concomitant variables to nine variables (days of growth since planting, days of regrowth since previous harvest, height of standing crop, leaf area index (LAI) of whole plant, DM yield of stubble at previous harvest, cumulative precipitation, degree days since previous harvest, percent leaf in DM harvest, LAI of whole plant at previous harvest). Six or fewer of these variates were associated with a large portion of the variability in the three dependent variables.

1122 GRAHAM, J.H., LEONARD, R.T., and MENGE, J.A. 1981. Membrane mediated decrease in root exudation responsible for phosphorus inhibition of vesicular

arbuscular mycorrhiza formation. *Plant Physiology* 68(3):548-552. 18 ref.

The mechanism responsible for phosphorus inhibition of vesicular-arbuscular mycorrhiza formation in sudangrass was investigated in a phosphorus-deficient sandy soil amended with increasing levels of phosphorus as superphosphate. It was shown that under low phosphorus nutrition, increased root membrane permeability leads to net loss of metabolites at sufficient levels to sustain the germination and growth of the mycorrhizal fungus during pre- and post infection. Subsequently, mycorrhizal infection leads to improvement of root phosphorus nutrition and a reduction in membrane-mediated loss of root metabolites.

1123 GRAY, F., HURT, V.K., and DUCKWORTH, D.L. 1981. Treatment of heterogeneity of variances in hydrocyanic acid data. *Agronomy Journal* 73(2):379-382. 18 ref.

Heterogeneity of variance in Hydrocyanic acid potential (HCN-p) data was studied to employ appropriate treatment for heterogeneity. Sorghum sudanense, and sorghum x sudangrass hybrids were subjected to five N treatments after first, second and third harvests. The cultivars, N, and harvest treatments were analyzed for heterogeneity of variances. For the natural data, the treatment means and variances were positively associated, and the variances for several treatment comparisons were heterogeneous. Heterogeneity of variances decreases the accuracy of statistical comparisons of means.

1124 HANNA, W.W., MONSON, W.G., and GAINES, T.P. 1981. IVDM, total sugars, and lignin measurements on normal and brown midrib (bmr) sorghums at various stages of development. *Agronomy Journal* 73(6):1050-1052. 10 ref.

The effects of five bmr mutants

on in vitro dry matter digestibility (IVDMD), lignin concentration and total sugars of young vegetative forage that would be used for grazing or hay was studied. Forage from bmr 12 and bmr 18 harvested 4 weeks after planting was significantly higher in IVDMD than their normal counterparts in each of the 3 years tested. Three other mutants were not consistently higher in IVDMD indicating a possible environmental interaction. Total reducing and non-reducing sugars were not related to IVDMD and the bmr mutants did not have a significantly different total sugar concentration than normal types. Four weeks after planting, IVDMD of bmr 12 forage was 7.2 and 5.6% units higher than normal forage for leaves and stems, respectively. The differences observed for the bmr gene should lead to significant improvement in animal performance.

1125 HASKINS, F.A., GORZ, H.J., and CLARK, R.B. 1981. Influence of radiation level on apparent hydrocyanic acid potential of sorghum seedlings. *Agronomy Abstracts* 73:86.

Exposure of seedlings of some sorghum lines to increased radiation level enhanced apparent hydrocyanic acid potential (HCN-p) as assayed spectrophotometrically. In investigations of this apparent increase, 7-day seedlings of a number of forage sorghum and *S. sudanense* lines were grown under photosynthetically active radiation (PAR) levels of about 180 micro E per sq m per sec (PAR-1) or 400 micro E per sq m per sec (PAR-2). Spectral scans of first-leaf extracts revealed the occurrence, especially in low-HCN-p seedlings grown under PAR-2, of substances that interfered with the 330 nm absorbance maximum of p-hydroxybenzaldehyde (p-HB), on which the spectrophotometry assay is based. For the spectrometric assay, seedlings should be grown under a radiation level of no more than 200 micro E per sq m per sec, and spectra should be scanned and/or ether extraction used

for any entries assaying less than 250 ppm HCN-p (fresh weight basis).

1126 HASSAN, K.I.A. 1981. Studies in some factors influencing the productivity of summer fodder crops. Ph.D. thesis, Cairo University, Cairo, Egypt. 137 pp. (Summary: Ar).

1127 IALEA, D.G. 1981. Agronomic evaluation of regrowth forage sorghum (*Sorghum* spp). (Es). Thesis, Universidad Nacional de Mar del Plata, Balcarce, Argentina. 71 pp. 14 ref.

1128 ILG, H.J., BOLSEN, K.K., and DIKEMAN, M. 1981. Growing rations of forage sorghum silage and alfalfa haylage. Pages 49-51 In *Cattlemen's day 1981: report of progress*, 394. Manhattan, Kansas, USA: Kansas Agricultural Experiment Station.

Growing rations containing forage sorghum silage (FSS) or equal amounts of FSS and alfalfa haylage were fed to crossbred steer calves for 112 days. Steers consumed more of the FSS + haylage but rate and efficiency of gain were best for steers fed the FSS. The value of alfalfa haylage at various prices for FSS and soybean meal was calculated.

1129 KARIM, M., and DREGNE, H.E. 1981. Forage yield and head weight of sorghum as influenced by broadcast vs. band application of nitrogen, phosphorus and potassium. *Pakistan Journal of Agricultural Research* 2(1):24-28. 12 ref.

Broadcast vs. band application of 160, 80 and 10 lb/acre of nitrogen, phosphorus and potassium, singly and in combination, to 'Frontier S-214' variety of forage sorghum grown in pots under greenhouse conditions at the New Mexico State University, showed that under broadcast application of fertilizers with 0.75 bars soil moisture tension, PK significantly increased the forage yield over the P, N and control treatments, while under band application no significant differences



were observed between the treatments. The fresh head weight of sorghum was highest from pots supplied with the three nutrients. The response of the fertilizer treatments was different under the two methods of application; treatment NPK produced the highest yield when broadcast, while PK and NP treatments gave best results when applied as bands 2.5 inch below the seeds. The head weight of sorghum, on oven dry basis, was significantly increased by PK and NPK treatments over the control and N broadcast. Under band application PK treatment increased the oven dry head weight significantly over NK, N and control.

1130 KATSURA, I., and TAKAHASHI, K. 1981. The effect of water table on the growth of forage crops. (Ja). Tohoku Agricultural Research 29:173-174. 2 ref.

1131 KOHNO, K., HARUMOTO, S., and NAKAMURA, N. 1981. Residues of diazinon insecticide in forage crops following aerial application. (Ja). Bulletin of the Miyazaki Agricultural Experiment Station 15:27-32. 7 ref. (Summary: En).

1132 KOUNO, K., OGATA, S., ANDO, T., and AKAGI, E. 1981. Studies on establishments of grasses. 4. Effects of lime nitrogen application on the establishments and yields of several warm-season grasses in a serial non-tilled sowing. (Ja). Journal of Japanese Society of Grassland Science 27(2):208-215. 6 ref. (Summary: En).

In the field, Italian ryegrass (Ir) swards were treated with 12, 24 kg/10 a using lime nitrogen or ammonium sulfate on June 17 and in the pot experiments, 0, 0.2, 0.4, 0.6 gN were applied to each pot using lime nitrogen or ammonium sulfate on July 4. Then sweet sorghum (So), African millet (Am), Rhodes grass (Ro), and Green Panic (Gp) were oversown on June 20 and July 7 respectively. Better establishment and growth of So, Am, Ro, Gp were found on the field which

received N; 24 kg/10a of lime nitrogen and on the pot which received 0.4 g/pot N lime nitrogen.

1133 KUHL, G., CARLSON, C., WILLIAMSON, G., and JURGENSEN, B. 1981. Effectiveness of cold-Flo anhydrous ammonia with forage sorghum silage. Annual Cattle Feeders Day, South Dakota Agricultural Experiment Station 24:28-30.

1134 KUKADIA, M.U., and SINGHANIA, D.L. 1981. Study of character associations in forage sorghum. Gujarat Agricultural University Research Journal 6(2):105-108. 7 ref.

To study the genetic association of forage yield with a number of other quantitative traits in Sorghum bicolor 21 genotypes comprising 6 parents and their 15 single crosses were grown. Five plants were randomly selected and were used for recording the observations on green and dry forage yield, days to 50% flowering, plant height, number of intact leaves per plant, stem diameter, flag leaf area, total soluble solids, and leaf-stem ratio. Results showed that values for genetic coefficient of variation (GCV) ranged from 9.04 (leaf-stem ratio) to 38.11 (dry forage yield). Significant and positive correlations at genotypic and phenotypic levels were observed for forage yield with plant height, number of intact leaves per plant, stem diameter, and total soluble solids content but all characters showed non-significant association with flag leaf area. However, leafiness showed positive relationship with forage yield and yield components which is regarded as the sole criterion of voluntary intake for cattle.

1135 LANCETA, M.A. 1981. Primary growth and regrowth curves in forage sorghum. (E). Thesis, Universidad Nacional de Mar del Plata, Balcarce, Argentina. 52 pp.

1136 LIAO, C.H., and CHEN, T.A. 1981. Isolation, culture and

pathogenicity to sudangrass of a corynebacterium associated with ratoon stunting of sugarcane and with Bermuda grass.

Phytopathology 71(12):1303-1306. 22 ref.

The small bacterium associated with ratoon stunting disease of sugarcane was successfully cultured in Muller-Hinton agar (3.8%) or Muller-Hinton broth (2.2%), hemoglobin (10 micro g/ml), Isovitalex (BBL) (1%), asparagine (0.2%), glutamic acid (0.05%), KH<sub>2</sub>P<sub>04</sub> (0.1%), K<sub>2</sub>H<sub>2</sub>P<sub>04</sub> (0.25%), MgSO<sub>4</sub>.7H<sub>2</sub>O (0.02%), sodium citrate (0.01%), ammonium sulfate (0.05%), CaCl<sub>2</sub> (-0.5 micro g/ml), ZnSO<sub>4</sub> (0.01 micro g/ml), and CuSO<sub>4</sub> (0.01 micro g/ml). The same medium was also used to isolate and culture the RSD-like bacterium present in Bermuda grass. This bacterium can infect and multiply in a sudan grass-sorghum hybrid. Wilting symptoms were observed in some of the inoculated plants. Cultured organisms exhibited lack of motility, absence of endospores, nonacid fastness, and gram-positive reaction, but often irregular staining, aerobic growth, and a filamentous-rod (0.25-0.35 x 2-5 micro m), clublike, or occasionally V-form morphology was observed. Tiny colonies (0.05-0.23 mm in diameter) were observed in agar medium after 8-19 days of incubation at 30 C.

1137 LODHI, G.P., and DANGI, O.P. 1981. Present status, problems and research strategies for forage sorghum improvement. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 6 pp.

1138 MADER, T.L., HORN, G.W., and PHILLIPS, W.E. 1981. Effect of feeding wheat straw or sorghum-sudan hay on gains and wheat forage utilization of stocker cattle. Pages 96-101 In Animal science research report: beef and dairy cattle, swine, sheep and their products 1981. Stillwater, Oklahoma, USA: Oklahoma State University. 4 ref.

Grazing and metabolism trials

were conducted during the 1979-90 wheat pasture grazing season to determine the effect which feeding wheat straw (WS) or sorghum-sudan hay (SS) to wheat pasture stockers had on gains and wheat forage intake and utilization. Live and carcass daily weight gains were not significantly altered by feeding either WS or SS. The data indicate that feeding WS or SS to wheat pasture stockers does not alter wheat forage utilization or significantly decrease wheat forage intake.

1139 MASON, L., and BRACY, R. 1981. Performance of corn and sorghum hybrids in no-till field plantings for silage production 1981. Pages 205-211 In Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

Performance data for sorghum hybrids revealed varying green silage yields from 8.1 tonnes per acre by grain type to 18.2 tonnes per acre by forage type, NK 300. The forage type Dekalb F5-1a produced 17.1 tonnes of green silage. Grain content of total yield was normal for Dekalb BR64 and NK 300 sorghum i.e. 37.4% and 18.3%. Data on sorghums planted on prepared seedbed and in no-till ryegrass stubble revealed that yield of grain and forage sorghum was higher in seedbed plantings than in no-till seedings.

1140 MIAKI, T., TANAKA, S., and KAWAMURA, O. 1981. Studies of the improvement in utilization of sorghum silages. 2. A comparison of sorgho silage and corn silage on the basis of digestibility and dry matter intake. (Ja). Bulletin of the Faculty of Agriculture, Miyazaki University 28(2):269-277. 35 ref. (Summary: En).

Hegari type forage sorghum and white dent corn were used to study the relative forage quality of silages in terms of nutritive value, dry matter intake and rate of passage through the

alimentary tract of sheep. Results revealed that sorghum silage was significantly higher in crude fiber content than corn silage, but significantly lower in crude protein content and digestibility for dry matter. There was a significant difference in the DCP content between sorghum and corn silages (1.4 v. 3.7%), but no significant difference in relation to the TDN content (48.8 v. 63.0%). The voluntary intake of corn silage was significantly higher than that of sorghum silage and the rate of passage of silage was faster for corn than for sorghum and the retention time was 24 and 39 hr for corn and sorghum silages, respectively.

1141 MISLEVY, P., and BLUE, W.G. 1981. Reclamation of quartz sand-tailings from phosphate mining. III. Summer annual grasses. Journal of Environmental Quality 10(4):457-460. 12 ref.

A split-plot field experiment was conducted to determine the production, quality, and nutrient concentration of four summer annual grasses: (1) full season corn, (2) mid-season corn, (3) Sorghum bicolor, and (4) sorghum x sudangrass hybrid grown on four amended sand-tailing treatments. The sorghum x sudangrass hybrid (S x S) produced higher ( $P^{1/4} 0.05$ ) total forage DM yields (13.4 metric tons/ha) than other grasses in both 1976 and 1977. Highest grain yields were obtained from the full-season corn hybrid. In vitro organic matter digestion was highest in both years for corn (67%), followed closely by S x S hybrid (61%) and grain sorghum (62%). The P and K concentrations increased in grain sorghum forage while P, K, Ca, Mg, Mn, Cu, Zn, and Fe increased in the S x S hybrid as the root system expanded over harvests.

1142 MONTGOMERY, C.R., NELSON, B.D., BRACY, R., and SCHILLING, P.E. 1981. Evaluation of a forage-type sorghum and sorghum-sudan hybrid for prussic acid levels 1981. Pages 202-204 In

Southeast Louisiana Dairy and Pasture Experiment Station annual progress report 1981. Franklinton, Louisiana, USA: Southeast Louisiana Dairy and Pasture Experiment Station.

A forage-type sorghum, and a sorghum-sudangrass hybrid, were planted to study the effects of clipping height on prussic acid levels. Samples of each forage were chopped with hand clippers to a fineness of approximately 1/8 inch and analyzed for prussic acid content on a fresh basis. Crops were harvested at the 12-, 18-, and 24 inch heights. Season mean prussic acid levels were higher in forage of the forage-type sorghum than in the sorghum-sudangrass hybrid. There were no differences in season-average prussic acid levels in the sorghum forages harvested at the 12- and 18-inch heights or the sorghum-sudan hybrid forage harvested at 12- and 18-inch heights. Prussic acid level was slightly higher at 24-inch forage height in both sorghum and sorghum-sudangrass hybrid.

1143 MUSTAFA, M.A., and ABDEL-MAGID, E.A. 1981. The effects of irrigation interval, urea-N, and gypsum on salt redistribution in a highly saline-sodic montmorillonitic clay soil under forage sorghum. Soil Science 132(4):308-315. 13 ref.

Two split-split plot field experiments were conducted during June-Dec 1978 and April to oct 1979 in Sudan to study the effects of irrigation interval 7, 10, and 15 days; ON, 1N, 2N, and 3N (1N=43.8 kg N/ha) applied as urea; and 0 or 11.9 tons/hectare gypsum on salt redistribution. Results showed that electrical conductivity of the soil saturation extract (ECe) of the 0- to 40 cm zone and exchangeable sodium percentage (ESP) of the 0- to 60 cm zone decreased with decrease in irrigation interval and nitrogen fertilization. Gypsum application increased ECe, but reduced ESP in the two zones, respectively. Irrigation, irrespective of treatments reduced ECe and ESP in the top zones and increased

it below. Peaks of salt concentration (ECe) and ESP were located at 40 to 60 and 60 to 80 cm, respectively. The effect of irrigation interval on salt redistribution was more pronounced than the effect of other treatments.

1144 NARDONE, M.R., CALCHA, N.A., and SIGNORILE, O. 1981. Direct seeding of forage sorghum on winter feed grasses. (Es). *Informacion Agropecuaria* 4(22):30-33.

1145 NAWA, N., HATAKEYAMA, S., TAMURA, K., and TOGAWA, K. 1981. Effects of utilization of livestock excreta on forage crops. (Ja). *Kyushu Agricultural Research* 43:128.

1146 OLEKSENKO, I.U.F., and BONDARENKO, V.P. 1981. Growing of silage sorghum subjected to irrigation in the southern Ukrainian SSR. (Uk). *Visnyk Sil's'kohospodars'koi Nauky* 5:32-34.

1147 PEDERSEN, J.F. 1981. Variability for forage quality, silage quality and agronomic traits in forage sorghum. Ph.D. thesis, University of Nebraska, Lincoln, Nebraska, USA. 57 pp.

1148 PEDERSEN, J.F., GORZ, H.J., HASKINS, F.A., and ROSS, W.M. 1981. Variability for forage and silage quality traits in forage sorghum. *Agronomy Abstracts* 73:134-135.

The variation among 49 F1 forage sorghum hybrids from a 7 x 7 cross-classified design was explored in 1979 and 1980 in both fresh-dried and ensiled samples for dry matter, crude protein (CP), in vitro dry matter disappearance, neutral detergent fiber, acid detergent fiber, and acid detergent lignin. Additional quality determinations included Brix readings on the juice from fresh stalks and NH3 levels in silage samples. Significant differences were shown between hybrids for all traits except CP in silage samples. Parental means for males generally had a wider range than for females. For most

traits, interactions with years were important. Genetic ratios that gave indications of the magnitude of general and specific combining ability were calculated from mean squares drawn from an analysis of variance for each trait. General combining ability effects appeared to be more important for all traits.

1149 SANDHU, H.S., DHALIWAL, J.S., and BRAR, S.S. 1981. Time of nitrogen application to jowar sown on different dates for fodder production. Pages 234-238 In *Proceedings, National Symposium on Crop Management to Meet the New Challenges*, 14-16 March 1981, Hissar, Haryana, India (eds. R.Prasad, K.S.Prashar, and R.P.Singh). New Delhi, India: Indian Society of Agronomy.

1150 SANGHI, A.K. 1981. Research strategy and priorities of forage sorghum during 1980's. Presented at the All India Coordinated Sorghum Improvement Project Workshop, 11-14 May 1981, Navsari, Gujarat, India. 8 pp. 6 ref.

The strategy and priorities of forage sorghum improvement work in Gujarat (India) during 1980's with reference to yield and quality improvement, early flowering and photoinstitutivity, drought tolerance, response to high management, regeneration capacity, and diseases and pest resistance are outlined.

1151 SANGHI, A.K., and MONPARA, B.A. 1981. Diallel analysis of forage yield and its components in sorghum. *Madras Agricultural Journal* 68(3):296-300. 3 ref.

Genetic analysis was carried out for green fodder yield and other eight quantitative characters in forage sorghum. The material consisted of seven forage sorghum varieties and their 21 F1 crosses. Both additive and non-additive components of genetic variance were contributing to the control of yield and other quantitative traits. Additive genetic variance was predominant for number of

tillers and number of leaves while non-additive for days to flowering, plant height, leaf length, leaf width, flag leaf area, green fodder and dry matter yield per plant. To get significant genetic advance exploitation of both additive and non-additive parts of genetic variance, the following of appropriate recurrent selection procedures was suggested.

1152 SCANTAMBURLO, J.L. 1981. Recommendation for the growth and uses of annual forage sorghum in the central region. (Es). Publicacion de Extension, Estacion Experimental Agropecuaria Manfredi (Argentina) no.113. 12 pp. 5 ref.

1153 SEAMAN, J.T., SMEAL, M.G., and WRIGHT, J.C. 1981. The possible association of a sorghum (Sorghum Sudanese) hybrid as a cause of developmental defects in calves. Australian Veterinary Journal 57(7) :351. 9 ref.

The limb abnormalities in 6 calves, and brain and spinal cord lesions in 2 of these calves born to heifers which had grazed Sudax (a hybrid of sorghum Sudanese x S. bicolor) during late pregnancy in the central tablelands of New South Wales were studied. The heifers grazed the Sudax from mid-February to early-April due to drought. Six heifers gave birth to full term calves over a 4-week period from the end of April. The 6 calves had limb abnormalities which caused dystocia and 4 of the calves were born dead. It was concluded that the progressive and active Wallerian degeneration in the spinal cord and associated limb abnormalities may be due to the effects of a toxic substance in sorghum acting on the foetus.

1154 SHARMA, G.D., PARODA, R.S., and DANGI, O.P. 1981. Genetics of forage characters in sorghum. Forage Research 7(1) :61-69. 16 ref.

Genetic architecture of nine forage attributes, using a 7 x 7

diallel set excluding reciprocals, was studied in four environments. Non-additive genetic component was pre-dominant for characters like the number of leaves, leaf breadth, leaf weight, stem weight, green fodder yield and dry matter yield. Additive genetic component was more for plant height, leaf length and stem girth. Over dominance was observed for almost all the characters in most of the environments. Heritability estimates were, in general, low for all the characters, except plant height, leaf length and stem thickness where it was medium.

1155 SHARPLEY, A.N. 1981. The contribution of phosphorus leached from crop canopy to losses in surface runoff. Journal of Environmental Quality 10(2) :160-165. 30 ref.

Simulated rainfall (6 cm/hour) was used to leach P from growing cotton, Sorghum sudanense, and soybean as a function of soil type and time interval between rainfall events. The relative contribution of plant material and surface soil to the transport of soluble P in surface runoff was estimated. The amount of soluble P in plant leachate, collected before contacting the soil surface, was found to increase with plant age and soil-water stress when changes in leaf area index were accounted for. A period of at least 1 day between rainfall events was needed for P to reaccumulate on the leaf surface. The contribution of soluble P in plant leachate to that transported in surface runoff was estimated as the difference in runoff concentration between planted and bare soil. When plants were subjected to a soil P stress, canopy leachate contributed the major proportion (90%) of that transported in surface runoff. With an increase in plant age from 42 to 82 days, the contribution of plant leachate to surface runoff increased from approximately 20-60%. the possible sorption of leached P is discussed along with estimating leaching losses in improving the

predictive ability of nutrient models.

1156 SHEKAR, V.B., and AHLUWALIA, M. 1981. Heterosis and combining ability analysis of forage yield and quality in Eu-sorghum species. Forage Research 7(1):105-107.

Line x tester analysis on eight male sterile lines and fifteen pollinators was undertaken for several fodder yield and yield components as well as fodder quality components such as protein content and LVDMD. The parent S. durra was high yielding followed by Pusa Chari 1. Hybrids involving these parents also yielded highest grain fodder yield.

1157 SINGH, K., TANEJA, K.D., GILL, P.S., and THAREJA, S.K. 1981. Effect of preceding crops and levels of nitrogen on forage yield of Chinese cabbage (*Brassica pekinensis*). Haryana Agricultural University Journal of Research 11(1):49-53. 6 ref.

Investigations on different summer forage mixtures revealed that pearl millet with cowpea gave significantly higher green fodder except sorghum + cowpea mixture in 1978-79. Mean dry matter from sorghum as pure crop or mixture with cowpea was higher than other crop mixtures.

1158 SMITH, F.W. 1981. Ionic relations in tropical pasture grasses. Journal of Plant Nutrition 3(5):813-826. 21 ref.

Ionic relations in the tops of nine tropical pasture grasses were studied by using K-Na and K-Mg nutrient replacement series in sand culture. Sorghum accumulated very little Na but considerable quantities of Mg when the K supply was low and Mg was available. Concentrations of K, Na, Ca, Mg, P, Cl, NO<sub>3</sub>, and SO<sub>4</sub> in the plant tops are presented. Although experimental treatments resulted in considerable variations in the concentrations of individual elements, cation-anion balances (C-A) remained relatively constant when nutrient deficiency did not depress yield in

sorghum. These results were used as a basis for suggesting management practices to improve the chemical composition of plant material and avoid a number of nutritional disorders that could occur in animals grazing these grasses.

1159 SOTOMAYOR-RIOS, A., and SANTIAGO, A. 1981. Performance of F1 hybrids from crosses of three sudangrasses and six forage sorghums with a Rhodesian sudangrass. Journal of Agriculture of the University of Puerto Rico 65(2):142-146. 7 ref. (Summary: Es).

A cytoplasmic male-sterile sudangrass (A Rhodesian) was crossed with three other sudangrasses (common, greenleaf, and Piper) and six forage sorghums (Sart, Millo Blanco, Bloomless, Forage Sorgo x Sugar Drip, Collier, and Brawley). The nine F1 hybrids were compared for yield of green forage (GF), yield of dry forage (DF), crude protein (CP) content, CP yield, and height at Isabela, Puerto Rico. Four cuttings were made. The first was 45 days after planting and the remaining three were at about 30-day intervals thereafter. The second harvest had the highest DF yield but the lowest CP content. The CP content was 15.7, 12.2, 14.6, and 15.6% for harvests 1, 2, 3, and 4, respectively. When data for all four harvests were combined, the F1 hybrid of A Rhodesian sudangrass x Common produced the highest GF and DF yields, 143 kg/ha/day of the latter which was 30% and 29% more than the 2nd and 3rd highest DF producing hybrids. Differences in CP content among the nine F1 hybrids were not significant, but A Rhodesian sudangrass x Common produced the highest CP yields. The tallest F1 hybrids were A Rhodesian x Common and A Rhodesian x Greenleaf. The GF and DF yields of A Rhodesian x Common were excellent. The results indicated that A Rhodesian sudangrass is a male-sterile line with potential for use in the development of superior F1 forage-sorghum hybrids in Puerto Rico.

1160 TANEJA, K.D., LODHI, G.P., and VERMA, A.N. 1981. Effect of sowing date and adoption of insect-pest control schedule on seed and stover yield of forage sorghum varieties. Forage Research 7(2):209-211. 3 ref.

A field experiment conducted at Hissar, India, revealed that if the crop is sown on 15th June, the losses due to shoot fly, stem borer and midge are negligible, whereas in case of early or late plantings, the expected high yield potential can only be obtained by protecting the crops from the insect pests. The variety JS20 excelled the other two varieties

(JS263 and JS29/1) in respect of seed yield, while JS263, and JS29/1 were at par with each other. Adoption of pest-control schedule in forage sorghum resulted in over 45.9% avoidable losses in seed yield and 17.5% in stover yield.

1161 TAYLOR, R.W., and MECHE, G.A. 1981. Comparison of sorghum-sudangrass hybrids for forage yield. Pages 381-384 In Louisiana Rice Experiment Station annual progress report 1981. Crowley, Louisiana, USA: Louisiana Rice Experiment Station. 3 ref.

1162 TAYLOR, R.W., and MECHE, G.A.

1981. Yield of sorghum-sudangrass hybrids and forage sorghums as influenced by time of harvest. Pages 385-387 In Louisiana Rice Experiment Station annual progress report 1981. Crowley, Louisiana, USA: Louisiana Rice Experiment Station.

1163 TAYLOR, R.W., and MECHE, G.A. 1981. Silage production of twelve sorghum varieties. Pages 394-396 In Louisiana Rice Experiment Station annual progress report 1981. Crowley, Louisiana, USA: Louisiana Rice Experiment Station.

1164 THATSRI, S. 1981. Toxins in forage. (Thai). Kasetsart Veterinarians Warasan Sattawaphaet 2(1):53-61.

1165 WARREN, F.S. 1981. Forage sorghum production. Forage Notes 25(1):38-39.

Twelve forage sorghum hybrids were compared for days to emergence, days to head, days to anthesis, height, dry matter, and dry matter yield at Ottawa. Some of the disadvantages of growing sorghum instead of corn for forage due to its less dry matter yield, low digestibility, and poisoning (HCN) effect are discussed.





# **Author Index**



ABDEL FATTAH, M. S.	0175	ANDRADE, V.M.M.	0310	BALASUBRAMANIAN, M.	0793
ABDEL-HAK, T.	0614	ANDREW, M. H.	0038	BALIEIRO, E. D. S.	0890
ABDEL-MAGID, E. A.	1143	ANDREWS, D. J.	0047	BALIGAR, V. C.	0314
ABDELRAHMAN, A. A.	0854	ANJARIA, J.V.	0967	BALYAN, R. S.	1074
	0855 0856	ANNISON, E.F.	0941	BANDRE, T.R.	0615
ABDIN, A.M.Z.E.	0741	ANTOHE, I.	0263	BANZATTO, D.A.	0407
ABDULLAHI, A.	0509		0726	BAPAT, D.R.	0178
ABERNATHY, J.R.	0567	ANTONGIOVANNI, M.	1100	0363 0649 0716	0757
ABSHAHI, A.	1049	ANZALONE, L., Jr.	0642	BAPORIKAR, V.R.	0451
ABUELGASIM, E.H.H.	0262		0814	BARAH, B.C.	1012
ACCORSI, C.A.	1034	APTE, R.	0336	BARAKAT, I.	0703
ACKERMAN, J.J.H.	0844	ARCOVERDE, A.S.S.	0510	BARBOSA, J.C.	0732
ACOSTA, M.	0480	AREVALO, C.	0289	BARBULESCU, A.	0263
ADAMSON, L.A.	0995	ARGENTINA: SECR. ESTAD.			0726
ADEGBITE, A.A.	0004	AGRIC. GANADERIA	0264	BARNES, C.E.	0274
ADESIYUN, A.A.	0702	ARGENTINA: UNIVERSIDAD		BARNETT, F.L.	0211
	0742	DE BUENOS AIRES	1071	BARRAQUIO, W.L.L.	0328
AFRIA, B.S.	0043	ARGUELLO DE ESPINOSA, R.	0825	BARRETT, J.	0046
	0044	ARIAS, J.A.	064B	BARRETT, M.	0548
AGARWAL, V.K.	0658	ARINGOLI, E.E.	0833	BARTLEY, E.E.	0906
AGEEB, C.A.	0361	ARKIN, G.F.	0089	BARTOLUCCI, R.	1034
AGHA, K.H.	1098		0531	BARWAD, W.L.	0786
AGUIAR, P.A.A.	0349	ARLEDGE, J.S.	0274	BASAIL, J.O.	1013
AGUNBIADE, R.M.O.	0004	ARMSTRONG, G.	1069	BASARKAR, C.D.	0780
AHLUWALIA, M.	1099	ARNOLD, R.N.	0274	BATH, S.J.	0583
	1156	ARNOLD, W.E.	0600	BATHKAL, B.G.	0406
AJAKAIYE, C.O.	0415	ARORA, S.K.	1101		0570
AJRI, D.S.	0725	ARQUIZA, R.P.	0176	BAXENDALE, F.P.	0787
AKAGI, E.	1132	ARRIVETS, J.	0321	BAXTER, H.D.	0891
AKINGBALA, J.O.	0824	ARYA, A.K.	0139	BEBAWI, F.F.	0691
	0830 0979	ASROROV, K.A.	0032	0692 0693 0694	0695
AL KHAWLANI, M.A.	0197	ATKINS, R.E.	0033	BECKER, R.L.	0560
AL-JIBBOURI, M.H.	0625		0034 0210 0265	BEHNKE, K.	0922
AL-SOHAILY, I.A.	0625	ATWELL, S.M.	0656	BELESKY, D.P.	1103
ALBRECHT, S.L.	0326	AU, P.M.	0981	BELYAEVA, E.V.	0049
ALCHUNDIAZ., H.A.	0910	AVELLANEDA, J.J.	1072	BENATTI, R.	0399
ALDRED, W.H.	1042	AVILA GONZALEZ, E.	0952	BENINCASA, M.	0407
ALFEREZ, A.C.	0462	AXTELL, J.D.	0149	BENINCASA, M.M.P.	0407
ALI, A.H.	0175	0177 0181 0182 0192	0982	BENNETT, H.W.	1075
	0362	AYAD, W.G.	0220	BENNETT, J.M.	0050
ALI, M.	0475	AZIZ, G.	0091	BEREAU, M.	1104
ALIYA, S.	0980	AZLIN, W.R.	1073	BERTRAND, J.E.	1105
ALL, J.N.	0675	BABARIA, C.J.	0416	BEST, E.K.	0430
ALLAM, E.K.	0676	BACIGALUPO, L.M.	1102	BETANCOURT-VALLEJO, A.	0626
ALLEN, M.	0266	BADIGER, M.K.	0448	BETTOLO, G.B.M.	0852
	0551 1108 1109	BADR, A.E.	0676	BEWLEY, J.D.	0052
ALLEN, R.R.	0602	BAFNA, A.M.	0048	BHALE, N.L.	0207
ALVARADO SILVERA, I.	0547	BAGHEL, S.S.	0235	BHALERAO, S.S.	0481
AMARAL, F.A.L.DO	0447	BAGNALL, D.	0157	BHAN, S.	0482
AMERIO, M.	0888	BAGNOLI, G.	0330	BHAN, V.M.	1074
ANAHOSUR, K.H.	0629	BAGYARAJ, D.J.	0327	BHANDAR1, D.C.	0589
	0630 0647		0339	BHARATHI, M.	0222
ANDEREGG, B.N.	0045	BAIGENT, D.R.	0923		0223 0224
ANDERSON, G.D.	0889	BAINADE, S.S.	0351	BHAT, K.V.	0036
ANDERSON, J.M.	1086		0494	BHAT, M.G.	0632
ANDERSON, J.W.	0046	BAKER, D.H.	0847	BHATIA, C.R.	0364
ANDERSON, W.B.	0411	BAKER, S.	0988	BHATIA, I.S.	0139
	0454	BALASUBRAMANIAN, G.	0613	BHATT, K.C.	0179
ANDO, T.	1132	BALASUBRAMANIAN, K.A.	0631	BHOI, P.G.	0473

		0538	BRAR, R. S.	0799	CAMPO, H. R. M. DEL	0952
BHOYAR, M. P.		0156	BRAR, S. S.	1149	CAMPOS-GIRAL, H.	0098
BHUTI, S. G.		0714	BRAZIL: CENT. NAC.		CANEZ, V. M., Jr.	0616
BIDINGER, F. R.		0047	PESQUI. MILHO SORGHO	0005		0659
	0103	0136	BRAZIL: EMPRESA BRASI-		CANTRELL, R. P.	0181
BIENKOWSKA, B.		0978	LEIRA PESQUI. AGROP-			0182 0192
BIJAPUR, U. K.		0180	ECU.	0006	CANTU G., F. J.	0152
		0365	BRAZIL: UNID. EXECU.		CAPRARIN, A.	0972
BIL, K. YA.		0097	PESQUI. AMBITO ESTAD.		CARBALLO, A.	0881
BINSWANGER, H. P.		1012	PELOTAS	0007	CARLSON, C.	1133
BITTINGER, T. S.		0181	BRAZIL: UNID. FED.		CARLSON, D. R.	0554
		0182	PELOTAS	0007	CARNEIRO, G. G.	0890
BITZER, M. J.		1069	BRECKE, B. J.	0552	CARO-COSTAS, R.	1112
BLACKWELL, K. H.		0215	BREIREM, K.	0928	CARPENTER, K. J.	0900
BLAD, B. L.		0307	BRENIERE, J.	0704	CARRIERE, B.	1040
BUM, J.		0944	BRETHOUR, J. R.	0897	CARTER, E. G. A.	0900
BLANCHARD, B. J.		0130	BRETTELL, R.	0161	CARVALHO, W. T. DE	0858
BLANCHET, C.		0607	BREWER, F.	0553	CASARIN VALVERDE, A.	0952
BLEIBERG, F.		0983	BRIGHT, S. W. J.	0252	CASSEL, D. K.	0957
BLUE, W. G.		0319	BRINHOLI, O.	0463	CASTELLANOS, J. Z.	1113
		1141	BROADHEAD, D. M.	1036	CASTILLO, A. P.	0483
BLUME, D. E.		0051		1037 1038	CASTILLO, J.	0345
BOCKHOLT, A. J.		0071	BROOKS, L.	0705	CASTOR, L. L.	0660
BODHADE, S. N.		0775	BROWN, W. L.	0184		0661
BODSWORTH, S.		0052	BROWNLEE, H.	0574	CASTRO, H. I.	0827
BOLSEN, K. K.		0892	BRUGGERS, R.	0082	CEAUSESCU, S.	0972
	0893 0894 0895 0922	0929		0809 0810	CELESTINO, A. F.	0484
		1106 1128	BRUN, T. A.	0983	CENA, R. L.	0176
BONDARENKO, V. P.		1146	BRUPBACHER, R. H.	1110	CERIOLI, C.	0888
BONDE, M. R.		0633	BRYAN, W. L.	1039	CERVANTES, T.	0374
BONNEFOY, D.		0896		1055	CERVATO, G.	0367
BONZI, S. M.		0743	BUCAR, A. C.	0293		0901
		0798	BUCHHOLZ, D.	0390	CHALAPATHY, K.	0327
BOORA, K. S.		1107	BUDNIK, G. S.	0737	CHANDRASEKHER, G.	0985
BOQDET, D. J.		0300	BUEHRING, N. W.	0278	CHANG, N. T.	0727
BORDOVSKY, J. P.		1035	BUENO, A.	0033	CHANG, S. C.	0056
BORGONOV, R. A.		1047		0034 0055		0643 0728
BORIKAR, S. T.		0183	BUICE, C. W.	0962	CHANNAL, H. T.	0350
	0207 0744	0745		0963	CHANTRASORN, W.	0796
BORRODGH, R.		0669	BUJAN, A.	0092	CHAUDHARY, H. R.	0788
BORSE, R. H.		0549	BULGERIN, L. E.	0977	CHAUDHARY, R. N.	0778
BORULKAR, D. N.		0438	BULL, K. L.	0857	CHAUDHURI, U. N.	0057
BOSWELL, F. C.		0072		0870	CHAUHAN, L. S.	0627
BOTSWAHA: DRYLAND FAR-			BULLARD, R. W.	0826	CHAVAN, I. G.	0907
MING RESEARCH SCHEME		0400	BURESH, R. J.	0418	CHAVAN, J. K.	0828
	0401	0402	BURLACU, G.	0918	CHAWANAPONG, M.	0756
BOURNE, J. (comp).		0366	BURLET, A.	0125	CHEDESTER, L. D.	0708
BOUVILLE, J.		0078	BURNS, J. C.	0957		0730
BOVEY, R. W.		0550		1111	CHELLIAH, S.	0758
BRACKER, C. E.		0648	BURNSIDE, O. C.	0554	CHEN, D. L.	0058
BRACY, R.		0266		0557 1096	CHEN, H. Y.	0154
	0551 0842 1108 1109	1110	BURRIS, W. R.	0898	CHEN, J. C. P.	1041
		1139 1142	BUTLER, L. G.	0084	CHEN, J. Z.	0058
BRADER, L.		0815	BYERS, F. M.	0857	CHEN, S. L.	0213
BRAGA, J. M.		0417		0899 0920 0961 0968 0969	CHEN, T. A.	1136
		0420		0970	CHENAULT, E. W.	0599
BRASSE, T. W.		0053	CAIELL, E. L.	0940	CHEW, W. Y.	0315
BRANDTZAEG, B.		0984	CALCHA, N. A.	1144	CHIDLEY, V. L.	0698
BRAR, D. S.		0054	CAMPBELL, D. R.	0951		0699

CHIN, J. C.	0135		1005	1008	DENNIS, S. M.	0906
CHINOY, J. J.	0179	CUELLAR, J. A.		0398	DERMENGI, C.	1095
CHOPDE, P. R.	0744	CULVAHOUSE, E. W.		0921	DERTING, C. W.	1097
	0745	CUMMINS, D. G.		0850	DESAI, K. B.	0255
CHOUDHARY, A. H.	0577		1116	1119		0369 0785
CHOWDHURY, M. S.	0485	CURREY, W. L.		0552	DESAI, R. T.	1117
CHOWDHURY, S. L.	0486	CURRIER, C. G.		0489	DESHAMANE, N. B.	0178
CHRIST, R. A.	0555	CUTLER, A. J.		0065	DESHMUKH, A. P.	0907
CHRISTODOULOU, V.	0944			0067	DESHMUKH, R. C.	0350
CHU, T. M.	0154	DABADGHAO, A. K.		0956	DESHMUKH, V. A.	0421
CHU, Y. I.	0800	DABHOLKAR, A. R.		0226	DESHMUKH, V. M.	1117
	0801		0369 0706	0878	DESHPANDE, S. B.	0403
CHUNDURWAR, R. D.	0789	DABROWSKI, Z. T.		0748	DESHPANDE, T. L.	0441
CIOACA, I.	1095	DACI, E.		0186	DESIDERIO, E.	0270
CLAFLIN, L. E.	0628	DAESCHEL, M. A.		1043	DESIKACHAR, H. S. B.	0984
CLARK, J. W.	0185	DAGINAWALA, H. F.		0615	DETHE, M. D.	0794
CLARK, L. E.	0267	DAIBER, K. H.		0931	DEV, A. D.	1118
CLARK, R. B.	0419	DALE, B. E.		1006	DEV, D. V.	1118
	0427 0442	DALE, J. E.		1076	DEXAMIR, A.	0972
CLEARWATER, J. R.	0746			1077	DEXTER, A. R.	0164
	0747	DALMACIO, S. C.		0644	DHALIWAL, G. S.	0753
COATS, R. E.	0008	DANGI, O. P.		1137	DHALIWAL, J. S.	0610
COBLE, C. G.	1042			1154		1149
COCHRAN, B. J.	1058	DANIELS, N. E.		0707	DHANDAPANI, N.	0793
COELHO DA SILVA, J. F.	0858		0708 0729	0730	DHAR, S. N.	0475
	0875	DANJO, T.		0306	DHARMAPUTRA, T. S.	0470
COELHO, A. D.	0556	DART, P. J.		0344	DHARNE, P. K.	0794
COETZER, J. J.	0797	DASCALU, D.		0263	DIAZ, A.	0511
COMMONWEALTH BUREAU		DAVENPORT, D. G.		0957	DIDIER, G.	0896
OF PASTURES AND FIELD		DAVIES, E. L. P.		0558	DIENER, U. L.	0617
CROPS	0059	DAVIES, J. C.		0749	DIGHE, R. S.	0370
0060 0061 0062 0063	0064		0750 0766	0790	DIKEMAN, E.	0841
0304	0305	DAVIS, G. V.		0905	DIKEMAN, M.	1128
COMMONWEALTH MYCOLOG-		DAVIS, M. J.		0671	DINU, C.	1095
ICAL INSTITUTE	0608	DAVIS, N. D.		0617	DOBEREINER, J.	0329
	0609	DAVIS, W. L.		0859		0337
CONDE, A. R.	0447	DAWSON, R. N.		1103	DOBRTSKAYA, Z. V.	0032
CONGLETON, W. F.	0487	DAYAN, M. P.		0644	DOHERTY, C. A.	0829
CONN, E. E.	0065	DE ARAUJO, M. R. A.		1120	DOHN, D. R.	0069
	0067	DE DATTA, S. K.		0382	DOMAN, N. G.	0049
CONNELL, J.	1080	DE FRANCISCO, A.		0860	DOMANSKI, C. E.	0293
CONSTABEL, S.	0054		0861	0862	DONGRE, A. B.	0840
CORKHILL, R. T.	0764	DE FREITAS, J. L. M.		0329	DORAN, J. W.	0404
CORNU, A.	0986	DE LA PENA, R. S.		0518	DOVE, A. A.	0412
CORONA, L.	0527	DE PEREZ, M. P.		0584	DREGNE, H. E.	1129
COSER, A. C.	1114	DE SCHAEPRDIJVER, P.		1007	DREIER, A. F.	0271
COSEREA, V.	0263	DE SOUZA MEDEIROS, A. C.		0268	DREMLYUK, G. K.	0187
COSMIN, O.	0263	DE SOUZA, J.		0420		0188
COTTERILL, R. W.	1031	DE VALLA, L. G.		1093	DREYER, D. L.	0731
COUSINS, B. W.	0902	DEFAY, G. H.		0863	DRUMM-HERREL, H.	0070
COUTINO A., J. L.	0903	DEFELIPO, B. V.		0420	DU, Y. T.	0116
CRABTREE, R. J.	0488	DELOBEL, A. G. L.		0751	DUBETZ, S.	0914
CRAFFORD, D. J.	0368			0752	DUCKWORTH, D. L.	1123
CRAMER, D. A.	0904	DELPEUCH, F.		0986	DUGAS, W. A.	0089
	0939	DEMO, M. A.		0009	DUKE, S. O.	0150
CRAMER, G. L.	0557	DENDY, D. A. V.		0987		0151
CREEL, R. J.	1115	DENISOVA, R. R.		0068	DUNCAN, R. R.	0071
	1121	DENMAN, C. E.		0269		0072 0422 0811 0838
CREELMAN, R. A.	0066	DENNING, J. L.		0442	DUNCAN, R. R. (ed).	0490

DUNKLE, L.D.	0639	FAO, REGIONAL OFFICE		FRESNILLO M., O.	0910
0648 0650 0651	0655	FOR ASIA AND THE			0911
DUNLAP, J.R.	0073	FAR EAST	0611	FRIBOURG, H.A.	1115
	0074 0075	FARAH, A.F.	0693		1121
DURANTON, J.F.	0802		0694 0695	FRITZ, J.O.	0192
DURLEY, R.C.	0076	FARIS, M.A.	0510	FUJIKAWA, K.	1082
	0136		1017 1120	FULLER, S.W.	1022
DUSCHANOV, I.D.	0816	FARRELL, D.J.	0909	FURLANI, A.M.	0425
DUSEK, D.A.	0356		0975	FURLANI, P.R.	0426
DUVICK, D.N.	0189	FARRELL, E.P.	0854		0427
DVORIN, A.	0950		0855 0856	GADAL, P.	0078
EARP, C.F.	0830	FAUBION, J.M.	0829		0125
	0831		0831 0837 0979	GADOON, M.A.	0090
EBERT, E.	0122	FAWCETT, R.S.	0560	GADZHIEVA, I.KH.	0172
ECKLES, R.	0118		1078	GAHUKAR, R.T.	0709
EDDS, G.T.	1105	FAYED, M.F.S.	0175		0710
EDDY, R.L.	0308	FEATHERSTON, W.R.	0964	GAIKWAD, C.B.	0403
EDJE, O.T.	0491		0965	GAINES, T.P.	1055
EDLUND, M.G.	0162	FENDERSON, J.M.	0561		1124
EDWARDS, C.H.	0995	FENTON, R.	0105	GALAN, J.M.	0428
EDWARDS, J.C.	0973	FERRARIS, R.	1045	GALBIATTI, J.A.	0407
EDWARDS, N.C.	0278		1046	GALEFFI, C.	0852
EGHAREVBA, P.N.	0391	FERREIRA, M.T.R.	1047	GALLAGHER, E.C. (comp).	0378
EIMORI, I.	0445	FERRIS, J.M.	0688	GALLI, A.J.B.	0732
EINHELLIG, F.A.	0586	FEYT, H.	0273	GALLINA, M.	0373
EKA, O.U.	0996	FIELDS, M.L.	0981	GALYEAN, M.L.	0912
EKMAN, R.	0993		0990	GAMBA, R.D.	0293
EL ATTAR, F.I.	0175	FINDLEY, W.R.	1069	GAMBORG, D.	0054
EL NASR, M.A.A.	0676	FINKNER, M.D.	0190	GANNO, K.	0603
EL RAYAH, A.H.	0077		0191		0604
	0371	FINKNER, R.E.	0190	GARCIA, J.A.	0858
EL SHAFIE, A.E.	0618		0191 0274		0875
	0662	FIORENTINI, L.	0888	GARDINER, E.E.	0913
EL SHOURBAGI, F.A.	0362	FLETCHER, D.S. (comp).	0378		0914
EL SUNNI, M.	0272	FLETCHER, S.M.	1016	GARDNER, B.R.	0307
ELIZAROV, V.P.	0068	FLOCK, R.A.	0683	GARRITY, D.P.	0307
ELLIS, R., JR.	0435	FLOWERDAY, A.D.	0512		0357
ELLIS, W.C.	0846		053 30544	GARUD, T.B.	0653
	0871	FOALE, M.A.	0409		0677
ELMORE, R.W.	0492		0412	GASCHO, G.J.	1039
ELSNER, J.E.	1103	FONOLLERA, V.C.	0428		1055 1062
ELSTNER, E.F.	0122	FONTES, L.A.N.	0447	GASKINS, M.H.	0326
ELY, L.O.	0908	FORBES, G.A.	0663	GATES, D.E.	0705
ENGLISH, J.R.	1080	FORDE, B.G.	0252	GATHAARA, M.P.H.	0079
ERB, N.	0832	FOREMAN, J.W. (comp).	0372	GATICA RAMIREZ, O.	0915
	0853	FORTUN, C.	0424	GAUSMAN, H.W.	1079
ERICKSON, W.	0809	FRANCA, G.V.	0399	GBELFI, R.	0092
ERMOLAEV, V.	1044	FRANCE: INSTITUT NATI-		GEBREKIDAN, B.	0010
ESCALADA, R.G.	0423	ONAL DE RECHERCHE		GEERVAN1, P.	0980
	0518	AGRONOMIQUE	0275	GEETHA, V.	0080
ESCASINAS, R.O.	0423		0276	GENG, S.	1049
ESSIG, H.W.	0898	FRANCIS, C.A.	0493	GENG, Y.X.	0099
ESTEVEES, A.D.L.	0827	FRANS, R.	0562	GEORGIADI, A.G.	0601
ETIENNE, J.	0783	FREDERIKSEN, R.A.	0640	GERA, K.L.	0916
ETO, H.	0413		0641 0661 0663 0819	GERBERMANN, A.H.	0398
FABRE, H.C.	0833	FREEMAN, K.C.	1038	GERIK, T.J.	0277
FALES, S.L.	1119		1069 1070	GHEBRIEL, A.W.	0917
FAN, Z.D.	0768	FREIRE, O.	0399	GHERSA, G.M.	1093
FAO	0559	FRENCH, A.V.	0412	GHODAKE, R.D.	1014

GHODERAO, B.N.	0657	GROVER, R.	0331						0335
GIARDINI, A.	0193	GRUBE, A.H.	0817	HENNESSY, D.W.					0923
GIBSON, P.T.	0754	GRUNDON, N.J.	0430	HENZELL, R.G. (comp).					0378
GILL, K.S.	0141	GUENTHER, J.J.	0977	HERANJAL, D.D.					0967
GILL, P.S.	1157	GUGA, E.	0186	HERERO, M.P.					0087
GILLASPIE, A.G., Jr.	0671	GUHAMUKHERJEE, S.	0126	HERNANDO, V.					0424
	0678 0680	GUPTA, A.K.	0235	HEROLD, I.					0924
GIOVANNETTI, M.	0330	GUPTA, B.S.	0956						0925
GIRI, A.N.	0351	GUPTA, P.C.	0919	HERTEL, J.M.					0192
	0494	GUTIERREZ, G.	0920	HESS, D.					0332
GIRIRAJ, K.	0194	GUTIERREZ, G.G.	0961	HIBBERD, C.A.					0432
	0195	GUTIERREZ, J.	0783					0433	0926
GLADYSH, V.P.	0386	HAGA, T.	1082	HIJLKURO, S.					0927
GLAZE, R.M.	0190	HAGERMAN, A.E.	0084	HILER, E.A.					1042
	0191	HAHN, D.H.	0837	HILL, L.D.					1022
GLENNIE, C.W.	0834	HAKIM, M.N.	0362	HILLS, F.J.					1049
	0835 0836 0843	HALL, B.	0412	HILTY, J.W.					0681
GNANAM, A.	0080	HALL, D.G., IV.	0733	HINTZ, R.L.					0432
	0081 0128 0129		0803					0433	0926
GODBILLON, G.	0078	HAMADA, A.A.	0563	HINZE, G.					0101
GOIHMAN, S.	0983	HAMDOUN, A.M.	0563	HIREMATH, I.G.					0804
GOLOB, P.	0864	HAMILTON, G.C.	0735	HIROCE, R.					0434
GOMATHINAYAGAM, P.	0196	HAMILTON, N.R.S.	0197	HITAKA, N.					0085
GOMES, C.S.	1048	HAMMAN, W.M.	0389						0379
GOMES, L.S.	1048	HANKS, A.H.	0073	HOBBS, E.H.					0353
GOMEZ M., N.	0374	HANNA, W.W.	1124						0380
GOMEZ, A.A.	0200	HARADA, M.	0507	HOESEL, W.					0086
GORZ, H.J.	0886	HARAK, T.	0376	HOLIHOSUR, S.N.					0784
	1125 1148		0466	HOLLANES, L.A.					1029
GOSHAEV, G.	0429	HARDCASTLE, W.S.	0564	HOLLINGSWORTH, L.D.					0602
GOTO, Y.	0603	HARMAN, R.D.	0008	HOLMSEN, T.W.					0087
GOUD, J.V.	0104		0278	HOMB, T.					0928
	0180 0194 0195 0201 0202	HARPER, S.R.	1026	HONDURAS: SECRETARIA					
	0203 0209 0365	HARRIS, J.	0836	DE RECURSOS NATURALES					0496
GOURLEY, L.M.	0215	HARRIS, R.W.	0671						0497
	0278	HARRISON, T.	0118	HOOKS, R.F.					0274
GOWDA, B.A.	0645	HARTMAN, C.L.	0948	HOPKINS, P.S.					0973
GOWDA, B.T.S.	0104	HARUMOTO, S.	1131	HORINO, T.					0376
	0180 0225 0365 0647 0714	HASABE, B.M.	0725						0466
GOWDA, D.N.	0619	HASKINS, F.A.	0886	HORN, G.W.					0977
GOWRI, G.	0131		1125 1148						1138
GRABOUSKI, P.H.	0271	HASSAN, K.I.A.	1126	HORROCKS, R.D.					0088
GRAHAM, G.G.	0992	HASSELMAN, C.	0082	HOSEL, W.					0067
GRAHAM, J.H.	1122	HASSEN, M.M.	0982	HOSENEY, R.C.					0861
GRANADE, G.	1052	HATAKEYAMA, S.	0471	0862 0933 0934 0935					0987
GRANOVSKY, T.A.	0796		1145	HOSHIKAWA, K.					1050
GRANT, W.R.	1015	HATFIELD, J.L.	0352	HOSHINO, I.					0838
GRAS, G.	0082	HATHCOCK, B.R.	0921	HOSHINO, T.					0811
GRAVES, C.R.	0279	HAVLIN, J.L.	0316	HOSKIN, R.L.					1015
GRAY, E.	1123	HEARON, S.S.	0680	HOSMANI, M.M.					0700
GREBER, R.S.	0679	HEBRARD.	0896	HOSMANI, S.A.					0381
GRECU, E.	0263	HEGAB, A.E.	0280	HOUSE, L.R.					0011
GREEN, J.M.	0522	HEGDE, R.K.	0630				0698 0699		0994
GREEN, R.C.	0998	HEGDE, S.V.	0327	HOVERMALE, C.H.					0898
GREGORY, E.J.	0274	HEIDKER, J.I.	0922	HOWELL, T.A.					0531
GRETZMACHER, R.	0375	HEINRICH, G.M.	0377	HSIAO, A.I.					0696
GRIFONI, F.	1100	HELKIAH, J.	0431	HSIEH, S.Y.					0498
GRINCHENKO, A.L.	0083	HELSEL, Z.R.	0495	HUBBARD, E.E.					1016
GROSSU, D.	0918	HENIS, Y.	0334	HUDA, A.K.S.					0089

HUME, D.J.	0476	JACKOBS, J.A.	0492	KALUZA, W.Z.	0835
HUME, I.D.	0975	JACKSON, W.B.	0809	KAMBOJ, R.K.	1074
HUNDAL, S.S.	0382	JACOBI, J.	0092	KAMEL, A.S.	0676
HUNSHAL, C.S.	0499	JACQUIN, C.	0385	KANANGARA, T.	0136
HURST, H.	0565	JADHAV, S.B.	0403	KANAUJIA, K.R.	0778
HURT, V.K.	1123	JADHAV, S.W.	0333	KANEMASU, E.T.	0053
HUSSAIN SAHIB, K.	0664	JAEGER, M.	0809		0057
HUSSAIN, F.	0090	JAIN, R.P.	1017	KANNAN, S.	0439
HUTCHINSON, R.L.	0300	JAISIL, P.	0205		0440 0461
LALEA, D.G.	1127	JALOUD, A.	0465	KANNANGARA, T.	0076
IBRAHIM, I.K.	0435	JAMBUNATHAN, R.	0839	KANWAR, J.S.	0505
ICRISAT	0012		0999	KAORE, S.V.	0406
	0013 0500	JAMES, R.C.	0308	KAPADIA, G.J.	0106
ICRISAT, FARMING SYST-		JANARDHAN, A.	0619	KAPULNIK, Y.	0334
EMS RESEARCH PROGRAM	0711	JANKE, G.C.	0634		0335 0346
	0805	JAYARAMAN, S.	0502	KARANJKAR, R.R.	0789
ICRISAT, MALI COOPERA-			0503	KARAU, P.K.	0930
TIVE PROGRAM	0014	JEFFERY, L.S.	1080	KARJM, M.	1129
	0383 0501	JEGEDF, J.F.O.	0024	KARIM, N.H.	0309
ICRISAT, SENEGAL COOP-		JELLUM, M.D.	0675	KARUNARATNE, S.M.	0206
ERATIVE PROGRAM	0015	JENNINGS, V.M.	0566	KASPER, P.	0107
ICRISAT, SORGHUM BREE-		JHA, D.	0436	KATARE, B.A.	0884
DING PROGRAM	0198		0437	KATSURA, I.	1130
ICRISAT, SUDAN COOPER-		JIMENEZ C., A.A.	0035	KAUR, J.	0139
ATIVE PROGRAM	0016	JODHA, N.S.	0504	KAURA, M.B.	0989
ICRISAT, UPPER VOLTA		JOFFE, B.I.	0988	KAVIMANDAN, S.K.	0336
COOPERATIVE PROGRAM	0017	JOHARI, R.P.	0840	KAWAMURA, O.	1140
	0199	JOHNSON, J.T.	0487	KAWANO, S.	0682
ILG, H.J.	0893	JOHNSON, J.W.	0292	KAY, R.D.	1042
0894 0895 0922 0929	1106		0792 0796	KAZANAS, N.	0990
	1128	JOHNSON, S.S.	1049	KEBEDE, Y.	0216
ILICEVICI, S.	0263	JOHNSON, Z.B.	0951		0476
IMAI, T.	0200	JONES, K.C.	0731	KEEFER, G.D.	0354
INAMDAR, A.N.	0991	JONES, O.R.	0324	KEELEY, P.E.	1081
INDI, S.K.	0201		0405	KEELING, J.W.	0567
	0202 0203	JOOSTE, J.V.D.W.	0594	KELKAR, S.S.	0991
INDIA: ALL INDIA COORD.		JORDAN, J.D.	0269	KELLOGG, D.W.	0917
RES. PROJ. DRYLAND		JORDAN, W.R.	0093	KEMM, E.H.	0931
AGRIC.	0384		0094	KENE, D.R.	0441
INDIA: ALL INDIA COORD.		JORGENSEN, M.E.	0088	KETCHERSID, M.L.	0095
SORGHUM IMPROV.		JOSEPH, K.T.	0315		0568 0569
PROJ.	0018	JOSHI, P.K.	0438	KHAN, S.A.	0482
	0019 0020	JOSHI, R.D.	0685	KHANTIKHUN, N.	1051
INDIA: MINISTRY OF			0686	KHEDEKAR, P.K.	0452
AGRICULTURE	0281	JOSHI, U.N.	1101	KHIDSE, S.R.	0207
INDIA: RAJASTHAN COM-		JOTWANI, M.G.	0712	KHUN, C.W.	0675
MAND AREA DEVELOPMENT	0282		0713 0714 0755 0765	KIBIRA, G.R.	0517
INDIA: TAMIL NADU AGR-			0770 0771	KIEFER, S.	0332
ICULTURAL UNIVERSITY	0021	JOUSTRA, S.M.	1007	KLGEL, J.	0334
INDIA: UNIVERSITY OF		JUIMALE, Y.	0809		0335
AGRICULTURAL SCIENCES	0022	JURGENSEN, B.	1133	KILBURN, S.R.	0826
INUYAMA, S.	0317	KADAM, J.R.	0785	KIMBROUGH, E.L.	1111
IQBAL, J.	0091	KADAM, S.S.	0828	KIMURA, F.	1082
IRIE, M.	0603	KADUSKAR, M.R.	0947	KINDLER, S.D.	0734
	0604	KAIHULLA, E.	0124	KING, C.C., Jr.	1052
ISAKOV, IA. I	0204	KALE, K.D.	0654	KING, S.B.	0616
ISAKOV, IA. I.	0023	KALE, S.P.	0538		0659
ITNAL, C.J.	0132	KALE, V.D.	0794	KIPPER L., G.	0911
IVY, R., Jr.	0008	KALIUZHNYI, A. I.	0386	KIRKLAND, R.L.	0735



KIRLEIS, A.W.		0982	LAUNOIS-LUONG, M.H.	0802	LOWE, R.F.				0923
KIRTI, P.B.		0222	LAVAKE, D.E.	0599	LUGG, D.G.				0101
		0223 0224	LAVY, T.L.	0553					0274
KLOPFENSTEIN, C.F.		0932	LAWSON, R.H.	0671	LUI, A.L.				0117
	0933 0934 0935		LAYTIMI, A.	0895	LUO, Y.W.				0213
KLUCAS, R.V.		0337	LAZARTE, A.	1083	LUTHRA, Y.P.				1101
		0338	LEAL DIAZ, J.	0355	LUTRICK, M.C.				1105
KNABE, D.A.		0902	LEATH, M.N.	1022	LYLE, W.M.				1035
		0954	LEAVITT, J.R.C.	1096	MACHADO, J.R.				0464
KNUDSEN, D.		0419	LEBLOVA, S.	0107					1060
		0442	LECHTENBERG, V.L.	0192	MACIEL, G.E.				0844
KOBAYASHI, Y.		0449	LECOQ, M.	0802	MACKEY, J.				1024
		0477	LEE, P.K.	0936	MACLEAN, W. C, Jr.				0992
KOBELEVA, E.N.		0188	LEEK, G.L.	0572	MADER, T.L.				1138
KOFOID, K.D.		0249	LEFROY, E.	0412	MAEDA, Y.				0306
KOHNO, K.		1131	LEGUIZAMON, E.S.	1084	MAESE, G.				0190
KOKWARO, E.D.		0747	LENARDON, S.L.	0652					0191
	0760 0761		LENGKEEK, V.H.	0673	MAFRA, R.C.				0510
KOLEVA, N.		0672	LENZ, M.C.	0210	MAHAJAN, U.B.				0549
KONDAP, S.M.		0570	LEON-DIAZ, J.R.	0098	MAHALAKSHMI, V.				0047
KONDE, B.K.		0654	LEONARD, R.T.	1122					0136
KOROKNAI, B.		0571	LEPORI, W.A.	1042	MAHMOUD, M.A.				1017
KOTHARI, I.L.		0036	LEPORINI, C.	0330	MAINRA, A.K.				0039
KOUNO, K.		1132	LERNER, H.R.	0159	MAITI, R.K.				0047
KRANTZ, B.A.		0506	LI, X.Q.	0258		0102 0103			0136
KRESOVICH, S.		1053	LI, Z.J.	0099	MAJOR, D.J.				0389
KRIEGER, R.I.		0069	LIANG, G.H.	0211					0914
KRISHNA, K.R.		0339	LIANG, Z.	0212	MAKONNEN, G.A.				0488
KROGMAN, K.K.		0380	LIAO, C.H.	1136	MALALI, S.B.				0104
KROKHINA, V.A.		0068	LIAO, J.L.	0030	MALAVOLTA, E.				0445
KROUSE, L.J.		0673		0040			0464		1060
KRUPNIKOVA, T.A.		0138	LICHTENSTEIN, E.P.	0045	MALI, V.R.				0677
KSHIRSAGAR, K.G.		0606	LICHTENWALNER, R.E.	0859	MALI :MINISTERE DE				
KUHL, G.		1133	LIEBENBERG, N.V.D.W.	0843	L'AGRICULTURE				0446
KUKADIA, M.U.		1134	LIKHACHEV, B.S.	0879	MALIK, H.S.				0341
KULKARNI, K.A.		0714	LIMA, E.	1054	MALIK, R.K.				1074
	0720 0784		LIN, C.F.	0444	MALINOVSKI, B.N.				0737
KULKARNI, N.		0208	LIYOU, R.F.	0800	MALLESHI, N.G.				0984
	0664 0779			0801	MALLOCH, K.R.				0105
KULLAISWAMY, B.Y.		0209	LIPPKE, H.	0937	MANDAVA, N.B.				0106
KUMAR, V.		0472	LIPPMAN, D.	0983	MANE, V.S.				0408
KUNZ, J.J.		1018	LIRA, M.DE A.	0510	MANGARANG, C.C.				0865
	1019 1020			1120	MANICKAM, T.S.				0431
KUO, S.		0443	LITVINENKI, E.L.	0386	MANTLE, P.G.				0656
KUROE, H.		0507	LIVEZEY, J.	1023	MANZO, S.K.				0620
KUSHNIRENKO, M.D.		0096	LODHI, G.P.	1107	MARANVILLE, J.W.				0249
KWOLEK, T.F.		0265		1137 1160					0419
LADEWIG, J.H.		0412	LOMBARDO, A.P.	1084	MARASCHIN, G.E.				1114
LADYGIN, V.G.		0097	LOMBIN, L.G.	0508	MARCH, J.				0652
LAGOKE, S.T.O.		0577		0509	MARCONDES, D.A.S.				0463
LAI, F.S.		0841	LOMTE, M.H.	0593	MARES, J.				0107
LAL, S.		0635	LONG, F.L.	0100	MARSHALL, J.G.				0300
LANCA, J.C.E.		0387	LOPES, L.R.	0407					0414
LANCETA, M.A.		1135	LOPEZ DE ROMANA, G.	0992	MARSHALL, R.J.				0108
LANDI, R.		0388	LOPEZ, J.V.	0283					0573
LARA, F.M.		0732		0736	MARTIN CIENCIA, M.J.				1102
LARINA, V.V.		0298	LOTHROP, J.E.	0265	MARTIN, C.R.				0841
LASSITER, G.C.		1021	LOUCCEL, C.	0788	MARTIN, F.A.				1058
LAUNOIS, M.		0802	LOVELL, R.	0978	MARTIN, P.B.				0536

MARTINEZ, J.F.	0514	MERKLE, M.G.	0095	MOON, N.J.	0908
MARTINS, C.E.	0447		0568 0569	MORACHAN, Y.B.	0342
MARTINS, C.O.	0340	MERTZ, E.T.	0982		0502 0503
MASON, L.,	0266	MERWINE, N.C.	0215	MORAGNE, L.	0995
0551 1108 1109 1110	1139	MEYER, R.E.	0550	MORARD, P.	0114
MASON, N.D.	0982	MIAKI, T.	1140	MORDANT, D.G.	0942
MASSINO, I.V.	0284	MICHAEL, P.W.	1088	MORE, B.B.	0654
MATEE, J.	0809	MICHAEL, R.	0448	MORELAND, D.E.	0696
MATEO, N.	0511	MIELKE, M.J.	1026	MORGAN, E.B.	0943
MATHUR, K.	0665	MIFL1N, B.J.	0252		0949
	0666	MIKHAL' CHEVSKIJ, B.M.	1067	MORGAN, P.W.	0073
MATLON, P.J.	1025	MIKKELSEN, D.S.	0443		0074 0075 0121
MATOCHA, J.E.	0411	MIKULAS, J.	1087	MORGAN-JONES, G.	0617
MATRE, T.	0928	MILLER, B.J.	1110	MORILLO VELARDE, R.	1056
MATSUMURA, T.	0037	MILLER, B.S.	0841	MORRALL, P.	0836
MATSUOKA, M.	1006	MILLER, D.D.	0917		0843
MATTEI SCARPACCINI, F.	0388	MILLER, F.R.	0066	MORRIS, H.F., Jr.	1110
MAURER, R.E.	0357		0071 0094 0109 0216 1005	MORRISON, E.	0929
MAYEE, C.D.	0653		1008 1027	MORRISON, R.D.	0269
MAYHEW, D.E.	0683	MILLS, R.B.	0895	MORRISON, W.P.	0722
MAZZINI, N.	0880	M1NTER, D.L.	0162		0723
MC BEE, G.G.	0109	MIKA BEIDA, A.	1056	MOTE, S.R.	1029
MCCARTY, I.E.	1043	MIRHADI, M.J.	0449	MOTE, U.N.	0716
MCCLELLAND, M.	0562		0477		0757
MCCLURE, R.M.	0512	MISANGU, R.N.	0485	MOTT, J.J.	0038
MCCULLOUGH, M.E.	0938	MISHRA, D.	0123	MROZEK, E., Jr.	0144
MCINTIRE, J.	1025	MISHRA, S.P.	0217	MRUTHYUNJAYA.	1028
MCKEAN, M.C.	0904	MISKELL, J.	0809	MU'ALLEM, AB. S.	0218
	0939	MISLEVY, P.	1141	MU, T.	0801
MCKIE, J.W.	0898	MITAL, V.P.	0785	MUDRIK, Z.	0944
MCMILLIAN, W.W.	0795	MITAWA, G.M.	0515	MUGNAI, E.	0388
MCNEW, R.W.	0269	MITCHELL, C.C., Jr.	0319	MUINDI, P.J.	0945
MCWHORTER, C.G.	1073	MITCHELL, M.E.	0326		0946 0993
	1085 1086	MITRA, R.	0364	MUKHERJEE, D.	0043
MEAD, R.	0513	MITTAL, V.P.	0706		0044
MECHE, G.A.	1161	MIYAZAKI, M.	0037	MUKURU, S.Z.	0219
	1162 1163	MIZE, T.	0808	MULLER, G.	0575
MECKENSTOCK, D.H.	0110	MOCK, R.G.	0680	MUNCK, L.	0982
MEELU, O.P.	0472	MOELLER, L.W.	0265	MUNDT, J.O.	1043
MEGGITT, W.F.	0548	MOHAMMED, A.H.	0080	MURAKOSO, K.	0413
MEHROTRA, P.C.	0436	MOHR, H.	0070	MURIEL FERNANDEZ, J.L.	1056
MEHTA, S.L.	0256		0112 0113 0119	MURPHY, W.J.	0390
	0840 0849	MOHR, H.E.	0669	MURRAY, D.S.	0561
MEKSONGSEE, B.	0756	MOHYUDDIN, A. I.	0715	MURTHI, A.N.	0220
MELLENDEZ, M.J.A.	0318	MOLLAH, Y.	0941		0221
MELLANDER, O.	0984	MONAGHAN, N.M.	0574	MURTHY, D.K.	0240
MELOTTI, L.	0940		1088	MURTHY, S.R.K.	0136
MENA T.,H	0111	MONK, R.L.	0093	MURTI, T.K.	0716
MENA T., H.	0001		0094	MURTY, D.S.	0994
	0285	MONNERAT, P.H.	0447	MURTY, K.N.	0208
MENPOZA O., L.E.	0035	MONPARA, B.A.	1151		0664 0779
MENDOZA-CASTILLO, M.	0881	MONROE, G.E.	1039	MURTY, U.R.	0222
MENDOZA-RODRIGUEZ, M.	0881		1055		0223 0224
MENENDEZ, J.	0514	MONSON, W.G.	1124	MUSICK, J.T.	0356
MENGE, J.A.	1122	MONTGOMERY, C.R.	0842	MUSTAFA, M.A.	1143
MENGES, R.M.	1079		0943 0949 1142	MUSTAIN, B.C.	0115
MENGESHA, M.H.	0214	MONTGOMERY, M.J.	0891	MYERS, R.J.K.	0409
	0232 0233	MONZON DE ASCONEGUI,			0412
MENKIR, A.	0010	M.A.	0340	MYHRE, D.L.	0314

NAGALAKSHMI, K.	0431	NOLAND, P.R.	0951	PALACIOS, L.G.	0824
NAGARAJA, T.G.	0906	NOLASCO, R.	0511	PALAGYI, A.	0924
NAGARKOTI, M.S.	0674	NONOYAMA, Y.	0320		0925
NAGESHACHANDRA, B.K.	0784		0453	PALANIAPPAN, S.P.	0410
NAGRE, K.T.	0450	NOON, T.H.	0971	PALANIVEL, S.	0120
	0451 0452	NORDQUIST, P.T.	0271	PALANIYAPPAN, K.	0882
NAHRSTEDT, A.	0832	NORMAN, J.M.	0118	PALM, E.W.	0390
NAIK, M.S.	0143	NORTON, K.	0569	PALMERTREE, H.D.	0565
NAIK, S.M.	0665	NOTT, R.W.	0368	PAMPLONA, P.P.	0592
	0666	NUR, I.	0334	PANAYOTOU, P.C.	1090
NAIK, S.T.	0630		0335 0346	PANDIT, B.R.	0578
NAINAWATEE, H.S.	0039	NYFFELER, A.	0575	PAO, C.I.	0121
NAKAGAWA, J.	0464	NYQUIST, W.E.	0182	PARADIES, I.	0122
NAKAMURA, N.	1131	O'DONNELL, D.J.	0844	PARAMESWARAPPA, R.	0225
NAKAYAMA, L.	0445	O'NEAL, H.P.	1042		0647 0714
NANDAN, D.	0916	OBILANA, A.T.	0233	PARETAS, J.J.	0527
NARAYANA, D.	0208		0286 0287	PARIKH, N.M.	0048
	0667 0738	ODHIAMBO, T.R.	0759	PARKER, C.	0579
NARAYANAN, A.	0136	ODUM, P.K.	0995	PARKPIAN, P.	0454
NARDONE, M.R.	1144	OELZE-KAROW, H.	0119	PARODA, R.S.	1154
NARKHEDE, B.N.	0456	OGATA, S.	1132	PARREIRA, J.DA S.	0387
	0457	OGUNDIWIN, J.O.	1009	PARVATHIKAR, S.R.	0132
NARKHEDE, P.N.	0947	OGUNLELA, V.B.	0391	PASCUAL, C.B.	0644
NASH, V.E.	0314	OGWARO, K.	0760	PASIERBSKI, Z.	0955
NATARAJAN, K.	0758		0761	PATEL, B.P.	0578
NATARAJAN, M.	0516	OJEDA O., M.A.	0952	PATEL, C.L.	0416
	0576	OKON, Y.	0334	PATEL, J.D.	0036
NAVARRO CARRILLO, E.	1056		0335 0346	PATEL, N.Y.	0748
NAWA, N.	0471	OLAH, B.	1089	PATEL, P.M.	0956
	1145	OLEKSENKO, I.U.F.	1146	PATIDAR, H.	0226
NAZARENKO, O.A.	0083	OLEKSENKO, YU.F.	0605	PATH, B.C.	0333
NAZARENKO, O.K.	0605	OLIVA, A.	0592	PATIL, B.R.	0725
NDAHI, W.B.	0577	OLIVA, L.P.	1029	PATIL, H.D.	0994
NEITZ, M.H.	0948	OLIVEIRA, I.P.	0445	PATIL, J.D.	0455
NEL, P.C.	0108	OLIVER, L.R.	1092	PATIL, N.D.	0455
	0573	OLLALA MERCADE, L.	1056	PATIL, P.L.	0333
NELSON, B.	0943	OOMAH, B.D.	0866	PATIL, S.H.	0647
NELSON, B.D.	0842		0867	PATIL, S.S.	0132
	0949 1142	OPREA, N.	1095	PATIL, V.D.	0336
NELSON, J.E.	0560	ORITA, Y.	0507	PATIL, V.N.	0370
NELSON, L.A.	0271	OSINUBI, O.A.	0996	PATRA, H.K.	0123
NETKE, S.P.	0956	OSLRU, D.S.O.	0517	PATTABIRAMAN, T.N.	0985
NEVES, M.J.B.	0417	OSMAN, A.M.	0465	PAUL, M.D.	0738
NEWTON, R.J.	0163	OSTLIE, S.C.	0953		0812
NICHOLS, R.L.	1039	OTHIENO, S.M.	0764	PAVA, H.M.	0227
	1055	OVERCASH, M.R.	0144		0288 0428
NIGAM, J.M.	0916	OWEN, J.R.	0891	PAVLOV, S.A.	0068
NIGERIA:NAT. ACCEL.		OWENS, F.N.	0912	PAWAR, H.K.	0456
FOOD PROD. PROJ.	0025		0958		0457
NIKAM, P.K.	0780	OWSLEY, W.F.	0954	PEACOCK, J.M.	0047
NIR, I.	0950	OYEDOKUN, A.O.	0004		0136
NIRALE, A.S.	0461	PADHYE, A.P.	0178	PECK, R.A.	0269
NISHIYAMA, R.	1082		0649	PEDERSEN, J.F.	1147
NITSAN, Z.	0950	PADOLE, V.R.	0421		1148
NIU, T.T.	0116	PAKISTAN AGRICULTURAL		PEDERSEN, W.	0338
	0117	RESEARCH COUNCIL	0026	PELLISSIER, C.	0082
NJOKU, J.E.	0004	PAL, M.	0133	PENG, S.Y.	0580
NNADI, L.A.	0468	PAL, U.R.	0341	PEPPER, I.L.	0325
NOGDEIRA, F.D.	0445		0394	PERALES R., S.O.	0358

PEREIRA, P.A.A.	0329	RAHI, G.S.	1062						0522	0543
PEREZ, F.	0289	RAHMAN, N.H.A.	0362			RAO, M.S.R.M.				0322
PERIES, I.D.	0735	RAI, R.K.	0458							0520
PERIYATHAMBI, C.	0410	RAI, S.C.	1032			RAO, N.G.P.				0217
PERKINS, H.F.	0124	RAINA, A.K.	0762			0222 0223 0224 0230				0231
PERRET, P.M.	0221		0763 0764			0234 0236 0238 0239				0240
PERROT, C.	0125	RAJAGOPAL, K.	0621			0241 0242 0256 0290				0523
PERTZ, G.	0868		0667			0535 0719 0765 0781				0849
PETERS, D.C.	0717	RAJAGOPAL, V.	0140							1012
PETERSON, G.L.	0633	RAJASAB, A.H.	0636			RAO, N.K.S.				0127
PETERSON, G.R.	1049	RAJASEKHAR, V.K.	0126			RAO, N.S.S.				0343
PETR, F.C.	0599	RAJASEKHARAN, S.	0196			RAO, P.K.				0806
PHILLIPS, W.E.	1138	RAJE, S.R.	0541			RAO, R.V.S.				0344
PICHOT, J.	0321	RAJPUT, F.K.	1098			RAO, S.A.				0214
PIER, P.A.	0419	RAJU, D.S.	0985			RAO, S.K.				0235
PIER, P.L.	0442	RAJU, P.S.	0103			RAO, S.S.				0234
PIETSCH, D.	0267	RAJURKAR, B.S.	0772			RAO, U.M.B.				0392
	0277 0292 0297		0775						0540	0697
PINTO, E.T.	0556	RAKES, A.H.	0957			RAO, V.J.M.				0230
PITRE, H.	0777	RALPH, W.	0460			0231 0236 0238 0239				0290
PLACKO, R.P.	0992	RAMAIAH, K.V.	0699							0781
PLETEA, V.	1095	RAMALAH, R.	0350			RAO, V.R.				0237
PLUCKNETT, D.L.	0518	RAMALAN, A.A.	0004							0322
POLJAKOFF-MAYBER, A.	0159	RAMALJUNGAM, A.	0636			RAPPARINI, G.				0582
POLLASTRO, L.	1091		0645			RAS, M.N.				0931
POLUIAN, I.V.	0883	RAMANATHAN, K.M.	0120			RATHORE, S.S.				0524
POMERANZ, Y.	0841	RAMANI, S.	0461			RAVET, F.				0313
POMMER, C.V.	0434	RAMARAJ, B.	0621			RAVINDRANATH, V.				0622
POONYATHAWORN, P.	0756	RAMLI, K.	0315			RAWAT, C.R.				0475
POPA, F.	1094	RANA, B.S.	0230			RAWSON, J.E.				0583
	1095	0231 0236 0238 0239	0290			RAYCHAUDHURI, S.P.				0818
POTRYKUS, I.	0161	0523 0719 0765 0781	1012			REDDY, B.B.				0230
POULAIN, J.F.	0321	RANDHAWA, N.S.	0472			0236 0238 0239 0290				0781
POWAR, C.B.	0615		0520			REDDY, B.V.S.				0136
PRABHAKAR, B.	0806	RANGADHAMAIAH, K.	0720			REDDY, C.R.				0646
PRADHAN, K.	0959		0791			REDDY, C.S.				0231
	0960	RANGASAMY, A.	0342			0240 0241 0242 0243				0244
PRAKASH, I.	0813	RAO, A.M.K.M.	0813							0245
PRASAD, M.M.	0458	RAO, A.N.	0581			REDDY, H.R.				0619
PRASAD, M.N.	0667		0588			REDDY, K.V.S.				0749
PRASAD, R.	0472	RAO, A.S.	0230						0750	0766
PRATT, P.F.	1113	RAO, B.H.K.	0812			REDDY, M.R.				0528
PRESCOTT, B.	0678	RAO, B.H.K.M.	0806			REDDY, M.S.				0542
PREST, T.J.	0228	RAO, B.N.	0776			REDDY, S.J.				0136
PRINCIPI, A.	0652	RAO, C.H.	0392			REDDY, V.R.B.				0246
PRING, D.R.	0250		0540 0697			REDDY, Y.R.N.				0247
PUJAKI, B.T.	0519	RAO, C.S.R.	0143			REESE, J.C.				0731
PURCELL, J.C.	1018	RAO, D.V.S.	0776			REEVES, H.E.				0269
	1019 1020	RAO, K.C.	0869			REEVES, S.A., Jr.				1064
PURI, D.N.	0472	RAO, K.E.P.	0214			REGIER, C.				0297
PUSHPAMMA, P.	0869		0232 0233			REGO, T.J.				0525
QIAO, Z.Q.	0213	RAO, K.J.	0720			REICHERT, R.D.				0866
QUILANG, R.R.	0459		0791							0867
QUINBY, J.R.	0229	RAO, K.N.	0670			REIDENBACH, V.G.				1042
QUINTANA, H.	0098	RAO, K.V.	0234							1057
RABB, J.L.	0300	RAO, L.V.M.	0126			RENFRO, B.L.				0819
RABSON, R.	0364	RAO, M.J.V.	0238			RENGASAMY, A.				0128
RAHATE, V.T.	0452		0698 0699							0129
RAHEJA, S.K.	0436	RAO, M.R.	0521			REYES, J.				0345

RHODES, L.H.	0623				0638			0943	1142
RIBEIRO, J.A.	0595	SAJJAN, C.C.			0132	SCHON, M.K.			0586
RICAMONTE, E.M.	0462	SAKAMOTO, S.			0413	SCHWAGER, B.			0777
RICAUD, R.	1058	SAKASHITA, N.			1082	SCOTT, K.J.			0135
RICELLI, M.	0098	SAKO, B.			1031				0206
RICHARDSON, A.J.	0398	SAKUNTHALA DEVI, G.			0036	SCURTU, M.			0263
	1079	SALIFU, A.			0668	SEAMAN, J.T.			1153
RICHARDSON, C.R.	0889	SALINAS, J.			0411	SEDOGO, M.P.			0321
RICHARDSON, C.W.	0531	SALUNKHE, D.K.			0828	SEETHARAMA, N.			0047
RIGGS, J.K.	0871	SALVO, A.E.W.			0890		0136		0141
RINCOREYES, R.M.	0915	SAMPHANTHARAK, K.			0997	SEFTEL, H.C.			0988
RING, S.H.	0830	SANCHEZ, R.A.			1093	SEITZ, L.M.			0669
RIQUELME V., E.	0903	SANDERS, T.G.			0278	SEKHON, G.S.			0472
RIQUELME VILLAGRAN, E.	0915	SANDHU, G.S.			0753	SELL, D.R.			0964
RIZEA, A.	0263	SANDHU, H.S.			1149				0965
ROACH, L.	0988	SANDLER, M.			0988	SELVAM, R.			0129
ROBERIO, G.	0510	SANGHI, A.K.			1150	SEMINARIO, E.			1072
ROCCA DE SARASOLA, M.A.	0612				1151	SENBOKU, T.			0682
ROCHA HERNANDEZ, A.E.	0952	SANGHI, N.K.			0392	SENEGAL:MINISTERE			
RODELLA, R.A.	0310		0540		0697	DE DEVELOPEMENT RURAL			0027
RODRIGUES, A.N.A.	1059	SANGITRAO, C.S.			0657	SERRANO, J.M.E.			0966
RODRIGUEZ, J.	0736	SANGKASUWAN, U.			0756	SESHADRI, A.R.			0689
RODRIGUEZ, N.	0584	SANTAKUMARI, M.			0646	SETTY, T.K.P.			0700
RODRIGUEZ, R.R.	1079	SANTI, E.			0888	SEWELL, H.			0390
ROGERS, N.K.	0585	SANTIAGO, A.			1159	SHAPIRO, C.A.			0512
	1092	SANTOS URIBILARREA			1072	SHARANAPPA			0587
ROGLER, J.C.	0964	SARAN, G.			0133	SHARDA, D.P.			0919
ROGLER, J.R.	0965	SARASOLA, A.A.			0612	SHARMA, D.			0251
ROMANIA:INST. CERCET-		SARDAR SINGH, S.			0136				0522
ARI PENT. CEREALE		SARIG, S.			0335	SHARMA, G.D.			1154
PLANTE TEH.	0291				0346	SHARMA, H.C.			0790
ROMANO, I. (comp).	0372	SARIN, R.			0436	SHARMA, V.K.			0778
ROMERO HERRERA, L.	0248		0437		0526	SHARPLEY, A.N.			1155
RONGWISIT, C.	0997	SARPE, N.			1094	SHCHERBAK OV, V.I.A.			0820
ROONEY, L.W.	0796				1095	SHEA, P.J.			0144
0824 0829 0830 0831 0837		SARROCA, J.			0527	SHEARMAN, R.C.			0338
0846 0979 1005		SARUP, S.			1032	SHEKAR, V.B.			1156
ROSENOW, D.T.	0292	SASTRY, K.P.			0134	SHELKE, V.B.			0593
ROSENTHAL, W.D.	0130	SATYANARAYANA, D.V.			0528	SHEPHERD, A.D.			0861
ROSOLEM, C.A.	0463	SAUNDERS, J.A.			0051		0872		0873
	0464 1060	SAVITRI, A.			0845	SHETTY, H.S.			0637
ROSS, W.M.	0249	SAVULESCU, V.			0263				0638
	0250 1148	SAWAZAKI, E.			0434	SHETTY, S.V.R.			0558
ROTOR, A.V.	1030	SAXENA, S.N.			0142		0576 0581		0588
ROY, J.	0815	SAXENA, V.P.			0959	SHEWRY, P.R.			0252
RUELKE, O.C.	0309				0960	SHI, J.N.			0058
RUELLE, P.	0810	SAYAGO, F.F.			0009		0137		0170
RUFF, J.F.	0962	SAYEGH, A.H.			0465	SHIBANO, K.			0466
RUFF, J.H.	0963	SCANTAMBURLO, J.L.			0293	SHIE, S.L.			0768
RUSSEL, J.S.	0323				1152	SHIGEHIRO, M.			1010
RUST, S.R.	0958	SCHAFFER, J.A.			0311	SHIH, S.F.			1062
RYAN, J.G.	0526	SCHAKE, L.M.			0857	SHIKATA, E.			0682
SACHAN, G.C.	0807	0859 0870 0871 0920			0961	SHINDE, M.D.			0178
SACHAN, R.C.	0136	0962 0963 0968 0969			0970				0649
	0141	SCELLING, G.T.			0846	SHINDE, V.K.			0253
SADAKATHULLA, S.	0718				1042				0254
	0767	SCHENONI, P.			1061	SHIRES, R.			0988
SADASIVAM, S.	0131	SCHERTZ, K.F.			0250	SHIRKIE, R.			0874
SAFEEUULLA, K.M.	0637	SCHILLING, P.E.			0842	SHIROLE, S.M.			0716

	0757	SONDGE, V. D.	0438	TAITI, M.	0821
SHIVANNA, H.	0225	SOPORY, S. K.	0126	TAKAHASHI, K.	1130
SHIVRAJ, A.	0136	SOTOMAYOR-RIOS, A.	1159	TAKEMASA, M.	0927
SHKOL'NIK, M. YA.	0138	SOUTHERN, L. L.	0847	TALBERT, R. E.	0553
SHUKLA, D. C.	0967	SPAIN: INST. NAC. SEM-			0585 1092
SHUKLA, K.	0684	ILLAS PLANTES VIV.	0294	TALEY, Y. M.	0772
	0685 0686	SPALLACCI, P.	0469	TALLURI, P.	0388
SIDHU, M. S.	0610	SPICER, L.,	0971	TAMEZ, S.	1079
SIEVERDING, E.	0347	SPIILKA, W., Jr.	0998	TAMURA, K.	0471
SIGNORILE, O.	1144	SRINIVAGAN	0143		1145
SIGNORINI, O.	0393	SRIVASTAVA, K. P.	0769	TANAKA, S.	1140
SILVA, H. G. B.	0827	SRIVASTAVA, U. S. L.	0478	TANDON, H. L. S.	0472
SILVA, H. M.	0890	STANCILL, M.	1066	TANEJA, K. D.	1157
SILVA, J. F.	1063	STANCIOIU, N.	0972		1160
SIMPSON, E. J., Jr.	0968	STAPLES, R.	0734	TANG, X. Q.	0258
	0969 0970	STARCZEWSKI, M.	0955	TANGHIAN, G. J., Jr.	0534
SIMPSON, G. M.	0076	STARKS, K. J.	0717	TANKSLEY, T. D.	0954
	0136		0739 0740	TANKSLEY, T. D., Jr.	0902
SIMS, P	0953	STARLING, J. G.	0489	TAO, S. H.	0173
SINGH, A. R.	0884	STAVRI, J.	0918	TARHALKAR, P. P.	0523
SINGH, B. U.	0719	STEINER, J. L.	0053		0535
	0781	STEPANESCU, E.	0301	TARUMOTO, I.	0037
SINGH, G.	0610	STEPHENSON, R. G. A.	0973	TAVERNER, M. R.	0975
SINGH, K.	1157	STERN, R. D.	0513	TAYLOR, G. K.	0412
SINGH, L.	0467	STERNBERG, M.	0067	TAYLOR, J. R. N.	0836
	0468	STEWART, B. A.	0356	TAYLOR, R. W.	1161
SINGH, P.	0919	STINSON, D. L.	0531		1162 1163
SINGH, R.	0139	STIRLING, G. D.	0412	TAYLOR, T. W.	0313
	0472	STOOP, W. A.	0532	TEEM, D. H.	0552
SINGH, S.	0478	STREK, H. J.	0144	TEETES, G. L.	0787
SINGH, S. D.	0666	STRINGFELLOW, A. C.	1002		0792 0796 0803
SINGH, S. P.	0127	STRUTINSKI, F. A.	0068	TEHINSE, J. F.	1009
	0235 0394 0529 0530 1074	SU, Y. M.	0258	TELYATNIKOV, N. YA.	1067
SINGH, U.	0839	SU, Z. H.	0768	TEMERAK, S. A.	0782
SINGH, Y. D.	0179	SUAREZ, A.	0736	TENG, Y. T.	0885
SINGHANIA, D. L.	1134	SUAREZ, W. A.	0871	TEREKHOVA, I. V.	0049
SINHA, M. N.	0458	SUBBAIAH, M. M.	0145	TERHUNE, E.	0562
SINHA, S. K.	0140	SUBRAMANIAN, V.	0839	THAKARE, K. R.	0772
	0217		0999		0775
SISK, L. R.	0938	SUDEWAD, S. M.	0254	THAKRE, S. K.	0848
SIVAKUMAR, M. V. K.	0089	SUDWEEKS, E. M.	0908		1000 1001
	0136 0141 0312	SUKHANI, T. R.	0770	THANGAVELU, O.	0667
SIVAPRAKASAM, K.	0613		0771	THANKY, H. H.	0255
SIWAWET, S.	0997	SULLIVAN, C. Y.	0050	THAREJA, S. K.	1157
SKINNER, J. D.	0766		0118 0357	THATSRI, S.	1164
SMEAL, M. G.	1153	SULLIVAN, W. M.	0512	THATTE, V. R.	0947
SMIRNOV, YU. S.	0138		0533 0544	THAYER, S. S.	0146
SMITH, B. A.	1064	SUTRISNO	0470	THEURER, B.	0971
SMITH, F. W.	1158	SVANBERG, U.	0984	THIEL, F.	0747
SMITH, J. D.	0243	SWAIN, D. J.	0590	THINDWA, H. Z.	0764
	0244 0245	SWANN, C. W.	0591	THOMAS, C. A.	0678
SMITH, M. T.	0808	SWARUP, J.	0674	THOMAS, G. A.	0412
SOBRINHO, I. L.	0875	SWEAT, V. E.	0824	THOMAS, G. W.	0390
SOEJOTO.	1065	SWEETEN, J. M.	1042	THOMKE, S.	0945
SOLANGI, G. Y.	1098	SWINDALE, L. D.	0028		0946 0993
SOLOMON, M. J.	0589		0312	THONTADARYA, T. S.	0714
SOLTANPOUR, P. N.	0316	SZENTMIHALYI, S.	0974		0720 0791
SOMAN, P.	0047	TABORA, R. S.	0592	THORNE, S. W.	0046
SOMANI, L. L.	0142	TABORDA, F.	0098	THULLEN, R. J.	1081

TIKKA, S.B.S.	0255		0479		0662
	0878	VEGA G., J.D.	0152	WEDIN, W.F.	0495
TINGARE, S.B.	1117		0358	WEIBEL, D.E.	0227
TOGAWA, K.	1145	VENEGAS, V.H.A.	0420		0432 0433 0739
TOKHTAROV, V.P.	1068	VENKATARAMAN, S.	0153	WEIMBERG, R.	0159
TOLL, J.	0220	VENKATESWARLU, J.	0539	WENDT, W.	0160
TORRE, M.A.G. DE LA	0833		0540	WERNICKE, W.	0161
TOSIC, M.	0687	VERGARA RUBIN, V.J.	0976	WEST, R.L.	1105
TOUCHTON, J.T.	0536	VERMA, A.N.	1160	WESTERMAN, R.L.	0162
TOURTE, R.	0876	VERMA, G.P.	0541	WHISLER, F.D.	0314
TOVAR, D.	0098	VERMA, J.P.	0818	WHITE, P.J.	0163
TOY, J.J.	0886	VERMA, S.C.	0627	WHITELEY, G.M.	0164
TRAYLOR, E.A.	0639	VERMA, S.K.	0807	WHITEMAN, P.	0397
TREFFRY, P.T.	0537	VERMAAK, C.J.	0797	WIDSTROM, N.W.	0795
TRENUELA, R.M.	0423	VERSOZA, J.C.	0480	WIEGAND, C.L.	0398
TRIPATHI, D.P.	0256	VIATOR, H.P.	0300	WIESE, A.F.	0597
	0849		0414		0598 0599
TSAI, S.L.	0147	VICTORIA FILHO, R.	0595	WILDE, G.	0808
TSUNEYOSHI, T.	0507	VIDAL, J.	0078	WILHELM, W.W.	0404
TULEEN, D.M.	0640		0125	WILKINSON, R.E.	0165
	0641	VIDYABHUSHANAM, R.V.	0029		0166 0167 0850
TURNER, K.C.	0148	VILJOEN, J.H.	0797	WILKINSON, S.R.	1103
TWU, L.T.	0580	VIRMANI, S.M.	0089	WILLEY, R.W.	0516
TYAGI, R.P.S.	0916		0312 0542	0521 0522 0542 0543	0576
TYLER, P.S.	0877	VLAD, I.	1095	WILLIAMS, J.E.	0977
UBI, E.O.	0004	VLAS, I.	0263	WILLIAMS, J.R.	0531
	0295 0296		0301	WILLIAMS, R.J.	0670
ULABY, F.T.	0053	VLEK, P.L.G.	0418	WILLIAMSON, G.	1133
ULLSTRUP, A.J.	0822	VOIGT, R.L.	0249	WILLIAMSON, P.J.	0923
UMEKI, Y.	0413	VORA, U.A.	0578	WILSON, E.	0053
UMRANI, N.K.	0394	WAGENER, R.E.	0617	WILSON, R.L.	0740
	0408 0473 0538	WAGNER, D.G.	0432	WINKLE, M.E.	1096
UNDERSANDER, D.J.	0297	0433 0912 0926 0953	0977	WISEMAN, B.R.	0722
UNGENFUKHT, V.F.	0298	WALDEN, R.P.	0544		0723 0795
UNGER, P.W.	0324	WALKER, C.	0623	WITT, M.D.	0168
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT	0721	WALKER, T.S.	0606	WOLPERT, T.J.	0651
		WALLER, G.R.	0977		0655
UNITED STATES DEPART- MENT OF AGRICULTURE	1033	WALTER, H.	0596	WOOD, C.J.	0135
			1079	WOOD, L.V.	0338
UNITED STATES: UNIVER- SITY OF GEORGIA	0299	WALTERS, L.E.	0977	WOOD, R.A.	0474
UNNITHAN, G.C.	0752	WANG, C.Y.	0154	WOODHEAD, S.	0851
	0773	WANG, F.D.	0030		0852
UPADHYAY, U.C.	0394	WANG, M.Q.	0040	WORLEY, E.E.	0938
	0438 0481 0593	WANG, Y.	0155	WORLEY, J.F.	0106
UTOMO, W.H.	0470	WANI, P.V.	0213	WORSHAM, A.D.	0696
VAISHNAV, P.P.	0179	WANJARI, K.B.	0654	WOZNIAK, K.L.	0533
VAN BILJON, J.J.	0594	WARDLAW, I.F.	0156		0544
VAN DER GRAAFF, N.A.	0815	WARREN, F.S.	0158	WRAGE, L.J.	0600
VAN NIEKERK, P.J.	0835	WASKOM, R.M., III.	1165	WRIGHT, G.C.	0169
VAN SCOYOC, S.W.	0149	WATANABE, I.	0109	WRIGHT, J.C.	1153
VAN ZYL, J.R.	0948	WATANABE, I.	0328	WRIGHT, V.F.	0895
VANCE, P.N.	0395	WATSON, B.T.	0158	WRONA, J.	0978
VARRIANO-MARSTON, E.	0861	WATSON, J.	0325	WU, C.H.	1097
	0862 0933 0934 0935 0987	WATSON, T.G.	1007	WU, M.X.	0058
VAUGHN, K.C.	0150	WATTS, D.G.	0307		0137 0170
	0151	WEBER, J.B.	0357	WU, Y.V.	1002
VECCHIETTINI, M.	0396	WEBSTER, J.	0144	WUENSCH, A.L.	0792
			0618	WYLIE, P.	0412
				XU, J.X.	0099

XU, R.Y.	0257	YOUNG, W.R.	0724	ZHANG, C.S.	0258
YAN, X.Z.	0213		0774	ZHANG, K.T.	0099
YANG, W.	0259	YOUNGMAN, V.E.	0101	ZHANG, L.S.	0213
YANG, Y.F.	0936	YOUNGS, C.G.	0866	ZHANG, W.J.	0258
YANUCCI, D.	0823		0867	ZHAO, N.L.	0117
YASSIN, A.M.	0690	YU, H.S.	0117	ZHAO, S.T.	0257
YASSIN, T.E.S.	0302	YUSUFOV, A.G.	0172	ZHAO, X.M.	0117
YATES, D.J.	0171	YUSUPOVA, G.M.	0601	ZHATKANBAEV, ZH.ZH.	0601
YAWALAK SURAPUNPISIT	1011	ZAMA, F.	1034	ZHOU, G.	0259
YEMEN ARAB REP. :NAT.		ZEBROWSKA, T.	0902	ZHOU, J.Y.	0174
SORGHUM MILLET CROP		ZEN, Y.	0259	ZHOU, Y.C.	0212
IMP. PROG.	0031	ZERINGUE, L.	0943	ZINSMEISTER, H.D.	0832
YOKOMICHI, J.	1082	ZHA, J.J.	0137		0853
YORK, J.O.	0246		0170	ZIV, O.	0663
	0303 0826	ZHANG, B.L.	0173	ZORZA, E.J.	00
				ZUMMO, N.	0624
					1038 1069 1070



# **Subject Index**



2-4-5-T:3-6-dichloropicolinic acid: Triclopyr, Toxicity; Sorghum, Seedlings,	0550	Combining ability, Line x tester analysis; Sorghum,	0254
2-4-D: Atrazine; Sorghum, Solatnum karsensis/Control, Sorghum, Weed control,	0574 0593	Combining ability: Hybrid vigour; Sorghum, Cytoplasm, Effect; Sorghum,	0255 0210
2-4-D: MCPA, Effect; Sorghum, Growth, Effect; Sorghum, Yields,	0573 0573	Effect; Sorghum (Forage), Growth: Dig- estibility: YieIds,	1121
2-4-D: Picloram: Atrazine; Sorghum, Weed control,	0583	Evaluation; Sorghum, Random mating/ Population,	0182
2-4-D: Simazine: Atrazine, India/Andhra Pradesh; Sorghum, Hybr- ids, Weed control,	0549	Gene action, Estimation; Sorghum,	0180 0203
3-6-dichloropicolinic acid: Triclopyr : 2-4-5-T, Toxicity; Sorghum, Seedlings,	0550	Gene action/Nature; Sorghum, Genetic variation; Sorghum,	0235 0253
ABA : GA: IAA, Analysis; Sorghum, Genotypes, Chromatography (Liquid); Sorghum, Genotypes,	0074 0073	Genetic variation; Sorghum (Forage), Inheritance; Sorghum, Line x tester analysis; Sorghum,	1154 0191 0235
Light effects; Sorghum, Genotypes,	0075	Nitrogen fertilizers: Seed quality, Effect; Sorghum,	0428
Abscisic acid see, ABA		Theses; Sorghum (Forage),	1147
Absorption; Sorghum, Phorate, Sorghum, Roots, Sodium,	0045 0114	Agronomic characters; Sorghum, Gene action,	0201
Acid phosphatase, Isolation; Sorghum, Thylakoids/Memb- ranes ,	0129	Sorghum, Genotypes, Aging, Comparison,	0071
Acid soils; Sorghum, Genotypes, Minerals and nutrients uptake,	0422	Agronomic characters: Grain molds/ Incidence, Relationship; Sorghum,	0667
Acidification, Effect, (in) Calcareous soils; Sorghum, Iron/Dusts,	0454	Agronomic characters: Lodging/Resist- ance, Inheritance, Theses; Sorghum,	0228
Adenosine triphosphate/Activity; Sorghum, Aging, Sorghum, Leaves/Development,	0123 0123	Agronomic characters: Yields, Genetic/Relationship; Sorghum (Fora- ge) ,	1134
Aflatoxins see, Mycotoxins		Agronomic characters see also, Head characters	
Africa, IBPGR; Sorghum, Germplasm/Collections,	0221	Agronomic practices, Theses; Sorghum, Hybrids, Flowering,	0134
Africa; Sorghum, Beers, Hypoglycaemia, Sorghum, Mycoses,	0988 0614	Agronomy, Botswana; Sorghum,	0400
Africa see also, East Africa Tropical Africa West Africa		Research, ICRISAT, Mali; Sorghum, Research, India, Review articles; Sorghum,	0383 0394
Aging, Adenosine triphosphate/Activity; Sorghum, Comparison, (by) Agronomic characters; Sorghum, Genotypes, Effect; Sorghum, Carbohydrate content,	0123 0071 0109	Research, India/Karnataka; Sorghum, Research, Kenya; Sorghum, Research, Nigeria; Sorghum, Research, Papua New Guinea; Sorghum, Sudan; Sorghum, Sudan; Sorghum arundinaceum,	0381 0397 0391 0395 0361 0371
Agronomic characters, Australia; Sorghum, Australia; Sorghum, Hybrids,	0360 0372	Agronomy; Sorghum,	0385
		Air moisture, Effect, Taiwan; Sorghum, Flowering: Seed development,	0056
		Air temperature: Leaf temperature: Soil temperature, Canopy, Effect; Sorghum,	0309
		Timing (Day), Effect; Sorghum,	0309
		Alachlor: Dalapon; Sorghum, Helminthosporium turcicum/ Control,	0646

Alachlor:Metolachlor, Toxicity, Soil moisture, Effect ; Sorghum,	0569	Analysis ; Sorghum (Male sterile), Anthers,	0849
Alachlor:Metolachlor ; Sorghum (Volunteer), Control,	1096	Poultry ; Milos, Swine ; Sorghum,	0950 0975
Alcohols/Production, Brazil ; Sweet sorghums,	1063 1066	Amino acids : Phenols : Sugars, Role ; Sorghum, Puccinia purpurea/ Resistance,	0630
Byproducts, (as) Feeds ; Sweet sorghums, Thailand ; Sweet sorghums,	1061 1051	Amino acids (Limiting), Analysis ; Sorghum,	0846
Theses ; Sorghum, Theses ; Sweet sorghums, Fermentation, USA ; Sweet sorghums,	1011 1057 1040	Amino acids/Content : Protein content, Changes, (during) Developmental stages ; Sorghum, Seeds,	0149
Alcohols/Product ion ; Sorghum,	1004	Amino acids/Leakage : Sugars/Leakage, Toluene, Effect ; Sorghum, Leaves : Roots,	0159
Sweet sorghums,	1008 1042	Amino acids see also, Leucine	
Sweet sorghums, Varieties,	1039 1042 1049 1058	Methionine Proline	
Alfisols see, Luvisols		Ammonia, Effect ; Sorghum (Forage), Silage,	1133
Alimentary canal, Enzymes ; Sorghum, Atherigona soccata, Larvae,	0748	Anatomy, Kenya ; Sorghum, Atherigona, Females,	0746
Alkaloids, Biosynthesis ; Sorghum, Sphacelia sorghii,	0656	Anatomy ; Sorghum, Atherigona/Trifoliolate organ,	0747 1089
Effect ; Sorghum, Growth,	0106	Anatomy : Physiology : Yields/Stability, Environmental effects, Theses ; Sorghum,	0377
Allelism, Tests ; Sorghum, Mutants (Brown midrib),	0181	Anthers, Amino acids, Analysis ; Milos,	0849
Allelopathy, (on) Amaranthus retroflexus ; Sorghum halepense,	1087	Amino acids, Analysis ; Sorghum (Male sterile),	0849
(on) Maize ; Sorghum halepense, Effect ; Sorghum, Gomphrena decumbens, Effect ; Sorghum, Helianthus annuus,	1087 0589 0586	Enzymes : Proteins ; Sorghum (Male sterile). Antibiotics, Effect ; Sorghum, Carbohydrates/Fermentation, (in) Cattle/Rumen, Lactic acid/Formation,	0256 0906
Allelopathy ; Sorghum,	0090	Antidotes see, Detoxicants	
Sorghum, Trianthema portulacastrum,	0578	Aphids/Control, India/Andhra Pradesh ; Sorghum,	0738
Almond moth see, Ephestia cautella		Aphids see also, Longiunguis sacchari Melanaphis sacchari Rhopalosiphum maidis Schizaphis graminum Toxoptera graminum	
Alternaria tenuis : Curvularia lunata : Fusarium moniliforme : Helminthosporium sorghicola ; Sorghum,	0665	Apomixis, Use ; Sorghum, Breeding,	0223
Aluminium, Effect, Theses ; Sorghum, Genotypes, Growth,	0426	Apomixis ; Sorghum,	0231
Effect, Theses ; Sorghum, Genotypes, Minerals and nutrients,	0426	Sorghum, Vybrids,	0222
Aluminium/Resistance, Evaluation ; Sorghum,	0427	Application methods, Evaluation ; Sorghum, Atherigona soccata/ Control, Insecticides,	0771
Aluminium/Tolerance ; Sorghum,	0445	Application methods ; Sorghum, Atherigona soccata/Control, Insecticides,	0767
Aluminium/Toxicity, Calcium carbonate : Calcium sulphate, Effect ; Sorghum,	0124		
Amino acids, Analysis ; Milos, Anthers,	0849		

Sorghum, Herbicides,	0561	Kenya ; Sorghum,	0752
Application methods/NPK fertilizers,		Kenya ; Sorghum arundinaceum,	0752
Effect ; Sorghum (Forage), Yields,	1129	Larvae, Alimentary canal, Enzymes ;	
Application methods see also,		Sorghum,	0748
Sidedressing		Larvae, Growth : Feeding habits : Move-	
Topdressing		ment ; Sorghum,	0763
Argentina ;		Larvae ; Sorghum,	0764
Sorghum,	0003	Natural enemies, Nigeria ; Sorghum,	0742
	0009	Oviposition ; Sorghum,	0749
Sorghum, Cultivation, Cost analysis,	1013		0751 0761 0762
Sorghum, Diseases,	0612	Population, Environmental effects,	
Sorghum, Hybrids, Composition, Analy-		Upper Volta ; Sorghum,	0743
sis,	0833	Reproduction ; Sorghum,	0773
Sorghum, Hybrids, Performance,	0283	Research, Review articles ; Sorghum,	0774
Sorghum, Hybrids, Statistics,	0283	Research, Sudan, Review articles ;	
Sorghum, Hybrids : Varieties, Perform-		Sorghum,	0741
ance trials,	0264	Atherigona soccata ;	
Sorghum, Performance trials,	0289	Sorghum,	0759
Sorghum, Trade,	1026	Sorghum, Yield loss / Assessment,	0716
Sorghum, Varieties, Performance tri-		Atherigona soccata : Chilo partellus,	
als,	0293	Planting date, Effect, India / Punjab ;	
Sorghum, Weed control,	0584	Sorghum,	0610
Sorghum (Forage), Growth,	1152	Atherigona soccata / Control,	
Sorghum (Forage), Uses,	1152	Carbofuran, Thailand ; Sorghum,	0756
Sorghum halepense / Control, Ecology,	1071	Insecticides, Application methods,	
Army worms see,		Evaluation ; Sorghum,	0771
Mythinma separata		Insecticides, Application methods ;	
Spodoptera frugiperda		Sorghum,	0767
Asclepias syriaca / Control,		Insecticides, Evaluation ; Sorghum,	0758
Glyphosate ; Sorghum,	0557	Insecticides, Seed treatment ; Sorghum,	0770
Ascorbic acid,		Insecticides ; Sorghum,	0769
Effect, Guinea pigs ; Sorghum, Nutrit-		Atherigona soccata / Control ;	
ive value,	0933	Sorghum,	0755
	0935	Atherigona soccata / Resistance,	
Ascorbic acid : Chlorophylls,		Evaluation ; Sorghum, Genotypes,	0714
Changes, (during) Seedlings / Growth ;		Evaluation ; Sorghum, Varieties,	0757
Sorghum, Fl hybrids,	0179	Inheritance, Theses ; Sorghum,	0754
Asia ;		Inheritance ; Sorghum,	0744
Sorghum, High-yielding varieties,			0765
Diseases : Insect pests : Weeds, Comp-		Atherigona soccata / Resistance ;	
lexes,	0611	Sorghum,	0764
Aspergillus candidus : Penicillium		Sorghum, Combining ability,	0745
citrinum,		Atherigona soccata / Resistance : Oligo-	
Infection ; Sorghum,	0615	nychus indicus / Resistance,	
Atherigona,		Relationship ; Sorghum,	0719
Females, Anatomy, Kenya ; Sorghum,	0746	Atrazine,	
Host range, India / Andhra Pradesh ;		Semi-arid tropics, India ; Sorghum,	
Sorghum,	0750	Weed control,	0558
Atherigona / Trifoliolate organ,		Atrazine : 2-4-D ;	
Anatomy ; Sorghum,	0747	Sorghum, Solanum karsensis / Control,	0574
Atherigona soccata,		Sorghum, Weed control,	0593
Attractants ; Sorghum,	0766	Atrazine : 2-4-D : Picloram ;	
Bionomics ; Sorghum,	0772	Sorghum, Weed control,	0583
China ; Sorghum,	0768	Atrazine : 2-4-D : Simazine,	
Host range, Upper Volta	0743	India / Andhra Pradesh ; Sorghum, Hybr-	
Infestation, Planting date : Seeding		ids, Weed control,	0549
rates, Effect ; Sorghum,	0753	Atrazine : Nitrofoska ;	
Insect biology, Thailand ; Sorghum,	0756	Sorghum, Striga hermonthica / Control,	0695
Insect biology ; Sorghum,	0760		

Atrazine:Propachlor;		x Sorghum sudanense,Hybrids,	0671
Sorghum, Weed control,	0556	Bacteria see also,	
Atrazine/Dissipation,		Azospirillum	
(from) Soils, (in) Irrigated farming,		Azotobacter	
Australia; Sorghum,	0590	Bacterial diseases see,	
Australia;		Bacterioses	
Sorghum, Agronomic characters,	0360	Bacterioses,	
Sorghum, Atrazine/Dissipation, (from)		Chemical control ; Sorghum, Leaves,	0673
Soils, (in) Irrigated farming,	0590	French Guyana ; Sorghum (Forage),	1104
Sorghum, Cropping systems (Strip)		Bacterioses see also,	
, Water management,	0537	Bacteria (Ratoon stunting)	
Sorghum, Feed supplements, Cattle,	0923	Corynebacterium	
Sorghum, Grain yield, Population		Erwinia sorghi	
density: Spacing, Effect,	0412	Pseudomonas	
Sorghum, Hybrids, Agronomic charact-		Beef see,	
ers ,	0372	Cattle	
Sorghum, Hybrids, Grain yield,	0378	Beers ,	
Sorghum, Hybrids, Planting/Guide,	0366	Hypoglycaemia, Africa ; Sorghum,	0988
	0372 0378	Beers ;	
Sorghum, Irrigation,	0354	Sorghum,	1003
Sorghum, Peregrinus maidis,	0679		1007
Sorghum, Species, Tropics,	0038	Bibliographies ;	
Sweet sorghums, Sugar/Production,		Sorghum, Diseases ,	0608
Maturity, Effect,	1046		0609
Sweet sorghums, Yields, Evaluation,	1045	Sorghum, Growth, Analysis,	0059
Sweet sorghums, Yields, Maturity,			0060
Effect,	1046	Sorghum, Solar radiation, Effect,	0304
Azospirillum,			0305
Effect ; Sorghum, Nitrogen metabolism,	0329	Sorghum, Venezuela,	0001
Humid tropics ; Sorghum, Nitrogen		Sorghum, Water relations,	0061
fixation,	0341		0062 0063 0064
Organic matter, Effect ; Sorghum, Nit-		Sorghum, Weeds,	0559
rogen fixation,	0326	Sorghum saccharatum,	1047
Soil moisture, Effect ; Sorghum, Nitro-		Bioassay,	
gen fixation,	0326	Poultry ; Sorghum, Feeds, Nutritive	
Azospirillum;		value,	0909
Sorghum,	0340	Bioassay;	
Sorghum, Nitrogen fixation,	0343	Sorghum, Schizaphis graminum, Feeding	
Azospirillum/Inoculation,		deterrents,	0731
Effect ; Sorghum, Growth: Nitrogen		Biogas see,	
content,	0334	Methane	
Irrigation, Effect ; Sorghum,	0346	Biological control,	
Israel ; Sorghum, Nitrogen fixation,	0335	Egypt ; Sorghum, Sesamia cretica,	0782
Israel ; Sorghum, Yield increase,	0335	Research, Pakistan ; Sorghum, Insect	
Azospirillum/Inoculation;		pests,	0715
Sorghum, Nitrogen fixation,	0334	West Africa ; Sorghum, Insect pests,	0709
Azotobacter;			0721
Sorghum, Nitrogen fixation,	0336	Biological control;	
Azotobacter/Inoculation,		Sorghum, Chilo partellus,	0780
Effect ; Sorghum, Grain yield,	0333	Sorghum, Insect pests,	0720
Bacteria,		Biological control see also,	
Induction ; Sorghum nigricans, Nitro-		Parasitic insects	
gen fixation,	0332	Predators	
Theses ; Sorghum, Nitrogen fixation,	0331	Biomass : Height : Leaf area index,	
USA ; Sorghum, Nitrogen fixation,	0338	Relationship ; Sweet sorghums,	1062
Bacteria;		Biomass/Estimation : Classification,	
Sorghum, Nitrogen fixation,	0328	Microwave radiation/Data ; Sorghum,	0130
Bacteria (Ratoon stunting),			
Isolation : Pathogenicity ; Sorghum			

Biomass/Product ion,		Sweet sorghums, Alcohols/Production,	1063
Japan; Sweet sorghums,	1050		1066
Models; Sweet sorghums,	1062	Sweet sorghums, Methane/Product ion,	1048
Biomass/Production;		Breeding,	
Sweet sorghums,	1058	Apomixis, Use; Sorghum,	0223
	1064	Chilo partellus/Resistance; Sorghum,	0779
Sweet sorghums, Varieties,	1052	Genetic variation, ICRISAT; Sorghum,	0219
Bionomics;		Ghana; Sorghum,	0251
Sorghum, Atherigona soccata,	0772	Grain molds/Resistance, ICRISAT;	
Biosynthesis,		Sorghum,	0198
Enzymic activity, Determination,		India/Maharashtra; Sorghum,	0178
(by) Chromatography; Sorghum, Pheno-		Insect pests/Resistance, Tropical	
lic compounds,	0051	Africa; Sorghum,	0702
Biosynthesis;		Internodes/Pat terns, Significance;	
Sorghum, Cyanogenic glycosides,	0065	Sorghum,	0238
	0086		0239
Sorghum, Sphacelia sorghi, Alkaloids,	0656	Nutritive value, Review articles;	
Sorghum, Taxiphyllin,	0067	Sorghum,	0177
Biphenyl/Toxicity,		Nutritive value; Sorghum,	0236
Carbon (Activated), Effect; Sorghum,	0144		0252
Bird pests,		Research, ICRISAT, Upper Volta; Sorg-	
Senegal; Sorghum, Yield loss,	0810	hum,	0199
Bird pests/Control,		Rhopalosiphum maidis/Resistance;	
Methiocarb, East Africa; Sorghum,	0809	Sorghum,	0737
Methiocarb, Senegal; Sorghum,	0082	Striga/Resistance, ICRISAT; Sorghum,	0698
Methiocarb; Sorghum, Hybrids,	0072	Striga asiatica/Resistance, ICRISAT;	
Bird pests/Resistance : Tannins/Content,		Sorghum,	0699
Environmental effects; Sorghum, Hyb-		Toxoptera graminum/Resistance; Sor-	
rids,	0811	ghum,	0737
Black soils see,		Yield increase; Sorghum,	0216
Vertisols		Breeding;	
Blissus leucopterus,		Sorghum,	0204
Photoperiod, Effect; Sorghum,	0808	Breeding methods see also,	
Boron/Deficiency: Enzymic activity,		Chromosome manipulation	
Relationship; Sorghum,	0138	Breeding see also,	
Botswana;		Crossbreeding	
Sorghum, Agronomy,	0400	Brewing,	
Sorghum, Yields, Population: Spacing,		Effect; Sorghum, Nutritive value,	0984
Effect,	0400	Broadcasting;	
Bovines;		Sorghum,	0413
Sorghum, Feeds,	0887	Buffaloes;	
	0916	Sorghum, Feed supplements,	0907
Branching,		Bugs,	
Environmental effects; Sorghum,	0306	Host range, USA/Texas; Sorghum,	0803
Brazil;		Bugs see also,	
Sorghum,	0007	Calocoris angustatus	
Sorghum, Development, Planting date,		Bulgaria;	
Effect,	0310	Sorghum, Pseudomonas syringae/Cont-	
Sorghum, Genotypes, Performance,	0268	rol,	0672
Sorghum, Genotypes, Schizaphis gram-		Bullocks see,	
inum/Resistance,	0732	Cattle	
Sorghum, Phenology,	0310	Bulls see,	
Sorghum, Research,	0005	Cattle	
	0006	Butanol;	
Sorghum: Cowpeas : Kidney beans, Inte-		Sorghum, Plastids, Protein/Solubility,	0128
rcropping,	0510	Byproducts,	
Sorghum (Forage), Yields, Semi-arid		(as) Feeds; Sweet sorghums, Alcohols/	
tropics,	1120	Production,	1061
Sorghum saccharatum, Performance,	0268	Feeds, South Africa; Sorghum,	0942

CGA-43089 see,		Leaf temperature: Soil temperature,	0309
CONCEP		Phosphorus/Leaching: Runoff/Losses,	
CONCEP,		Relationship; Sorghum sudanense,	1155
Effect, Theses; Sorghum, Herbicides,		Canopy/Development: Light/Use,	
Toxicity,	0572	(in) Mixed cropping, ICRISAT; Sorghum,	0581
Effect; Sorghum, Herbicides, Toxicity,	0569	ICRISAT; Sorghum: Pigeonpea, Inter-	
CONCEP;		cropping,	0516
Sorghum, Protection, (from) Metolach-		Canopy/Moisture,	
lor/Toxicity,	0575	Microwave radiation, Response: Sorg-	
Sorghum, Seedlings, Protection, (from)		hum,	0053
Metolachlor/Toxicity,	0122	Carbofuran,	
CONCEP: Metolachlor,		Effect; Sorghum, Hybrids, NPK fertil-	
Combined application, Effect; Sorghum,	0555	izers/Uptake,	0421
Effect; Sorghum, Leaves/Elongation,	0555	Effect; Sorghum, Hybrids, Yields,	0421
Effect; Sorghum, Weed control,	0568	Thailand; Sorghum, Atherigona soccata/	
CONCEP: Soil moisture,		Control,	0756
Effect; Sorghum, Metolachlor/Uptake,	0095	Carbohydrate content,	
Cakes;		Aging, Effect; Sorghum,	0109
Sorghum, Flours,	0997	Carbohydrates,	
Calcareous soils;		Processing, Effect; Sorghum,	0858
Sorghum, Chlorosis/Control, (by) Iron,	0435	Carbohydrates (Soluble),	
	0454	Water stress, Effect; Sorghum,	0163
Sorghum, Hybrids, Iron/Uptake,	0416	Carbohydrates/Fermentation,	
Sorghum, Iron/Dusts, Acidification,		(in) Cattle/Rumen, Lactic acid/Form-	
Effect,	0454	ation, Antibiotics, Effect; Sorghum,	0906
Calcium: Magnesium: Potassium,		Inheritance, Theses; Sorghum; Stems,	0185
Use; Sorghum, Hybrids,	0447	Carbon (Activated),	
Calcium: Sodium,		Effect; Sorghum, Biphenyl/Toxicity,	0144
Effect; Sorghum, Germination,	0048	Carbon dioxide: Methyl bromide,	
Calcium/Content,		Fumigation; Sorghum, Stored products	
Nitrogen fertilizers/Sidedressing,		pests/Control,	0797
Effect; Sorghum,	0466	Carotenoids/Accumulation,	
Calcium carbonate: Calcium sulphate,		Phytochromes, Effect; Sorghum,	0126
Effect; Sorghum, Aluminium/Toxicity,	0124	Carps see,	
Calcium carbonate: Organic matter,		Fishes	
Effect; Sorghum, Iron/Concentration,	0455	Caryopsis,	
Effect; Sorghum, Manganese/Concentr-		Development, Theses; Sorghum,	0110
ation,	0455	Cassia obtusifolia/Control,	
Effect; Sorghum, Yields,	0455	Metolachlor: Propazine; Sorghum,	0564
Calcium sulphate: Calcium carbonate,		Cattle,	
Effect; Sorghum, Aluminium/Toxicity,	0124	Australia; Sorghum, Feed supplements,	0923
Calocoris angustatus,		Theses; Sorghum (Forage), Feeds,	1102
Theses; Sorghum, Yield loss,	0804	Cattle;	
Calocoris angustatus/Control,		Sorghum, (as) Feed supplements,	0903
Theses; Sorghum,	0804	Sorghum, Composition,	0977
Calves see,		Sorghum, Feeds,	0904
Cattle			0915 0922 0939 0953 0962
Canada;			0977
Sorghum, Grain yield, Irrigation,		Sorghum, Grain, Proteins/Digestibil-	
Effect,	0380	ity,	0971
Sorghum, Grain yield, Nitrogen fert-		Sorghum, Grain, Reconstitution,	0969
ilizers, Effect,	0380	Sorghum, Hay, Nutritive value, Conce-	
Sorghum, Hybrids, Grain yield, Plant-		ntrates, Effect,	0948
ing date, Effect,	0476	Sorghum, Nutritive value,	0955
Sorghum, Hybrids, Grain yield, Popul-		Sorghum, Nutritive value, Feed addi-	
ation density, Effect,	0476	tives, Effect,	0897
Sorghum (Forage), Production,	1165	Sorghum, Nutritive value, Reconstit-	
Canopy,		ution: Soaking, Effect,	0968
Effect; Sorghum, Air temperature:		Sorghum, Reconstitution: Soaking,	0970



Sorghum, Silage,	0890	hum,	0778
Sorghum, Silage, (as) Roughage,	0958	Chilo partellus:Atherigona soccata,	
Sorghum, Silage, Digestibility,	0937	Planting date, Effect, India/Punjab;	
Sorghum, Silage, Digestibility, Processing, Effect,	0920	Sorghum,	0610
Sorghum, Silage, Digestibility: Nutritive value, Sodium hydroxide/Treatment, Effect,	0917	Chilo partellus/Control, Insecticides; Sorghum,	0718
Sorghum, Silage, Feed additives,	0893	Xanthopimpla stemmator; Sorghum,	0780
Sorghum, Silage, Nutritive value,	0898	Chilo partellus/Resistance,	
	0938 0963	Evaluation; Sorghum, Genotypes,	0714
Sorghum, Silage, Nutritive value, Processing, Effect,	0961	Genetics; Sorghum,	0781
Sorghum, Silage, Proteins/Rations,	0943	Chilo partellus/Resistance;	
Sorghum, Silage, Rations, Effect,	0896	Sorghum, Breeding,	0779
Sorghum, Silage, Storage,	0859	China;	
Sorghum, Straw (Ammoniated), Nutritive value,	0905	Sorghum, Atherigona soccata,	0768
Sorghum:AlfaIffa, Silage, Comparison,	0957	Sorghum, Evolution:Origin,	0030
Sorghum:Maize, Silage, Nutritive value, Comparison,	0891	Sorghum nervosum, Taxonomy,	0040
Sorghum x Sorghum sudanense, Hybrids, Hydrocyanic acid/Toxicity,	1153	Chinch bug see,	
Sorghum x Sorghum sudanense, Hybrids, Hay, Feed supplements,	1138	Blissus leucopterus	
Sweet sorghums, Feeds,	1044	Chlorophylls;	
Cattle/Lactation;		Sorghum, Leaves,	0172
Sorghum, Silage, Sodium hydroxide/Treatment,	0917	Chlorophylls:Ascorbic acid,	
Cattle/Rumen,		Changes, (during) Seedlings/Growth;	
Lactic acid/Formation, Antibiotics, Effect; Sorghum, Carbohydrates/Fermentation,	0906	Sorghum, Fl hybrids,	0179
Cell structure,		Chlorophylls:Proteins,	
Toluene, Effect; Sorghum,	0159	Complexes; Sorghum,	0046
Cells (Somatic),		Chlorophylls/Accumulation,	
Culture; Sorghum,	0054	Phytochromes, Effect; Sorghum,	0126
Embryogenesis; Sorghum,	0174	Chlorophylls/Content,	
Chapathis/Quality,		(during) Developmental stages; Sorghum, Leaves,	0131
Evaluation, ICRISAT; Sorghum,	0994	Chlorophylls/Content;	
Chapathis/Quality:Flours/Physicochemical properties,		Sorghum, Hybrid vigour,	0207
Relationship; Sorghum,	0999	Sorghum, Leaves (Chlorotic),	0631
Charcoal rot see,		Chlorophylls/Optical properties;	
Macrophomina		Sorghum, Leaves:Plastids,	0097
Chemical composition see,		Chlorophylls/Synthesis,	
Composition		Phytochromes, Action; Sorghum,	0119
Chemical control;		Chloroplasts see,	
Sorghum, Leaves, Bacterioses,	0673	Plastids	
Sorghum halepense,	1074	Chlorosis;	
Chemical control see also,		Sorghum, Hybrid vigour,	0439
Fungicides		Sorghum, Leaves,	0631
Herbicides		Chlorosis/Control,	
Insecticides		(by) Iron, (in) Calcareous soils; Sorghum,	0435
Chickens see,			0454
Poultry		Chlorosis/Iron,	
Chilo partellus,		Roots, Role; Sorghum, Seedlings,	0440
Biological control; Sorghum,	0780	Chromatography;	
Emergence, Timing (Day), Effect; Sorghum,		Sorghum, Grain, Phenolic compounds,	0837
		Sorghum, Phenolic compounds, Biosynthesis, Enzymic activity, Determination,	0051
		Sorghum (Bird resistant), Grain, Flavonoids/Content,	0835
		Chromatography (Liquid);	
		Sorghum, Genotypes, ABA:GA:IAA,	0073

Chromosome manipulation, Solar radiation (Eclipse), Effect ; Sorghum,	0240	Lactobacillus plantarum/Inoculation, Effect ; Sorghum, Silage,	0908
Classification : Biomass/Estimation, Microwave radiation/Data ; Sorghum,	0130	Light effects ; Sorghum, Leaves, Maturity/Stage, Effect ; Sorghum,	0043 0926
Clay soils, Salts/Distribution, Gypsum : Irrigat- ion : Nitrogen fertilizers, Effect ; Sorghum (Forage),	1143	Microscopy ; Sorghum, Grain, Nitrogen fertilizers, Effect ; Sorghum, Reconstitution, Effect ; Sorghum, Review articles ; Sorghum,	0831 0433 0926 0987
Cleistogamy : Glumes, Inheritance ; Sorghum,	0215	Theses ; Sorghum, High-yielding vari- eties ,	0845
Climatic change, Effect, Semi-arid tropics ; Sorghum, Yields,	0312	Water stress, Effect, Theses ; Sorghum, Genotypes,	0145
Effect ; Sorghum, Growth,	0160	Composition ; Sorghum, Grain,	0839 1027
Climatic effects see, Environmental effects		Sorghum, Grain/Dust,	0841
Cold climate, Polyethylene glycol, Effect ; Sorghum, Germination,	0052	Sorghum, Tannins, Sorghum, Varieties, Feeds, Sorghum (Forage),	0825 0848 1158
Coleoptile, Growth ; Sorghum,	0156	Composition : Energy (Metabolizable), Evaluation, Poultry ; Sorghum,	0941
Coleoptile/Length, Effect ; Sorghum, Germination,	0156	Composition : Nutritive value, Comparison ; Sorghum, Feeds,	0924
Colletotrichum graminicola, Spores, Germination ; Sorghum, Pollen,	0645	Fermentation, Effect ; Sorghum (Forage),	1111
Colletotrichum graminicola/Incidence, Planting date, Effect, India/Punjab ; Sorghum,	0610	Composition/Changes, (during) Germination ; Sorghum,	0828
Combine harvesters, Effect ; Sorghum, Lodging,	0602	Concentrates , Effect, Cattle ; Sorghum, Hay, Nutritive value,	0948
Combine harvesters ; Sorghum, Harvesting,	0603 0604	Consumer behaviour, India/Andhra Pradesh ; Sorghum, Nigeria ; Sorghum, Palatability/Tests,	0869 0989
Combining ability, Atherigona soccata/Resistance ; Sor- ghum,	0745	Contarinia sorghicola, Hibernation ; Sorghum, Spikelets, Reproduction, Progeny forms ; Sorghum,	0786 0787
Grain yield ; Sorghum, Fl hybrids, Line x tester analysis ; Sorghum, Agronomic characters,	1075 0254	Contarinia sorghicola ; Sorghum, Yield loss,	0789
Combining ability ; Sorghum,	0235	Contarinia sorghicola/Control, Insecticides ; Sorghum,	0718
Sorghum, Hybrids,	0186	Parasitic insects : Predators, India/ Karnataka ; Sorghum,	0791
Sorghum (Forage),	1107 1156	Contarinia sorghicola/Resistance, Evaluation, ICRISAT ; Sorghum, Genoty- pes,	0790 0792 0714 0788
Combining ability : Hybrid vigour ; Sorghum, Agronomic characters,	0255	Cooking, Effect, Nigeria ; Sorghum, Koko, Nutri- tive value,	0996
Composition, Analysis, Argentina ; Sorghum, Hybrids,	0833	Cooking quality, Theses ; Sorghum,	0860
Analysis ; Sorghum, Grain,	0836	Theses ; Sorghum, High-yielding vari- eties ,	0845
Cattle ; Sorghum,	0977	Cooperative activities, ICRISAT ; Sorghum, Research,	0011
Effect ; Sweet sorghums, Feeds, Nutri- tive value,	1067	Copper/Deficiency ; Sorghum,	0430
Fibre content, Effect, Theses ; Sorghum, Silage,	0930		
Herbicides, Effect ; Sorghum, India/Haryana ; Sorghum (Forage), Var- ieties ,	0601 1101		

Corynebacterium ;		Highland, Italy ; Sorghum,	0373
Sorghum x Sorghum sudanense, Hybrids,	1136	India/Maharashtra ; Sorghum,	0363
Cost analysis,		Mexico ; Sorghum,	0374
Argentina ; Sorghum, Cultivation,	1013	Solonetz ; Sorghum, Hybrids,	0301
Cost analysis ;		Cultivation ;	
Sorghum, Processing,	0870	Sorghum,	0367
Cows see,			0387 0396 0407
Cattle		Cultural control,	
Crop climate,		Effect ; Sorghum (Forage), Yields, In-	
Effect ; Sorghum, Hybrids, Evapotrans-		sect pests,	1160
piration,	0307	Theses ; Sorghum, Peronosclerospora	
Effect ; Sorghum, Hybrids, Grain yield,	0307	sorghii,	0634
Crop climate : Evapotranspiration : Grain		Cultural control ;	
yield,		Sorghum, Diseases,	0821
Relationship ; Sorghum, Hybrids,	0307	Curvularia : Fusarium,	
Cropping patterns,		Review articles ; Sorghum,	0670
(for) Dry farming, India/Maharashtra ;		Curvularia lunata : Fusarium monilifo-	
Sorghum,	0538	rme : Helminthosporium sorghicola :	
Cropping patterns see also,		Alternaria tenuis ;	
Intercropping		Sorghum,	0665
Ratooning		Cuticle/Leaves,	
Rotational cropping		Fatty acids/Content ; Sorghum,	0850
Upland cropping		Fatty alcohols/Content ; Sorghum,	0850
Cropping systems,		Cuticle/Wax,	
Honduras ; Sorghum,	0496	P-Hydroxybenzaldehyde ; Sorghum, See-	
	0497	dlings ,	0852
Honduras ; Sorghum : Maize,	0511	Cyanidins see,	
Italy ; Sorghum,	0359	Flavonoids	
	0388	Cyanogenic glycosides,	
Semi-arid tropics, India ; Sorghum,		Analysis ; Sorghum,	0832
Luvisols,	0505	Biosynthesis ; Sorghum,	0065
Semi-arid tropics, India ; Sorghum,			0086
Vertisols ,	0505	Localization ; Sorghum, Leaves,	0146
USA ; Sorghum, Hybrids,	0493	Cyanogenic glycosides ;	
Vertisols, India/Madhya Pradesh ;		Sorghum,	0853
Sorghum,	0541	Cyanogenic glycosides see also,	
Vertisols ; Sorghum, Production,	0542	Taxiphyllin	
Cropping systems ;		Cysteine,	
Sorghum,	0503	Effect ; Sorghum, Hydrazine/Toxicity,	0245
Cropping systems (Strip),		Cysteine : EMS : Gamma radiation : Hydraz-	
Water management, Australia ; Sorghum,	0537	ine : MMS,	
Cropping systems see also,		Review articles ; Sorghum, Induced	
Cropping patterns		mutation,	0241
Dry farming		Cysteine : EMS : Gamma radiation : Hydraz-	
Irrigated farming		ine : MMS ;	
Rainfed farming		Sorghum, Induced mutation,	0243
Crops/Budgets : Pricing policies,		Cysteine/Treatment,	
Relationship, India/Karnataka ; Sorg-		Effect ; Sorghum, Induced mutation,	
hum,	1028	Hydrazine/Efficiency,	0245
Crops/Residues,		Cytology,	
Effect ; Sorghum, Yields,	0404	Trisomies, Effect ; Sorghum,	0211
Nigeria ; Sorghum,	0468	Cytoplasm,	
Proteins, Extraction ; Sorghum,	1006	Differences ; Sorghum,	0250
Toxicity ; Sorghum,	0142	Effect ; Sorghum, Agronomic characters,	0210
Crossbreeding/Systems,		Cytoplasm : Genes,	
Evaluation ; Sorghum,	0230	Interaction ; Sorghum, Male sterility.	0229
Cultivation,		Cytoplasm/Durras ;	
Cost analysis, Argentina ; Sorghum,	1013	Sorghum, Hybrids, Male sterility/	
France ; Sorghum,	0260	Development,	0225

Cytoplasmic organelles :Male sterility (Cytoplasmic); Sorghum,	0250	Particle size, Effect, Swine ; Sorghum, Particle size, Effect ; Sorghum, Dry matter:Starch,	0954 0912
DBCP, Effect ; Sorghum, Fluchloralin/Persi- sistence,	0553	Processing, Effect, Cattle ; Sorghum, Silage,	0920
DKA/Reassociation, Sorghum x Rice, Hybrids,	0259	Processing, Effect ; Sorghum, Dry mat- ter:Starch,	0912
DSMA:Hoeing:Weeding; Sorghum halepense/Control,	1081	Reconstitution, Effect, Sheep ; Sorghum, Sodium hydroxide/Treatment, Effect,	0889 0889
Dalapon:Alachlor; Sorghum, Helminthosporium turcicum/ Control,	0646	Sheep ; Sorghum, Tannins/Content, Effect, Poultry ; Sorghum,	0945
Decorticating see, Peeling		Tannins/Content, Effect, Swine ; Sorg- hum,	0902
Defoliation, Effect, Taiwan ; Sorghum, Yields,	0154	Digestibility:Nutritive value, Sheep ; Sorghum (Forage), Silage,	1140
Effect ; Sorghum, Yields,	0362	Sodium hydroxide/Treatment, Effect, Cattle ; Sorghum, Silage,	0917
	0376 0379 0607	Digestibility:Yields:Growth, Agronomic characters, Effect ; Sorghum (Forage),	1121
Defoliation/Management :Yields, Effect ; Sorghum (Forage),	1115	Digestibility/Dry matter, Maturity/Stage, Effect ; Sorghum,	0926
Dehullers, Comparison ; Sorghum,	0867	Mutants, Effect ; Sorghum (Forage),	1124
Dehulling ; Sorghum,	0866 0867	Mutants (Brown midrib), Effect ; Sorg- hum,	0192
Detoxicants see also, CONCEP Naphthalic anhydride		Mutants (Brown midrib), Effect ; Sorg- hum sudanense,	0192 0858
Development, Planting date, Effect, Brazil ; Sorghum,	0310	Processing, Effect ; Sorghum, Reconstitution, Effect ; Sorghum,	0926 0921
Theses ; Sorghum, Caryopsis,	0110	Tannins, Effect ; Sorghum,	
Developmental stages ; Sorghum,	0041 0042	Digestibility/Dry matter ; Sorghum, Silage,	0949 0921
Sorghum, Grain, Enzymes :Nucleic acids: Proteins, Changes,	0840	Sorghum (Bird resistant),	0936
Sorghum, Grain yield, Water stress, Effect,	0133	Digestibility/Energy, Swine ; Sorghum,	0936
Sorghum, Leaves, Chlorophylls/Content,	0131	Digestibility/Nitrogen, Fibre content, Effect ; Sorghum,	0986
Sorghum, Leaves, Enzymic activity,	0131	Digestibility/Proteins, Cattle ; Sorghum, Grain,	0971
Sorghum, Peronosclerospora sorghi,	0635	Processing, Effect ; Sorghum,	0875
Sorghum, Seed weight, Changes,	0149	Swine ; Sorghum,	0936
Sorghum, Seeds, Amino acids/Content: Protein content, Changes,	0149	Digestibility/Proteins ; Sorghum,	0982
Sorghum (Bird resistant), Grain, Tan- nins/Changes,	0834	Digestibility/Straw, Sodium hydroxide/Treatment, Effect ; Sorghum,	0911
Developmental stages : Gamma radiation, Effect ; Sorghum, Grain yield,	0091	Dihaploids/Development, (by) Synkaryogenesis ; Sorghum,	0224
Diazinon, Residues, Analysis ; Sorghum (Forage),	1131	Diploids ; Sorghum, Induced polyploidy,	0213
Digestibility, Cattle ; Sorghum, Silage,	0937	Sorghum, Tetraploids (Induced),	0213
Children ; Sorghum,	0992	Directional selection see, Select ion (Directional)	
Enzymes, Effect, Poultry, Theses ; Sor- ghum,	0976	Disease control, Tropics ; Sorghum,	0819
Formaldehyde/Treatment, Effect, Swine ; Sorghum (Bird resistant),	0931	USA ; Sorghum,	0822
Nitrogen fertilizers, Effect ; Sorghum,	0433		

Disease control;		rison,	0389
Sorghum,	0613	Sorghum:Pigeonpea, Intercropping/	
	0818	Profitability,	0523
Disease resistance;		Dry matter,	
Sorghum, Germplasm (Exotic),	0184	Microwave radiation, Response; Sorg-	
Diseases,		hum,	0053
Argentina; Sorghum,	0612	Dry matter: Starch,	
Bibliographies; Sorghum,	0608	Digestibility, Particle size, Effect;	
	0609	Sorghum,	0912
Cultural control; Sorghum,	0821	Digestibility, Processing, Effect;	
Diseases;		Sorghum,	0912
Sorghum,	0607	Dry matter/Digestibility,	
Diseases: Insect pests: Weeds,		Maturity/Stage, Effect; Sorghum,	0926
Complexes, Asia; Sorghum, High-yield-		Mutants, Effect; Sorghum (Forage),	1124
ing varieties,	0611	Mutants (Brown midrib), Effect; Sorg-	
Complexes, Pacific Islands; Sorghum,		hum,	0192
High-yielding varieties,	0611	Mutants (Brown midrib), Effect; Sorg-	
Diseases see also,		hum sudanense,	0192
Bacterioses		Processing, Effect; Sorghum,	0858
Mycoses		Reconstitution, Effect; Sorghum,	0926
Viroses		Tannins, Effect; Sorghum,	0921
Divergent selection see,		Dry matter/Digestibility;	
Select ion (Divergent)		Sorghum, Silage,	0949
Double cropping see,		Sorghum (Bird resistant),	0921
Rotational cropping		Dry matter/Yields,	
Downy mildew see,		NPK fertilizers, Effect; Sorghum,	0456
Peronosclerospora sorghi		USA/Iowa; Sorghum, Rotational cropp-	
Drought: Schizaphis graminum;		ing,	0495
Sorghum, Yield loss,	0734	Dry matter/Yields;	
Drought resistance,		Sorghum (Forage),	1118
Evaluation, ICRISAT; Sorghum,	0047	Durras ,	
Physiology; Sorghum,	0147	Nematodes, Sudan	0690
Physiology; Sorghum, Hybrids,	0117	Durras/Cytoplasm;	
Review articles; Sorghum,	0093	Sorghum, Hybrids, Male sterility/	
Theses; Sorghum,	0169	Development,	0225
Drought resistance;		EMS: Gamma radiation: Hydrazine;	
Sorghum,	0076	Sorghum, Induced mutation,	0244
	0096 0207	EMS: Gamma radiation: Hydrazine: MMS .	
Drought resistance: Yields,		Cysteine,	
Relationship, ICRISAT; Sorghum,	0136	Review articles; Sorghum, Induced	
Drought stress see,		mutation,	0241
Water stress		EMS: Gamma radiation: Hydrazine: MMS:	
Dry farming,		Cysteine;	
India/Maharashtra; Sorghum,	0351	Sorghum, Induced mutation,	0243
	0408	Early maturation,	
India/Maharashtra; Sorghum, Cropping		Effect, Nigeria; Sorghum, Grain molds,	
patterns,	0538	Mycotoxins,	0668
India/Tamil Nadu; Sorghum,	0410	East Africa;	
India/Uttar Pradesh; Sorghum,	0482	Sorghum, Bird pests/Control, Methio-	
Research, India; Sorghum,	0384	carb,	0809
Research; Sorghum,	0028	Ecology,	
USA/Texas; Sorghum,	0405	Argentina; Sorghum halepense/Control,	1071
Dry farming;		Theses; Sorghum, Fusarium moniliforme,	0620
Sorghum,	0102	Economics,	
	0382 0473 0534	Research, ICRISAT, West Africa; Sorg-	
Sorghum, Grain yield, Planting date,		hum,	1025
Effect,	0475	Semi-arid tropics, India; Sorghum,	
Sorghum, Intercropping, Studies,	0524	Fertilizers/Use,	0437
Sorghum: Barley: Wheat, Yields, Compa-		Semi-arid tropics, India; Sorghum,	

Production, (in) VertisoIs, Watersheds/Technology,	0526	Sorghum, Fl hybrids, Hybrid vigour,	0200
Semi-arid tropics, India; Sorghum, Threshers,	0606	Sorghum, Hybrids, Bird pests/Resistance: Tannins/Content,	0811
Economics ;		Sorghum, Male sterility,	0099
Sorghum,	0193	Sorghum, Peronosclerospora sorghi, Vegetative reproduction,	0637
Sorghum, Nitrogen fertilizers/Application,	0438	Sorghum, Phenolic content,	0851
Sorghum, Processing,	0857	Sorghum, Spikelets,	0306
Egypt;		Sorghum (Forage), Genotypes,	1120
Sorghum, Sesamia cretica, Biological control,	0782	Sorghum halepense/Control, Metriflufen/Trans location,	1085
Sorghum, Viroses,	0676	Enzyme inhibitors,	
Electrolytes/Leakage,		Effect ; Sorghum, Nutritive value,	0985
Periconia circinata/Toxins, Effect ; Sorghum, Seedlings,	0651	Enzymes,	
Elongation/Leaves,		Effect, Poultry ; Theses ; Sorghum. Digestibility,	0976
CONCEP: Metolachlor, Effect ; Sorghum,	0555	Light effects ; Sorghum, Leaves,	0078
Water stress, Effect, Theses ; Sorghum, Genotypes,	0145	Localization, (by) Immunofluorescence ; Sorghum, Leaves,	0155
Embryogenesis ;		Localization ; Sorghum, Leaves,	0146
Sorghum, Cells (Somatic),	0174	Localization ; Sorghum, Plastids,	0151
Embryogenesis (Somatic) ;		Role ; Sorghum, Grain, Protein synthesis : Starch synthesis,	0139
Sorghum, Leaves,	0161	Role ; Sorghum, Leaves, Photosynthesis,	0131
Emergence,		Substrates effect ; Sorghum,	0049
Pythium graminicola, Infection, Effect ; Sorghum, Seedlings,	0663	Enzymes ;	
Seed treatment, Effect, USA/Louisiana ; Sorghum, Seedlings,	0814	Sorghum,	0212
SoiIs/Salinity, Effect ; Sorghum,	0048		0258
Timing (Day), Effect ; Sorghum, Chilo partellus,	0778	Sorghum, Atherigona soccata, Larvae,	0748
Water stress, Effect, ICRISAT ; Sorghum,	0047	Alimentary canal,	0107
Emergence: Establishment,		Sorghum, Leaves,	0212
Irrigation: Sowing, Effect ; Sorghum arundinaceum,	0077	Sorghum x Mil lets, Hybrids,	
Emergence: Germination,		Enzymes: Nucleic acids: Proteins,	
Temperature effects, Theses ; Sorghum,	0115	Changes, (during) Developmental stages ; Sorghum, Grain,	0840
Endosperm: Flours,		Enzymes: Proteins,	
Protein content ; Sorghum,	1002	Analysis ; Sorghum, Species,	0039
Energy (Metabolizable) : Composition, Evaluation, Poultry ; Sorghum,	0941	Enzymes: Proteins ;	
Energy/Digestibility,		Sorghum (Male sterile), Anthers,	0256
Swine ; Sorghum,	0936	Enzymes (Malic),	
Energy content see,		Characteristics ; Sorghum, Leaves,	0058
Nutritive value		Enzymes (Malic) ;	
Entomology,		Sorghum, Plastids/Protein synthesis,	0080
Research, ICRISAT ; Sorghum,	0711	Enzymes see also,	
Environment: Genotypes,		Acid phosphatase	
Interactions ; Sorghum,	0234	Phosphoenol pyruvate carboxylase	
Environmental effects,		Enzymic activity,	
Mexico ; Sorghum, Genotypes,	0374	(during) Developmental stages ; Sorghum, Leaves,	0131
Theses ; Sorghum, Anatomy: Physiology: Yields/Stability,	0377	Determination, (by) Chromatography ; Sorghum, Phenolic compounds, Biosynthesis,	0051
Theses ; Sorghum, Phenology,	0311	Enzymic activity: Boron/Deficiency, Relationship ; Sorghum,	0138
Upper Volta ; Sorghum, Atherigona soccata, Population,	0743	Ephelis oryzae,	
Environmental effects ;		India/Karnataka ; Sorghum,	0619
Sorghum, Branching,	0306	Ephestia cautella/Resistance ; Sorghum,	0807

Epidemiology		desian) x Sorghum sudanense,	1159
Sorghum, Peronosclerospora sorghi,	0636	Seed production; Sorghum (Male sterile),	0886
Ergot see,		Farm inputs,	
Sphacelia		Effect; Sorghum, Genotypes, Yields,	0234
Erwinia sorghi;		Farmers,	
Sorghum,	0674	Upper Volta; Sorghum, Food intake,	0983
Erythraeus,		Upper Volta; Sorghum, Nutritive value,	0983
India/Kamataka; Sorghum,	0784	Farmyard manure,	
India/Karnataka; Sorghum, Perigrinus maidis/Control,	0784	Effect; Sorghum, Hybrids, Iron/Uptake: Yields,	0416
Establishment,		Farnesol,	
Effect, Theses; Sorghum,	0534	Effect; Sorghum, Transpiration,	0105
Establishment: Emergence,		Fatty acids/Content;	
Irrigation: Sowing, Effect; Sorghum arundinaceum,	0077	Sorghum, Leaves/Cuticle,	0850
Ethiopia;		Fatty alcohols/Content;	
Sorghum, Research,	0010	Sorghum, Leaves/Cuticle,	0850
Sorghum caudatum, Germplasm/Collections,	0232	Feed additives,	
Ethyl methanesulphonate see,		Cattle; Sorghum, Silage,	0893
EMS		Effect, Cattle; Sorghum, Nutritive value,	0897
Ethylene/Formation,		Effect, Poultry; Sorghum, Nutritive value,	0952
Metolachlor/Toxicity, Effect; Sorghum, Seedlings,	0122	Feed additives;	
Etriazole: Nitrapyrin,		Sorghum, Silage,	0892
Effect; Sorghum, Grain yield,	0162		0894
Effect; Sorghum, Nitrogen metabolism,	0162	Sorghum (Forage), Silage,	1106
Evaporation: Evapotranspiration,		Feed supplements,	
Ratio; Sorghum,	0152	Buffaloes; Sorghum,	0907
Evapotranspiration,		Cattle, Australia; Sorghum,	0923
Crop climate, Effect; Sorghum, Hybrids,	0307	Cattle; Sorghum,	0903
Water stress, Effect; Sorghum, Hybrids,	0307	Cattle; Sorghum x Sorghum sudanense, Hybrids, Hay,	1138
Evapotranspiration: Evaporation,		Nutritive value, Poultry; Sorghum,	0914
Ratio; Sorghum,	0152	Nutritive value; Sorghum, Forage,	0899
Evapotranspiration: Grain yield: Crop climate,		Poultry; Sorghum,	0944
Relationship; Sorghum, Hybrids,	0307	Rations, Poultry; Sorghum,	0947
Evolution: Origin,		Sheep; Sorghum,	0973
China; Sorghum,	0030	Feed supplements see also,	
Excreta/Livestock,		Feed additives	
Effect; Sorghum (Forage),	1145	Feeding deterrents,	
Exports,		Bioassay; Sorghum, Schizaphis graminum,	0731
USA; Sorghum,	1033	Feeding habits;	
Extraction;		Sorghum, Nephrotettix cincticeps,	0800
Sorghum, Roots, Strigol,	0696	Feeding habits: Movement: Growth;	
F1 hybrids,		Sorghum, Atherigona soccata, Larvae,	0763
Ascorbic acid: Chlorophylls, Changes, (during) Seedlings/Growth; Sorghum,	0179	Feeding value see,	
Combining ability, Grain yield; Sorghum,	1075	Nutritive value	
Hybrid vigour, Environmental effects; Sorghum,	0200	Feed lots/Performance,	
Induced mutation, (by) Gamma radiation; Sorghum,	0196	Reconstitution, Effect, Sheep; Sorghum, Sodium hydroxide/Treatment, Effect, Sheep; Sorghum,	0889
Nutritive value, Comparison; Sorghum (Forage),	1148	Feeds,	0889
Performance; Sorghum (Forage) x Sorghum sudanense (Rhodesian),	1159	Bovines; Sorghum,	0887
Performance; Sorghum sudanense (Rhodesian) x Sorghum sudanense,		Cattle, Theses; Sorghum (Forage),	1102
		Cattle; Sorghum,	0904
		0915 0922 0939 0953	0962

	0977	Effect; Sorghum, Growth,	0471
Cattle; Sweet sorghums,	1044	Fertilizers/Uptake,	
Composition; Sorghum, Varieties,	0848	Spacing, Effect; Sorghum:Maize:Millet,	0402
Composition:Nutritive value, Comparison; Sorghum,	0924	Fertilizers/Use,	
Fishes; Sorghum,	0978	Economics, Semi-arid tropics, India;	0437
Mycotoxins, Analysis; Sorghum,	0956	Sorghum,	
Nutritive value, Bioassay, Poultry;		Research, India, Review articles;	0472
Sorghum,	0909	Sorghum,	
Nutritive value, Composition, Effect;		Semi-arid tropics, India; Sorghum,	0436
Sweet sorghums,	1067	High-yielding varieties,	
Nutritive value, Improvement; Sorghum,	0888	Fertilizers see also,	
Nutritive value, Poultry; Sorghum,	0918	NPK fertilizers	
	0959	Nitrogen-phosphorus fertilizers	
Nutritive value, Swine; Sorghum,	0960	Nitrogen fertilizers	
Nutritive value; Sorghum, Varieties,	0951	Phosphate fertilizers	
Nutritive value; Sweet sorghums,	0848	Phosphorus-potassium fertilizers	
Poultry; Sorghum,	1068	Feteritas see,	
	0913	Sorghum caudatum	
	0972	Fibre content,	
South Africa; Sorghum, Byproducts,	0942	Effect, Theses; Sorghum, Silage, Comp-	
Swine; Sorghum,	0928	osition,	0930
Tannins; Sorghum,	0888	Effect; Theses; Sorghum, Silage, Nutr-	
Feeds;		itive value,	0930
Sorghum,	0901	Effect; Sorghum, Nitrogen/Digestibi-	
Sorghum (Forage), Silage,	1128	lity,	0986
Sweet sorghums, Alcohols/Production,		Moisture effects; Sorghum (Forage),	1119
Byproducts,	1061	Mutants (Brown midrib), Effect; Sorg-	
Fermentation,		hum,	0192
Alcohols/Production, Theses; Sweet		Mutants (Brown midrib), Effect; Sorg-	
sorghums,	1057	hum sudanense,	0192
Effect; Sorghum, Nutritive value,	0990	Fishes;	
Effect; Sorghum (Forage), Composition:		Sorghum, Feeds,	0978
Nutritive value,	1111	Flaking;	
Fermentation;		Sorghum,	0872
Sorghum, Stems,	0827	Flavonoids:Proteins,	
Fermentation/Tests;		Interaction; Sorghum,	0084
Sorghum, Wort,	1009	Flavonoids/Content,	
Fermented products,		Chromatography; Sorghum (Bird resis-	
Protein quality, Analysis; Sorghum,	0980	tant), Grain,	0835
Vitamins B/Content, Analysis; Sorghum,	0980	Flavonoids/Synthesis,	
Fertility;		Ultraviolet radiation, Effect; Sorg-	
Sorghum,	0257	hum, Seedlings,	0070
Fertilizers,		Florets/Abortion,	
Effect, Nigeria; Sorghum:Wheat, Rota-		Causes; Sorghum (Male sterile),	0116
tional cropping, Yields,	0468	Flours,	
Effect, Theses; Sweet sorghums,	1059	Cakes; Sorghum,	0997
Fertilizers: Irrigation,		Thermal properties; Sorghum,	0824
Effect; Sorghum, Yields,	0429	Flours:Endosperm,	
Fertilizers:Manures,		Protein content; Sorghum,	1002
Effect, (in) VertisoIs; Soil physico-		Flours (Malted),	
chemical properties,	0431	Nutritive value, Children; Sorghum,	0984
Effect, (in) VertisoIs; Sorghum, Hybr-		Flours/Physicochemical properties:	
ids, Yields,	0431	Chapathis/Quality,	
Effect, Upper Volta; Sorghum, Tropical		Relationship; Sorghum,	0999
soils, Soil fertility,	0321	Flowering,	
Effect, Upper Volta; Sorghum, Yields,	0321	Agronomic practices, Theses; Sorghum,	
Fertilizers/Constraints;		Hybrids,	0134
Sorghum, Grain yield,	0364	Synchronization; Sorghum, Hybrids,	0104
Fertilizers/Mixing,			



Flowering;		France;	
Sorghum, Genotypes,	0121	Sorghum, Cultivation,	0260
Flowering: Growth: Morphogenesis;		Sorghum, Varieties,	0260
Sorghum,	0172		0261 0275 0276
Flowering: Seed development,		Sorghum, Varieties, Performance tri-	
Air moisture, Effect, Taiwan; Sorghum,	0056	als,	0273
Fluazifop-butyl;		French Guyana;	
Sorghum halepense/Control,	1082	Sorghum (Forage), Bacterioses,	1104
Fluchloralin/Persistence,		Sorghum (Forage), Mycoses,	1104
DBCP, Effect; Sorghum,	0553	Fuel/Production,	
Foliar diseases/Resistance,		Spain; Sweet sorghums,	1056
Evaluation, Philippines; Sorghum,	0644	Fumigation;	
Evaluation; Sorghum,	0621	Sorghum, Stored products pests/Con-	
Food intake,		trol, Carbon dioxide: Methyl bromide,	0797
Farmers, Upper Volta; Sorghum,	0983	Fungal diseases see,	
Food products,		Mycoses	
Protein quality, Nigeria; Sorghum,	0995	Fungi,	
Review articles; Sorghum,	0987	Toxicity; Sorghum,	0617
Food products see also,		Fungi see also,	
Cakes		Seed-borne fungi	
Chapathis		Fungicides,	
Koko		Evaluation; Sorghum, Hybrids, Leaf-	
Ogi		spots/Control,	0642
Forage,		USA/Louisiana; Sorghum, Soil-borne	
(as) Feed supplements, Nutritive		diseases/Control,	0814
value; Sorghum,	0899	Fungicides;	
Nitrogen fertilizers/Timing, Effect;		Sorghum, Grain molds/Control,	0666
Sorghum,	1149	Sorghum, Seed-borne fungi/Control,	0658
Nutritive value; Sorghum x Sorghum		Sorghum, Seed treatment,	0628
sudanense, Hybrids,	1111		0816
Planting date, Effect; Sorghum,	1149	Sorghum, Sphacelotheca sorghi/Cont-	
Forage/Quality,		rol,	0628
Maturity, Effect; Sorghum, Hybrids,	1116	Fungicides see also,	
Forage/Quality;		Mancozeb	
Sorghum,	1114	Furadon,	
Forage/Yields,		Effect; Sorghum, Growth: Yields,	0132
Comparison; Sorghum x Sorghum suda-		Fusarium: Curvularia,	
nense, Hybrids,	1161	Review articles; Sorghum,	0670
Harvesting/Intervals, Effect, Puerto		Fusarium moniliforme,	
Rico; Sorghum x Sorghum sudanense,		Ecology, Theses; Sorghum,	0620
Hybrids,	1112	Infection; Sorghum,	0661
Harvesting/Timing, Effect; Sorghum		Fusarium moniliforme: Helminthosporium	
x Sorghum sudanense, Hybrids,	1162	sorghicola: Alternaria tenuis: Curvul-	
Maturity, Effect; Sorghum, Hybrids,	1116	aria lunata;	
Nitrogen fertilizers: Planting date,		Sorghum,	0665
Effect, Pakistan; Sorghum,	1098	Fusilade: Rusagard,	
Forage/Yields;		Romania; Sorghum halepense/Control,	1095
Sorghum,	0130	GA: IAA: ABA,	
	1114	Analysis; Sorghum, Genotypes,	0074
Sorghum: Cowpeas, Mixed cropping,	1157	Chromatography (Liquid); Sorghum,	
Sorghum x Sorghum sudanense: Festuca		Genotypes,	0073
arundinacea, Intercropping,	1103	Light effects; Sorghum, Genotypes,	0075
Forage see also,		GA/Synthesis,	
Sorghum (Forage)		Metolachlor/Toxicity, Effect; Sorghum,	0166
Formaldehyde/Treatment,			0167
Effect, Swine; Sorghum (Bird resistant)		Gamma radiation;	
, Digestibility,	0931	Sorghum, F1 hybrids, Induced mutation,	0196
Effect, Swine; Sorghum (Bird resistant)			
, Nutritive value,	0931		

Gamma radiation: Developmental stages, Effect; Sorghum, Grain yield,	0091	Sorghum, Grain yield: Protein content,	0249
Gamma radiation: Hydrazine: EMS; Sorghum, Induced mutation,	0244	Sorghum, Growth,	0239
Gamma radiation: Hydrazine: MMS: Cyste- ine: EHS, Review articles; Sorghum, Induced mutation,	0241	Sorghum, Seed size,	0183
Gamma radiation: Hydrazine: MMS: Cyste- ine: EMS; Sorghum, Induced mutation,	0243	Genotypes,	
Geese see, Poultry		ABA: GA: IAA, Analysis; Sorghum,	0074
Gene action, Agronomic characters; Sorghum,	0201	ABA: GA: IAA, Chromatography (Liquid) ; Sorghum,	0073
Estimation; Sorghum, Agronomic char- acters,	0180	ABA: GA: IAA, Light effects; Sorghum,	0075
Grain yield; Sorghum,	0201	Aging, Comparison, (by) Agronomic characters; Sorghum,	0071
Grain yield: Protein content; Sorghum,	0190	Atherigona soccata/Resistance, Eva- luation; Sorghum,	0714
Grain yield: Seed size; Sorghum,	0226	Chilo partellus/Resistance, Evalua- tion; Sorghum,	0714
Line x tester analysis; Sorghum (Male sterile),	0180	Composition, Water stress, Effect, Theses; Sorghum,	0145
Seed size; Sorghum,	0183	Contarinia sorghicola/Resistance, Evaluation, ICRISAT; Sorghum,	0790
Gene action/Nature; Sorghum, Agronomic characters,	0235	Contarinia sorghicola/Resistance, Evaluation; Sorghum,	0714
Gene pools, USA; Sorghum,	0189	Environmental effects, MexicoSorg- hum,	0374
Genes: Cytoplasm, Interaction; Sorghum, Male sterility,	0229	Environmental effects; Sorghum (For- age),	1120
Genetic/Relationship; Sorghum (Forage), Agronomic charact- ers: Yields,	1134	Evaluation, (in) Intercropping; Sorg- hum: Pigeonpea,	0522
Genetic analysis; Sorghum, Hybrid vigour: Nitrate red- uctase/Activity,	0217	Flowering; Sorghum,	0121
Sorghum, Hybrids, Nitrate reductase/ Activity: Yields,	0217	Growth, Aluminium, Effect, Theses; Sorghum,	0426
Genetic control, Grain yield: Protein content; Sorghum,	0190	Growth, Striga, Infestation, Effect; Sorghum,	0700
Genetic variation, ICRISAT; Sorghum, Breeding,	0219	Growth; Sorghum,	0121
USA; Sorghum,	0189	Growth substances, Water stress, Effect; Sorghum,	0076
Genetic variation; Sorghum,	0190	Growth substances: Photoperiodism; Sorghum,	0074
Sorghum, Agronomic characters,	0253		0075
Sorghum, Contarinia sorghicola/Res- istance,	0788	Leaves/Elongation, Water stress, Effect, Theses; Sorghum,	0145
Sorghum, Hybrids,	0195	Macrophomina phaseolina/Resistance, Evaluation; Sorghum,	0647
Sorghum, Random mating/Population,	0182	Minerals and nutrients, Aluminium, Effect, Theses; Sorghum,	0426
Sorghum (Forage), Agronomic charact- ers,	1154	Minerals and nutrients uptake, (in) Acid soils; Sorghum,	0422
Sorghum (Forage), Yields,	1151	Nitrate reductase/Activity, Nitrogen fertilizers, Effect; Sorghum,	0415
Genetics; Sorghum,	0193	Performance, Brazil; Sorghum,	0268
Sorghum, Chilo partellus/Resistance,	0781	Phosphorus/Uptake, Theses; Sorghum,	0425
Sorghum, Grain molds/Resistance,	0664	Protein content, Nitrogen fertiliz- ers, Effect; Sorghum,	0415
		Schizaphis graminum/Resistance, Brazil; Sorghum,	0732
		Seed production, Irrigation, Effect; Sorghum,	0884
		Seed production, Seeding rates, Eff- ect; Sorghum,	0884
		Yields, Farm inputs, Effect; Sorghum,	0234
		Yields, Striga, Infestation, Effect;	

Sorghum,	0700	Inheritance; Sorghum,	0215
Genotypes: Environment,		Glyphosate,	
Interactions; Sorghum,	0234	Effect; Sorghum halepense, Growth,	1080
Genotypes/Studies,		Glyphosate;	
ICRISAT; Sorghum: Pearl millet, Inter-		Sorghum, Asclepias syriaca/Control,	0557
cropping,	0543	Sorghum halepense/Control,	1076
ICRISAT; Sorghum: Pigeonpea, Inter-			1077 1080 1097
cropping,	0543	Glyphosate: Paraquat,	
Gerbills see,		Sprayers; Sorghum, Shattercane/Cont-	
Rodents		rol,	0554
Germination,		Gomphrena decumbens,	
(in) Cold climate, Polyethylene gly-		Allelopathy, Effect; Sorghum,	0589
col, Effect; Sorghum,	0052	Grain,	
Calcium: Sodium, Effect; Sorghum,	0048	Composition, Analysis; Sorghum,	0836
Coleoptile/Length, Effect; Sorghum,	0156	Composition, Microscopy; Sorghum,	0831
Seed treatment, Effect, Theses; Sorg-		Composition; Sorghum,	0839
hum,	0079		1027
Strigol, Effect; Striga asiatica,	0696	Enzymes: Nucleic acids: Proteins,	
Germination;		Changes, (during) Developmental	
Sorghum,	0386	stages; Sorghum,	0840
Sorghum, Composition/Changes,	0828	Flavonoids/Content, Chromatography;	
Sorghum, Pollen, (effect on) Colleto-		Sorghum (Bird resistant),	0835
trichum graminicola, Spores,	0645	Palatability, Poultry; Sorghum,	0927
Germination: Emergence,		Phenolic compounds, Analysis; Sorghum	
Temperature effects, Theses; Sorghum,	0115	(Bird resistant),	0826
Germination: Leaf temperature,		Phenolic compounds, Chromatography;	
Relationship; Sorghum, Hybrids,	0066	Sorghum,	0837
Germination: Yields,		Protein content: Starch/Content,	
Seed size, Effect; Sorghum,	0370	Analysis; Sorghum,	0844
Germination inhibitors,		Protein synthesis: Starch synthesis,	
Effect; Sorghum, Peronosclerospora		Enzymes, Role; Sorghum,	0139
sorghi, Spores,	0639	Proteins/Digestibility, Cattle; Sor-	
Germplasm,		ghum,	0971
USA; Sorghum,	0189	Reconstitution, Cattle; Sorghum,	0969
Germplasm (Exotic),		Rhizopertha dominica/Resistance;	
Disease resistance; Sorghum,	0184	Sorghum,	0794
Yield increase; Sorghum,	0184	Sitophilus oryzae/Resistance; Sorg-	
Germplasm/Collections,		hum,	0794
Africa, LBPGR; Sorghum,	0221	Tannins, Analysis; Sorghum,	0838
Documentation; Sorghum,	0220	Tannins; Sorghum (Bird resistant)	
Ethiopia; Sorghum caudatum,	0232	, Hybrids,	0843
ICRISAT; Sorghum,	0214	Tannins/Changes, (during) Developme-	
Mozambique; Sorghum,	0237	ntal stages; Sorghum (Bird resista-	
Nigeria, ICRISAT; Sorghum,	0233	nt),	0834
Yemen Arab Republic; Sorghum,	0197	Water uptake/Rate, (during) Tempering;	
Yemen People's Democratic Republic;		Sorghum,	0854
Sorghum,	0218		0855
Germplasm/Screening,		Grain (Damaged),	
(for) Red stripe virus/Resistance;		Nutritive value, Sheep; Sorghum,	0895
Sorghum,	0677	Grain/Dust,	
Ghana;		Composition; Sorghum,	0841
Sorghum, Breeding,	0251	Grain/Hardness;	
Gibberellic acid see,		Sorghum,	0862
GA		Grain molds,	
Gibberellins see,		Evaluation; Sorghum,	0659
GA		Mycotoxins, Early maturation, Effect,	
Glomus albidus;		Nigeria; Sorghum,	0668
Sorghum,	0623	Review articles; Sorghum,	0670
Glumes: Cliestogamy,		Theses; Sorghum, Yield loss/Assessm-	

ent,	0660	Water stress, Effect; Sorghum, Hybrids,	0307
Grain molds/Control,		Weeds, Effect; Sorghum,	0599
Fungicides; Sorghum,	0666	Grain yield;	
Grain molds/Incidence: Agronomic characters,		Sorghum, F1 hybrids, Combining ability,	1075
Relationship; Sorghum,	0667	Sorghum, Gene action,	0201
Grain molds/Resistance,		Sorghum, Hybrid vigour,	0194
Evaluation, Theses; Sorghum,	0660		0227
Evaluation; Sorghum,	0621	Sorghum, Progeny testing,	0208
Genetics; Sorghum,	0664	Sorghum, Selection (Directional),	0208
ICRISAT; Sorghum, Breeding,	0198	Grain yield: Crop climate: Evapotranspiration,	
Grain molds/Resistance;		Relationship; Sorghum, Hybrids,	0307
Sorghum,	0665	Grain yield: Leaf area index: Vegetation/Index,	
Grain yield,		Relationship; Sorghum,	0398
(under) Irrigation; Sorghum,	0349	Grain yield: Maturity,	
Australia; Sorghum, Hybrids,	0378	Relationship; Sorghum,	0392
Azotobacter/Inoculation, Effect;		Grain yield: Protein content,	
Sorghum,	0333	Genetics; Sorghum,	0249
Crop climate, Effect; Sorghum, Hybrids,	0307	Nitrogen fertilizers: Water stress,	
Developmental stages: Gamma radiation, Effect; Sorghum,	0091	Effect; Sorghum,	0449
Etriazole: Nitrapyrin, Effect; Sorghum,	0162	Grain yield: Protein content;	
Fertilizers/Constraints; Sorghum,	0364	Sorghum, Gene action,	0190
Harvesting/Index, Effect; Sorghum,	0364	Sorghum, Genetic control,	0190
Herbicides, Effect; Sorghum,	0551	Sorghum, Random mating/Population,	
Irrigation, Effect, Canada; Sorghum,	0380	Selection,	0249
Irrigation, Effect, India/Maharashtra;		Sorghum, Selection (Divergent),	0190
Sorghum,	0351	Grain yield: Seed size;	
Irrigation: Planting date, Effect;		Sorghum, Gene action,	0226
Sorghum,	0477	Grain yield: Water balance,	
Methiocarb, Effect; Sorghum, Hybrids,	0072	Ratooning, Effect; Sorghum,	0531
NPK fertilizers, Effect; Sorghum,	0464	Grain yield/Stability;	
Nitrogen fertilizers, Effect, Canada;		Sorghum, Hybrids,	0365
Sorghum,	0380	Grasshoppers,	
Nitrogen fertilizers, Effect; Sorghum,	0470	Research, West Africa; Sorghum,	0802
Nitrogen fertilizers: Seed quality,		Grazing;	
Effect; Sorghum,	0428	Sorghum,	1114
Planting date, Effect, (under) Dry farming; Sorghum,	0475	Greece;	
Planting date, Effect, Canada; Sorghum,		Sorghum halepense, Maize dwarf mosaic virus,	1090
Hybrids,	0476	Greenbugs see,	
Planting date, Effect; Sorghum,	0478	Schizaphis graminum	
Population density, Effect, Canada;		Grits;	
Sorghum, Hybrids,	0476	Sorghum,	0856
Population density, Effect; Sorghum,	0409	Growth,	
Population density: Spacing, Effect,		2-4-D: MCPA, Effect; Sorghum,	0573
Australia; Sorghum,	0412	Alkaloids, Effect; Sorghum,	0106
Sahel; Sorghum, Varieties,	0295	Aluminium, Effect, Theses; Sorghum,	
Spacing, Effect; Sorghum,	0409	Genotypes,	0426
Sprinkler irrigation: Surface irrigation, Effect; Sorghum,	0350	Analysis, Bibliographies; Sorghum,	0059
Striga hermonthica/Control, Effect;			0060
Sorghum,	0695	Analysis; Sorghum,	0055
Sudan; Sorghum, Varieties,	0295	Argentina; Sorghum (Forage),	1152
Tillage, Effect; Sorghum,	0411	Climatic change, Effect; Sorghum,	0160
USA/Louisiana; Sorghum, Hybrids,	0266	Fertilizers/Mixing, Effect; Sorghum,	0471
Water stress, Effect, (during) Developmental stages; Sorghum,	0133	Genetics; Sorghum,	0239
		Glyphosate, Effect; Sorghum halepense,	1080
		Intercropping, Effect; Theses; Sorghum,	

Hybrids,	0519	Soil density: Soil compaction, Effect;	
Irrigation, Effect, Theses; Sorghum,		Sorghum,	0314
Hybrids,	0519	Growth/Seedlings,	
Irrigation: Planting date, Effect;		Light effects; Sorghum,	0044
Sorghum,	0477	Seed treatment, Effect, Theses; Sorghum,	
Light: Ultraviolet radiation, Effect;		h,	0079
Sorghum,	0112	Solar radiation (Eclipse), Effect;	
Light effects; Sorghum,	0113	Sorghum,	0240
Manganese: Phosphorus, Effect; Sorghum,	0443	Growth/Seedlings;	
Metolachlor/Toxicity, Effect; Sorghum,	0166	Sorghum, Fl hybrids, Ascorbic acid:	
Models; Sorghum,	0308	Chlorophylls, Changes,	0179
Mulching, Effect; Sorghum,	0160	Growth/Simulation models,	
Nitrogen fertilizers: Planting date,		(for) Semi-arid tropics, Evaluation;	
Effect, Pakistan; Sorghum,	1098	Sorghum,	0089
Precipitation, Effect; Sorghum,	0308	Growth inhibitors,	
Soil moisture, Effect; Sorghum,	0347	Effect; Sorghum, Growth: Yields,	0083
Striga, Infestation, Effect; Sorghum,		Growth inhibitors;	
Genotypes,	0700	Sorghum, Sugarcane mosaic virus,	0678
Studies, ICRISAT; Sorghum: Pigeonpea,		Growth inhibitors see also,	
Intercropping,	0516	Alkaloids	
Temperature effects; Sorghum,	0157	Plinthite	
Theses; Sorghum (Forage),	1127	Growth substances,	
	1135	Effect; Sorghum, Sugarcane mosaic	
Water table, Effect; Sorghum (Forage),	1130	virus, Infection,	0685
Growth;		Water stress, Effect; Sorghum, Genot-	
Sorghum, Coleoptile,	0156	ypes,	0076
Sorghum, Genotypes,	0121	Growth substances;	
Sorghum, Heliothis armigera,	0793	Sorghum, Yield increase,	0087
Growth: Digestibility: Yields,		Growth substances: Photoperiodism;	
Agronomic characters, Effect; Sorghum		Sorghum, Genotypes,	0074
(Forage),	1121		0075
Growth: Feeding habits: Movement;		Growth substances see also,	
Sorghum, Ather igona soccata, Larvae,	0763	Germination inhibitors	
Growth: Minerals and nutrients uptake,		Growth inhibitors	
Trace elements; Effect; Sorghum,	0419	Guinea pigs;	
Growth: Morphogenesis: Flowering;		Sorghum, Nutritive value,	0932
Sorghum,	0172		0934
Growth: Nitrogen content,		Sorghum, Nutritive value, Ascorbic	
Azospirillum/Inoculation, Effect;		acid, Effect,	0933
Sorghum,	0334		0935
Growth: Water relations: Yields,		Gypsum: Irrigation: Nitrogen fertiliz-	
Soil moisture, Effect; Sorghum, Hybr-		ers,	
ids,	0057	Effect; Sorghum (Forage), Clay soils,	
Growth: Yields,		Salts/Distribution,	1143
Furadon, Effect; Sorghum,	0132	Harvesters see also,	
Growth inhibitors, Effect; Sorghum,	0083	Combine harvesters	
Herbicides, Application timing, Eff-		Harvesting,	
ect; Sorghum,	0567	Combine harvesters; Sorghum,	0603
Intercropping, Effect, Theses; Sorghum,	0483		0604
Manures, Effect, (in) Rainfed farming,		Machinery; Sorghum,	0605
India/Maharashtra; Sorghum,	0403	Harvesting/Index,	
Mulching, India/Maharashtra; Sorghum,	0408	(for) Yields, Theses; Sorghum,	0248
Propachlor, Effect; Sorghum,	0108	Effect; Sorghum, Grain yield,	0364
Theses; Sorghum: Stylosanthes guiya-		Harvesting/Intervals,	
nensis, Intercropping,	0483	Effect, Puerto Rico; Sorghum x Sorg-	
Tillage, Effect, (in) Rainfed farming,		humsudanense, Hybrids, Forage/Yie-	
India/Maharashtra; Sorghum,	0403	lds,	1112
Growth/Roots,			
Mulches, Effect ; Sorghum	0120		

Harvesting/Timing,		Sorghum, Weed control,	0548
Effect; Sorghum (Forage), Yields,	1162	0552 0565 0574 0591 0600	
Effect; Sorghum x Sorghum sudanense,		Sorghum halepense/Control,	0565
Hybrids, Forage/Yields,	1162	1084 1086 1091 1094	
Hay,		Herbicides/Absorption,	
Feed supplements, Cattle; Sorghum		Weeds/Density, Effect; Sorghum,	1096
x Sorghum sudanense, Hybrids,	1138	Herbicides/Safeners,	
Nutritive value, Concentrates, Effect,		Use; Sorghum, Rottboellia exaltata/	
Cattle; Sorghum,	0948	Control,	0579
Haymaking;		Herbicides see also,	
Sorghum,	0966	2-4-5-T	
Head characters,		2-4-D	
Inheritance; Sorghum,	0209	3-6-dichloropicolinic acid	
Height,		Alachlor	
Effect, Puerto Rico; Sorghum: Soybeans,		Atrazine	
Intercropping, Yields,	0492	DBCP	
Effect; Sorghum, Hydrocyanic acid		DSMA	
content,	1142	Dalapon	
Height: Leaf area index: Biomass,		Fluazifop-butyl	
Relationship; Sweet sorghums,	1062	Fluchloralin	
Height: Yields,		Fusilade	
Rotational cropping, Effect; Sorghum,	0512	Glyphosate	
Helianthus annuus,		Kusagard	
Allelopathy, Effect; Sorghum,	0586	MCPA	
Heliothis annigera,		Metolachlor	
Growth; Sorghum,	0793	Metriflufen	
Helminthosporium sorghicola: Alternaria		Nitrophoska	
tenus: Curvularia lunata: Fusarium		Paraquat	
moniliforme;		Picloram	
Sorghum,	0665	Propachlor	
Helminthosporium sorghicola/Resistance,		Propazine	
Evaluation; Sorghum (Male sterile),	0643	Simazine	
Helminthosporium turcicum/Control,		Triclopyr	
Alachlor: Dalapon; Sorghum,	0646	Heterosis see,	
Hemiptera,		Hybrid vigour	
India/Andhra Pradesh; Sorghum,	0806	Hibernation;	
Herbicides,		Sorghum, Spikelets, Contarinia sorghicola,	0786
Application methods; Sorghum,	0561	High-yielding varieties,	
Application timing, Effect; Sorghum,		Composition, Theses; Sorghum,	0845
Growth: Yields,	0567	Cooking quality, Theses; Sorghum,	0845
Effect; Sorghum, Composition,	0601	Diseases: Insect pests: Weeds, Complexes, Asia; Sorghum,	0611
Effect; Sorghum, Grain yield,	0551	Diseases: Insect pests: Weeds, Complexes, Pacific Islands; Sorghum,	0611
Effect; Sorghum (Forage), Yields,	0551	Fertilizers/Use, Semi-arid tropics, India; Sorghum,	0436
Nigeria; Sorghum, Weed control,	0577	India; Sorghum (Forage),	1099
Research, Semi-arid tropics, India;		Nutritive value; Sorghum,	1000
Sorghum,	0558	High-yielding varieties;	
Sudan; Sorghum, Weed control,	0563	Sorghum,	0298
Taiwan; Sorghum: Sugarcane, Intercropping, Weed control,	0580	Highland,	
Toxicity, (by) Naphthalic anhydride;		Italy; Sorghum, Cultivation,	0373
Sorghum, Protection,	0579	Hills see,	
Toxicity, CONCEP, Effect, Theses; Sorghum,	0572	Highland	
Toxicity, CONCEP, Effect; Sorghum,	0569	Hoarding;	
USA/Iowa; Sorghum, Weed control,	0560	Sorghum, Rodents,	0813
USA/Texas; Sorghum, Weed control,	0562		
Herbicides;			
Sorghum, Varieties, Weed control,	0595		

Hoeing; Weeding, India/Andhra Pradesh; Sorghum, Hybrids, Weed control,	0549	Bird pests/Resistance: Tannins/Content, Environmental effects; Sorghum,	0811
Hoeing: Weeding; Sorghum, Weed control,	0593	Calcium: Magnesium: Potassium, Use; Sorghum,	0447
Hoeing: Weeding: DSMA; Sorghum halepense/Control,	1081	Combining ability; Sorghum,	0186
Holotrichia serrata/Control, Insecticides; Sorghum,	0725	Composition, Analysis, Argentina; Sorghum,	0833
Honduras; Sorghum, Cropping systems,	0496	Corynebacterium; Sorghum x Sorghum sudanense,	1136
	0497	Crop climate: Evapotranspiration: Grain yield, Relationship; Sorghum,	0307
Sorghum: Maize, Cropping systems,	0511	Cropping systems, USA; Sorghum,	0493
Host range, India/Andhra Pradesh; Sorghum, Atherigona,	0750	Cultivation, Solonetz; Sorghum,	0301
Taiwan; Peronosclerospora sacchari, Theses; Sorghum, Schizaphis graminurn,	0633	DNA/Reassociation; Sorghum x Rice,	0259
USA/Texas; Sorghum, Bugs,	0803	Drought resistance, Physiology; Sorghum,	0117
Upper Volta; Atherigona soccata,	0743	Enzymes; Sorghum x Millets,	0212
Hosts; Sorghum, Viroses,	0682	Evapotranspiration, Crop climate, Effect; Sorghum,	0307
Humid tropics; Sorghum, Nitrogen fixation, Azospirillum,	0341	Evapotranspiration, Water stress, Effect; Sorghum,	0307
Hungary; Sorghum, Weeds,	0571	Flowering, Agronomic practices, Theses; Sorghum,	0134
Hybrid vigour, (for) Chlorosis; Sorghum,	0439	Flowering, Synchronization; Sorghum,	0104
(for) Grain yield; Sorghum,	0227	Forage, Nutritive value; Sorghum x Sorghum sudanense,	1111
Chlorophylls/Content; Sorghum, Environmental effects; Sorghum, F1 hybrids,	0207	Forage/Quality, Maturity, Effect; Sorghum,	1116
Grain yield; Sorghum,	0200	Forage/Yields, Comparison; Sorghum x Sorghum sudanense,	1161
Iron/Stress; Sorghum,	0194	Forage/Yields, Harvesting/Intervals, Effect, Puerto Rico; Sorghum x Sorghum sudanense,	1112
Nitrogen metabolism: Photosynthesis; Sorghum,	0439	Forage/Yields, Harvesting/Timing, Effect; Sorghum x Sorghum sudanense,	1162
Hybrid vigour; Sorghum,	0179	Forage/Yields, Maturity, Effect; Sorghum,	1116
	0201	Genetic variation; Sorghum,	0195
	0222	Germination: Leaf temperature, Relationship; Sorghum,	0066
Sorghum (Forage),	1107	Grain, Tannins; Sorghum (Bird resistant),	0843
	1156	Grain yield, Australia; Sorghum,	0378
Hybrid vigour: Combining ability; Sorghum, Agronomic characters,	0255	Grain yield, Crop climate, Effect; Sorghum,	0307
Hybrid vigour: Inbreeding; Sorghum,	0203	Grain yield, Methiocarb, Effect; Sorghum,	0072
Hybrid vigour: Nitrate reductase/Activity, Genetic analysis; Sorghum,	0217	Grain yield, Planting date, Effect, Canada; Sorghum,	0476
Hybridizing (Intergeneric); Sorghum x Rice,	0259	Grain yield, Population density, Effect, Canada; Sorghum,	0476
Hybrids, Agronomic characters, Australia; Sorghum,	0372	Grain yield, USA/Louisiana; Sorghum, Grain yield, Water stress, Effect; Sorghum,	0266
Bacteria (Ratoon stunting), Isolation: Pathogenicity; Sorghum x Sorghum sudanense,	0671	Grain yield/Stability; Sorghum,	0365
Bird pests/Control, Methiocarb; Sorghum,	0072	Growth, Intercropping, Effect, Theses; Sorghum,	0519
		Growth, Irrigation, Effect, Theses; Sorghum,	0519

Growth:Water relations:Yields, Soil moisture, Effect; Sorghum,	0057	Seed production; Sorghum x Sorghum sudanense,	0883
Hay, Feed supplements, Cattle; Sorghum x Sorghum sudanense,	1138	Silage, Nutritive value; Sorghum x Sorghum sudanense,	0886
Hydrocyanic acid/Toxicity, Cattle; Sorghum x Sorghum sudanense,	1153	Silage/Production, USA/Louisiana; Sorghum,	0910
Hydrocyanic acid content, Evaluation; Sorghum x Sorghum sudanense,	1142	Silage/Product ion, Zero-tillage, Effect; Sorghum,	0266
Inbreeding, Depression; Sorghum,	0176	Statistics, Argentina; Sorghum, USSR; Sorghum,	1139
Intercropping, Yields, (under) Rainfed farming; Sorghum,	0494	Weed control, Atrazine: 2-4-D: Simazine, India/Andhra Pradesh; Sorghum,	0283
Iron/Stress; Sorghum,	0439	Weed control, Hoeing: Weeding, India/Andhra Pradesh; Sorghum,	0284
Iron/Uptake, (in) Calcareous soils; Sorghum,	0416	Yields, Carbofuran, Effect; Sorghum,	0549
Iron/Uptake: Yields, Farmyard manure, Effect; Sorghum,	0416	Yields, Fertilizers: Manures, Effect, (in) Vertisols; Sorghum,	0549
Iron/Uptake: Yields, Iron, Effect; Sorghum,	0416	Yields, Intercropping, Effect, Theses; Sorghum,	0421
Iron/Uptake: Yields, Sulphur, Effect; Sorghum,	0416	Yields, Irrigation, Effect, Theses; Sorghum,	0431
Leaf-spots/Control, Fungicides, Evaluation; Sorghum,	0642	Yields, NPK fertilizers, Effect, India/Maharashtra; Sorghum,	0519
Male sterility/Development, (with) Durra/Cytoplasm; Sorghum,	0225	Yields, Phosphate fertilizers, Effect; Sorghum x Sorghum sudanense,	0519
Micronutrient fertilizers, Effect, India/Maharashtra; Sorghum,	0441	Yields, Spacing, Effect, India/Maharashtra; Sorghum,	0451
Minerals and nutrients uptake, Methiocarb, Effect; Sorghum,	0072	Yields; Sorghum (Forage),	1141
NPK fertilizers/Uptake, Carbofuran, Effect; Sorghum,	0421	Hybrids;	0451
Nigeria; Sorghum,	0287	Sorghum,	1108
Nitrate reductase/Activity: Yields, Genetic analysis; Sorghum,	0217	Hybrids: Varieties,	0298
Performance, Argentina; Sorghum,	0283	NPK fertilizers, Effect, (under) Irrigation; Sorghum,	0456
Performance; Sorghum,	0263		0457
Performance trials, USA/Iowa; Sorghum,	0265	NPK fertilizers, Response, (under) Rainfed farming, India/Maharashtra; Sorghum,	0450
Performance trials, USA/Louisiana; Sorghum,	0266	Performance trials, Argentina; Sorghum,	0264
	0300	Performance trials, India; Sorghum,	0281
Performance trials, USA/New Mexico; Sorghum x Sorghum sudanense,	0274	Performance trials, India/Rajasthan; Sorghum,	0290
Performance trials, USA/oklahoma; Sorghum,	0269	Performance trials, USA/New Mexico; Sorghum,	0282
Performance trials, USA/Texas; Sorghum,	0267	Yields, Nitrogen-phosphorus fertilizers, Effect; Sorghum,	0274
	0277 0292 0297	Hybrids see also,	0452
Performance trials; Sorghum,	0227	F1 hybrids	
Photosynthesis/Rate, Water stress, Effect; Sorghum,	0050	Hydrazine: EMS: Gamma radiation; Sorghum, Induced mutation,	0244
Planting/Guide, Australia; Sorghum,	0366	Hydrazine: MMS: Cysteine: EMS: Gamma radiation,	
	0372 0378	Review articles; Sorghum, Induced mutation,	0241
Ratooning, USA/Georgia; Sorghum,	0490	Hydrazine: MMS: Cysteine: EMS: Gamma radiation;	
Research, Romania; Sorghum,	0291	Sorghum, Induced mutation,	0243
Roots, Minerals and nutrients, Leaching, Control; Sorghum x Sorghum sudanense,	0100		
Roots, Minerals and nutrients uptake; Sorghum x Sorghum sudanense,	0100		
Seed production; Sorghum,	0881		



Hydrazine/Efficiency, Cysteine/Treatment, Effect; Sorghum, Induced mutation,	0245	Sorghum, Germplasm/Collections, Sorghum, Germplasm/Collections, Nig- eria,	0214 0233
Hydrazine/Toxicity, Cysteine, Effect; Sorghum,	0245	Sorghum, Land races/Collections, Nigeria,	0233
Hydrocyanic acid, Evaluation; Sorghum sudanense, Sheep; Sorghum, Poisoning,	1123 0967	Sorghum, Nitrogen fixation, Research, Sorghum, Research,	0344 0012 0013
Hydrocyanic acid/Toxicity, Cattle; Sorghum x Sorghum sudanense, Hybrids,	1153	Sorghum, Research, Cooperative acti- vities, Sorghum, Striga/Resistance, Evaluat- ion,	0011 0698
Hydrocyanic acid content, Evaluation; Sorghum (Forage), Evaluation; Sorghum x Sorghum suda- nense, Hybrids,	1142 1142	Sorghum, Water stress/Studies, (under) Sprinkler irrigation, Sorghum, Weed control,	0141 0576
Height, Effect; Sorghum, Radiations, Effect; Sorghum (Forage) , Seedlings,	1142 1125	Sorghum, Weeds, Research, Sorghum, Yields, Water stress, Effect, Sorghum: Cowpeas: Mungbeans, Mixed cropping,	0576 0136 0581
Hypoglycaemia, Africa; Sorghum, Beers,	0988	Sorghum: Pearl millet, Intercropping, Genotypes/Studies,	0543
IAA: ABA: GA, Analysis; Sorghum, Genotypes, Chromatography (Liquid); Sorghum, Genotypes,	0074 0073	Sorghum: Pigeonpea, Intercropping, Canopy/Development: Light/Use, Sorghum: Pigeonpea, Intercropping, Genotypes/Studies,	0516 0543
Light effects; Sorghum, Genotypes,	0075	Sorghum: Pigeonpea, Intercropping, Growth, Studies,	0516
IBPGR; Sorghum, Germplasm/Collections, Afr- ica,	0221	Sorghum: Pigeonpea, Intercropping, Nitrogen fertilizers, Effect,	0525
ICRISAT, Mali; Sorghum, Agronomy, Research, Mali; Sorghum, Research, Senegal; Sorghum, Research, Sudan; Sorghum, Research,	0383 0014 0015 0016	Immunofluorescence; Sorghum, Leaves, Enzymes, Localization, Inbreeding, Depression; Sorghum, Hybrids,	0155 0176
Upper Volta; Sorghum, Breeding, Rese- arch,	0199	Inbreeding: Hybrid vigour; Sorghum,	0203
Upper Volta; Sorghum, Research, West Africa; Sorghum, Economics, Res- earch,	0017 1025	Inbreeding/Lines, Phenotypes/Classification; Sorghum, India,	0188
ICRISAT; Intercropping, Research, Sorghum, Breeding, Genetic variation, Sorghum, Breeding, Grain molds/Resi- stance,	0500 0219 0198	Review articles; Sorghum, Agronomy, Research, Review articles; Sorghum, Fertilizers/ Use, Research, Review articles; Sorghum, Insect pests/Control,	0394 0472 0713
Sorghum, Breeding, Striga/Resistance, Sorghum, Breeding, Striga asiatica/ Resistance,	0698 0699	Review articles; Sorghum, Soil fert- ility, Research,	0472
Sorghum, Canopy/Development: Light/ Use, (in) Mixed cropping, Sorghum, Chapathis/Quality, Evaluat- ion,	0581 0994	India; Sorghum, Dry farming, Research, Sorghum, Fertilizers/Use, Economics, Semi-arid tropics,	0384 0437
Sorghum, Drought resistance, Evaluat- ion,	0047	Sorghum, Herbicides, Research, Semi- arid tropics,	0558
Sorghum, Drought resistance: Yields, Relationship, Sorghum, Emergence, Water stress, Effect,	0136 0047	Sorghum, High-yielding varieties, Fertilizers/Use, Semi-arid tropics, Sorghum, Hybrids: Varieties, Perform- ance trials,	0436 0281
Sorghum, Entomology, Research, Sorghum, Genotypes, Contarinia sorg- nicola/Resistance, Evaluation,	0711 0790	Sorghum, Intercropping, Sorghum, Luvisols, Cropping systems,	0290 0486

Semi-arid tropics,	0505	trol, Parasitic insects: Predators,	0791
Sorghum, Production,	1032	Sorghum, Crops/Budgets: Pricing pol-	
Sorghum, Production, (in) VertisoIs,		icies, Relationship,	1028
Watersheds/Technology, Economics,		Sorghum, <i>Ephelis oryzae</i> ,	0619
Semi-arid tropics,	0526	Sorghum, <i>Erythraeus</i> ,	0784
Sorghum, Production, Soil management,	0539	Sorghum, <i>Perigrinus maidis</i> /Control,	
Sorghum, Production, Soil management,		<i>Erythraeus</i> ,	0784
Semi-arid tropics,	0520	Sorghum, Research,	0022
Sorghum, Production, VertisoIs, Mana-		India/Madhya Pradesh;	
gement,	0539	Sorghum, Cropping systems, VertisoIs,	0541
Sorghum, Production, Vertisols, Semi-		Sorghum, Production, Vertisols,	0541
arid tropics,	0520	India/Maharashtra;	
Sorghum, Research,	0019	Sorghum, Breeding,	0178
	0029	Sorghum, Cropping patterns, (for)	
Sorghum, Seed production,	0878	Dry farming,	0538
	0882	Sorghum, Cultivation,	0363
Sorghum, Soil management, Semi-arid		Sorghum, Dry farming,	0351
tropics,	0505		0408
Sorghum, <i>Sphacelotheca sorghi</i> ,	0627	Sorghum, Grain yield, Irrigation,	
Sorghum, Threshers, Economics, Semi-		Effect,	0351
arid tropics,	0606	Sorghum, Growth: Yields, Manures, Eff-	
Sorghum, Vertisols, Cropping systems,		ect, (in) Rainfed farming,	0403
Semi-arid tropics,	0505	Sorghum, Growth: Yields, Mulching,	0408
Sorghum, Weed control, Atrazine, Semi-		Sorghum, Growth: Yields, Tillage, Eff-	
arid tropics,	0558	ect, (in) Rainfed farming,	0403
Sorghum, Yields, Vertisols, (in) Rabi,	0322	Sorghum, Hybrids, Micronutrient fer-	
Sorghum, Yields/Risk, Semi-arid trop-		tilizers, Effect,	0441
ics,	1012	Sorghum, Hybrids, Yields, NPK fertil-	
Sorghum (Forage), High-yielding var-		izers, Effect,	0451
ieties,	1099	Sorghum, Hybrids, Yields, Spacing,	
India/Andhra Pradesh;		Effect,	0451
Sorghum, Aphids/Control,	0738	Sorghum, Hybrids: Varieties, NPK fer-	
Sorghum, <i>Atherigona</i> , Host range,	0750	tilizers, Response, (under) Rainfed	
Sorghum, Consumer behaviour,	0869	farming,	0450
Sorghum, Hemiptera,	0806	Sorghum, Research,	0020
Sorghum, Hybrids, Weed control, Atra-		Sorghum, Soil moisture,	0153
zine: 2-4-D: Simazine,	0549	Sorghum, Water requirements, Lysime-	
Sorghum, Hybrids, Weed control, Hoeing:		ters/observations,	0153
Weeding,	0549	Sorghum, Weed control,	0570
Sorghum, Insect pests,	0806	Sorghum, Weeds, Competition studies,	0570
Sorghum, Insect pests, Predators,	0805	India/Punjab;	
Sorghum, Marketing,	0869	Sorghum, <i>Atherigona soccata</i> : Chilo	
Sorghum, Processing,	0869	partellus, Planting date, Effect,	0610
Sorghum, Storage,	0869	Sorghum, <i>Colletotrichum graminicola</i> /	
Sorghum, Uses,	0869	Incidence, Planting date, Effect,	0610
Sorghum: Pigeonpea, Intercropping,		Sorghum, <i>Pyrilla perpusilla</i> , Natural	
Yield increase, Semi-arid tropics,	0540	enemies,	0799
India/Gujarat;		India/Rajasthan;	
Sorghum, <i>Oligonychus indicus</i> /Control,		Sorghum, Hybrids: Varieties, Perform-	
Insecticides,	0785	ance trials,	0282
Sorghum, Research,	0018	Sorghum, Research,	0282
Sorghum, Yield increase, Constraints,	0369	India/Tamil Nadu;	
Sorghum (Forage), Research,	1150	Sorghum, Dry farming,	0410
India/Haryana;		Sorghum, Research,	0021
Sorghum (Forage), Varieties, Composi-		Sorghum: Soybeans, Mixed cropping,	
tion,	1101	Yields,	0502
India/Karnataka;		India/Uttar Pradesh;	
Sorghum, Agronomy, Research,	0381	Sorghum, Dry farming,	0482
Sorghum, <i>Contarinia sorghicola</i> /Con-		Sorghum, Rotational cropping, Yields,	0482

Indoleacetic acid Bee, IAA		Sorghum, Seed characters,	0191
		Sorghum, Tan colour,	0202
Induced mutation, (by) Gamma radiation; Sorghum, F1 hybrids,	0196	Sorghum caudatum, Pericarp: Testa/ Colour,	0246
Cysteine:EMS:Gamma radiation:Hydr- azine:MMS, Review articles; Sorghum,	0241	Injurious mites see, Tetranychids	
Cysteine:EMS:Gamma radiation:Hydr- azine:MMS; Sorghum,	0243	Inoculation/Azospirillum, Effect; Sorghum, Growth: Nitrogen content,	0334
EMS:Gamma radiation:Hydrazine; Sor- ghum,	0244	Irrigation, Effect; Sorghum,	0346
Hydrazine/Efficiency, Cysteine/Tre- atment, Effect; Sorghum,	0245	Israel; Sorghum, Nitrogen fixation, Israel; Sorghum, Yield increase,	0335
Induced mutation; Sorghum,	0240	Inoculation/Azospirillum; Sorghum, Nitrogen fixation,	0334
Sorghum, Seedlings,	0242	Inoculation/Azotobacter, Effect; Sorghum, Grain yield,	0333
Induced polyploidy, (from) Diploids; Sorghum,	0213	Inoculation/Method; Sorghum, Macrophomina phaseolina,	0653
Infection, Effect; Sorghum, Seedlings, Emergence, Pythium graminicola,	0663	Insect biology, Thailand; Sorghum, Atherigona soccata,	0756
Growth substances, Effect; Sorghum, Sugarcane mosaic virus,	0685	Insect biology; Sorghum, Atherigona soccata,	0760
Infection; Sorghum, Aspergillus candidus: Peni- cillium citrinum,	0615	Insect pests, Biological control, Research, Pakis- tan; Sorghum,	0715
Sorghum, Fusarium moniliforme,	0661	Biological control, West Africa; Sorghum,	0709
Sorghum, Peronosclerospora sorghi,	0638		0721
Infestation, Effect; Sorghum, Genotypes, Growth, Striga,	0700	Biological control; Sorghum, Cultural control, Effect; Sorghum (Forage), Yields,	0720
Effect; Sorghum, Genotypes, Yields, Striga,	0700	India/Andhra Pradesh; Sorghum,	1160
Planting date: Seeding rates, Effect; Sorghum, Atherigona soccata,	0753	Predators, India/Andhra Pradesh; Sorghum,	0806
Sowing/Methods, Effect, (in) Irrigated farming; Sorghum, Striga,	0693		0805
Infrared radiation; Sorghum, Seed treatment,	0068	Insect pests; Sorghum, Yield loss/Assessment,	0716
Infrared radiation: Remote sensing; Sorghum, Irrigation scheduling,	0352	Insect pests: Mycoses, Effect; Sorghum, Phenolic content,	0851
Inheritance, Taiwan; Sorghum, Longiunguis sacchari/ Resistance,	0727	Insect pests: Weeds: Diseases, Complexes, Asia; Sorghum, High-yield- ing varieties,	0611
Theses; Sorghum, Agronomic characters: Lodging/Resistance,	0228	Complexes, Pacific Islands; Sorghum, High-yielding varieties,	0611
Theses; Sorghum, Atherigona soccata/ Resistance,	0754	Insect pests/Control, India, Review articles; Sorghum,	0713
Theses; Sorghum, Peronosclerospora sorghi/Resistance,	0632	Sudan; Sorghum arundinaceum,	0703
Theses; Sorghum, Stems, Carbohydrates/ Fermentation,	0185	Tropics; Sorghum,	0704
			0724
		USA; Sorghum,	0722
			0723
		USA/Kansas; Sorghum,	0705
		West Africa; Sorghum,	0710
Inheritance; Sorghum, Agronomic characters,	0191	Insect pests/Control; Sorghum,	0613
Sorghum, Atherigona soccata/Resist- ance,	0744		0701 0706 0707 0717
	0765	Insect pests/Incidence, Planting date, Effect; Sorghum (Fora- ge),	1160
Sorghum, Cliestogamy: Glumes,	0215		
Sorghum, Head characters,	0209		

Insect pests/Resistance,		Genotypes/Studies, ICRISAT; Sorghum:	
Review articles; Sorghum,	0712	Pearl millet,	0543
Tropical Africa; Sorghum, Breeding,	0702	Genotypes/Studies, ICRISAT; Sorghum:	
Insect pests see also,		Pigeonpea,	0543
Aphids		Growth, Studies, ICRISAT; Sorghum:	
Atherigona		Pigeonpea,	0516
Blissus leucopterus		Growth: Yields, Theses; Sorghum: Styl-	
Bugs		osantes guianensis,	0483
Chilo partellus		India; Sorghum,	0486
Contarinia sorghicola		Mali; Sorghum: Legumes,	0501
Ephestia cautella		Nitrogen fertilizers, Effect, ICRISAT;	
Grasshoppers		Sorghum: Pigeonpea,	0525
Hemiptera		Population density: Spacing: Studies;	
Holotrichia		Sorghum: Pigeonpea,	0517
Mythimna		Research, ICRISAT	0500
Nephotettix cincticeps		Research; Sorghum,	0500
Poophilus costalis			0506
Pyrilla perpusilla		Semi-arid tropics, Research; Sorghum,	0504
Sesamia cretica		Semi-arid tropics, Upper Volta; Sor-	
Spodoptera		ghum: Cowpeas,	0532
Stored products pests		Sowing/Methods; Sorghum: Bermuda	
Tetranychids		grass,	0527
Insecticides,		Spacing; Sorghum: Soybeans,	0528
Application methods, Evaluation;		Statistical analysis; Sorghum,	0513
Sorghum, Atherigona soccata/Control,	0771	Studies, (in) Dry farming; Sorghum,	0524
Application methods; Sorghum, Ather-		Tanzania; Sorghum: Chickpea,	0485
igona soccata/Control,	0767	Theses; Sorghum, Weed control,	0587
Evaluation; Sorghum, Atherigona soc-		Theses; Sorghum: Mung beans: Pigeonpea:	
cata/Control,	0758	Soybeans,	0499
India/Gujarat; Sorghum, oligonychus		Weed control, Herbicides, Taiwan;	
indicus/Control,	0785	Sorghum: Sugarcane,	0580
Seed treatment; Sorghum, Atherigona		Weed control; Sorghum: Pigeonpea,	0588
soccata/Control,	0770	Yield increase, Semi-arid tropics,	
Toxicity; Sorghum,	0111	India/Andhra Pradesh; Sorghum: Pig-	
Insecticides;		eonpea,	0540
Sorghum, Atherigona soccata/Control,	0769	Yields, (under) Rainfed farming; Sor-	
Sorghum, Chilo partellus/Control,	0718	ghum, Hybrids,	0494
Sorghum, Contarinia sorghicola/Con-		Yields, Height, Effect, Puerto Rico;	
trol,	0718	Sorghum: Soybeans,	0492
Sorghum, Holotrichia serrata/Control,	0725	Yields, Nitrogen fertilizers, Effect;	
Sorghum, oligonychus partensis/Con-		Sorghum: Mung beans,	0480
trol,	0708	Yields, Planting date, Effect, Theses;	
Sorghum, Schizaphis graminum/Control,	0708	Sorghum: Mung beans,	0484
Insecticides: Nitrogen fertilizers,		Yields, Population density, Effect,	
Effect; Sorghum, Ratooning, Yields,	0536	Theses; Sorghum: Mung beans,	0484
Insecticides see also,		Yields, Population density, Effect;	
Diazinon		Sorghum: Pigeonpea,	0535
Furadon		Yields, Population density: Spacing,	
Intercropping,		Effect; Sorghum: Pearl millet,	0515
Brazil; Sorghum: Cowpeas: Kidney beans,	0510	Yields, Spacing, Effect; Sorghum: Leg-	
Canopy/Development: Light/Use, ICRI-		umes,	0530
SAT; Sorghum: Pigeonpea,	0516	Yields; Sorghum: Pigeonpea,	0481
Effect, Theses; Sorghum, Growth: Yields,	0483		0517
Effect, Theses; Sorghum, Hybrids, Gro-		Yields; Sorghum: Soybeans,	0528
wth,	0519	Yields/Stability; Sorghum: Pigeonpea,	0521
Effect, Theses; Sorghum, Hybrids, Yie-			0523
lds,	0519	Intercropping;	
Forage/Yields; Sorghum x Sorghum		Sorghum, Spacing/Studies,	0529
sudanense: Festuca arundinacea,	1103	Sorghum: Legumes,	0529

Sorghum:Pigeonpea, Genotypes, Evaluation,	0522	Ids,	0519
Intercropping/Profitability,		Effect; Sorghum, Azospirillum/Inoculation,	0346
(in) Dry farming; Sorghum: Pigeonpea,	0523	Effect; Sorghum, Genotypes, Seed production,	0884
Internodes/Patterns,		USA; Sorghum:Maize, Rotational cropping,	0487
Significance; Sorghum, Breeding,	0238	USA/Texas; Sweet sorghums,	1035
	0239	USSR; Sorghum (Forage),	1146
Iraq;		Venezuela; Sorghum,	0348
Sorghum, Tolyposporium ehrenbergii/Resistance,	0625	Irrigation;	
Iron,		Sorghum, Grain yield,	0349
(in) Calcareous soils; Sorghum, Chlorosis/Control,	0435	Sorghum, Hybrids: Varieties, NPK fertilizers, Effect,	0456
Effect; Sorghum, Hybrids, Iron/Uptake: Yields,	0416		0457
Iron:Manganese,		Sorghum, Yields, Soils/Nitrogen, Losses, Effect,	0460
Transformation, Irrigation, Effect,	0448	Irrigation: Fertilizers,	
(in) Vertisols; Sorghum,		Effect; Sorghum, Yields,	0429
Transformation, Manures, Effect,	0448	Irrigation: Nitrogen fertilizers gypsum,	
(in) Vertisols; Sorghum,		Effect; Sorghum (Forage), Claysoils, Salts/Distribution,	1143
Iron: Zinc;		Irrigation: Planting date,	
Sorghum, Soil testing,	0316	Effect; Sorghum, Grain yield,	0477
Iron/Chlorosis,		Effect; Sorghum, Growth,	0477
Roots, Role; Sorghum, Seedlings,	0440	Effect; Sorghum, Protein content,	0477
Iron/Concentration,		Irrigation: Rain/use;	
Calcium carbonate: organic matter, Effect; Sorghum,	0455	Sorghum,	0356
Iron/Dusts,		Irrigation: Sowing,	
Acidification, Effect, (in) Calcareous soils; Sorghum,	0454	Effect; Sorghum arundinaceum, Emergence: Establishment,	0077
Iron/Stress;		Irrigation/LeveIs;	
Sorghum, Hybrid vigour,	0439	Sorghum,	0357
Sorghum, Hybrids,	0439	Irrigation scheduling,	
Iron/Uptake,		Infrared radiation: Remote sensing;	
(in) Calcareous soils; Sorghum, Chlorosis/Control,	0454	Sorghum,	0352
(in) Calcareous soils; Sorghum, Hybrids,	0416	Irrigation see also,	
		Sprinkler irrigation	
Iron/Uptake: Yields,		Isoenzymes see,	
Farmyard manure, Effect; Sorghum, Hybrids,	0416	Enzymes	
Iron, Effect; Sorghum, Hybrids,	0416	Israel;	
Sulphur, Effect; Sorghum, Hybrids,	0416	Sorghum, Nitrogen fixation, Azospirillum/Inoculation,	0335
Irrigated farming,		Sorghum, Yield increase, Azospirillum/Inoculation,	0335
Australia; Sorghum, Atrazine/Dissipation, (from) Soils,	0590	Italy;	
Irrigated farming;		Sorghum, Cropping systems,	0359
Sorghum, Striga, Infestation, Sowing/Methods, Effect,	0693		0388
Irrigation,		Sorghum, Cultivation, Highland,	0373
Australia; Sorghum,	0354	Sorghum, Performance trials,	0270
Effect, (in) Vertisols; Sorghum, Iron: Manganese, Transformation,	0448	Japan;	
Effect, Canada; Sorghum, Grain yield,	0380	Sweet sorghums, Biomass/Production,	1050
Effect, India/Maharashtra; Sorghum, Grain yield,	0351	Johnson grass see,	
Effect, Theses; Sorghum, Hybrids, Growth,	0519	Sorghum halepense	
Effect, Theses; Sorghum, Hybrids, Yie-		Kenya;	
		Sorghum, Agronomy, Research,	0397
		Sorghum, Atherigona, Females, Anatomy,	0746
		Sorghum, Atherigona soccata,	0752

Sorghum arundinaceum, Atherigona soccata,	0752	Chlorosis; Sorghum,	0631
Koko,		Composition, Light effects; Sorghum,	0043
Nutritive value, Cooking, Effect,		Cyanogenic glycosides, Localisation;	
Nigeria; Sorghum,	0996	Sorghum,	0146
Kusagard: Fusilade,		Embryogenesis (Somatic); Sorghum,	0161
Romania; Sorghum halepense/Control,	1095	Enzymes, Light effects; Sorghum,	0078
Lactic acid/Formation,		Enzymes, Localization, (by) Immunofluorescence; Sorghum,	0155
Antibiotics, Effect; Sorghum, Carbohydrates/Fermentation, (in) Cattle/Rumen,	0906	Enzymes, Localization; Sorghum,	0146
Lactobacillus plantarum/Inoculation, Effect; Sorghum, Silage, Composition,	0908	Enzymes; Sorghum,	0107
Lambs see,		Enzymes (Malic), Characteristics; Sorghum,	0058
Sheep		Enzymic activity, (during) Developmental stages; Sorghum,	0131
Land preparation,		Metabolites, Translocation; Sorghum,	0127
Effect, USA/Texas; Sorghum, Runoff,	0405	Metals/Concentration, Sewage products, Effect; Sorghum,	0325
Effect, USA/Texas; Sorghum, Yield increase,	0405	Optical properties, Statistics; Sorghum halepense,	1079
Land races/Collections,		Orientation; Sorghum,	0101
Nigeria, ICRISAT; Sorghum,	0233	Phosphoenol pyruvate carboxylase; Sorghum,	0125
Larvae,			0137 0170
Alimentary canal, Enzymes; Sorghum, Atherigona soccata,	0748	Photosynthesis, Enzymes, Role; Sorghum,	0131
Growth: Feeding habits: Movement; Sorghum, Atherigona soccata,	0763	Photosynthesis, Light/Angle, Effect; Sorghum alnum,	0171
Larvae;		Photosynthesis; Sorghum,	0078
Sorghum, Atherigona soccata,	0764	Protoplasm, Isolation; Sorghum,	0135
Leaching,		Protoplasm, Mitosis; Sorghum,	0206
(in) Soils: Sorghum, Metriflufen,	0585	Translocation/Photosynthates, Water stress, Effect; Sorghum sudanense,	0158
Control; Sorghum x Sorghum sudanense, Hybrids, Roots, Minerals and nutrients,	0100	Transpiration; Sorghum,	0148
Leaf-spots/Control,		Leaves: Plastids,	
Fungicides, Evaluation; Sorghum, Hybrids,	0642	Chlorophylls/Optical properties; Sorghum,	0097
Leaf area,		Leaves: Roots,	
Estimation; Sorghum,	0032	Amino acids/Leakage: Sugars/Leakage, Toluene, Effect; Sorghum,	0159
	0033 0034 0035	Leaves (Chlorotic),	
Leaf area index,		Chlorophylls/Content; Sorghum,	0631
Microwave radiation, Response; Sorghum,	0053	Mineral content; Sorghum,	0631
Leaf area index: Biomass: Height, Relationship; Sweet sorghums,	1062	Leaves/Cuticle,	
Leaf area index: Vegetation/Index: Grain yield,		Fatty acids/Content; Sorghum,	0850
Relationship; Sorghum,	0398	Fatty alcohols/Content; Sorghum,	0850
Leaf temperature: Germination, Relationship; Sorghum, Hybrids,	0066	Leaves/Development,	
Leaf temperature: Soil temperature: Air temperature,		Adenosine triphosphate/Activity; Sorghum,	0123
Canopy, Effect; Sorghum,	0309	Leaves/Elongation,	
Timing (Day), Effect; Sorghum,	0309	CONCEP: Metolachlor, Effect; Sorghum,	0555
Leaves,		Water stress, Effect, Theses; Sorghum, Genotypes,	0145
Bacterioses, Chemical control; Sorghum,	0673	Leaves/Leucaena,	
Chlorophylls; Sorghum,	0172	Effect, Theses; Sorghum,	0459
Chlorophylls/Content, (during) Developmental stages; Sorghum,	0131	Leaves/Mineral content,	
		NPK fertilizers, Effect; Sorghum,	0434
		Leaves/Nitrogen content,	
		Nitrogen fertilizers, Effect; Sorghum,	0470

Leaves/Surface, Microscopy; Sorghum,	0037	Longiunguis sacchari/Resistance, Inheritance, Taiwan; Sorghum,	0727
Leucaena/Leaves, Effect, Theses; Sorghum,	0459	Luvisols, Cropping systems, Semi-arid tropics, India; Sorghum,	0505
Leucine/Content, Effect; Sorghum, Nutritive value,	0991	Lysimeters/Observations, India/Maharashtra; Sorghum, Water requirements,	0153
Light: Mitochondria, Role, Review articles; Sorghum, Nitro- gen metabolism,	0143	MCPA: 2-4-D, Effect; Sorghum, Growth,	0573
Light: Ultraviolet radiation, Effect; Sorghum, Growth,	0112	Effect; Sorghum, Yields,	0573
Light/Angle, Effect; Sorghum alnum, Leaves, Photo- synthesis,	0171	MMS: Cysteine: EMS: Gamma radiation: Hydrazine, Review articles; Sorghum, Induced mutation,	0241
Light/Use: Canopy/Development, (in) Mixed cropping, ICRISAT; Sorghum, ICRISAT; Sorghum: Pigeonpea, Inter-cr- opping,	0581 0516	MMS: Cysteine: EMS: Gamma radiation: Hydrazine; Sorghum, Induced mutation,	0243
Light effects; Sorghum, Genotypes, ABA: GA: IAA,	0075	Machinery; Sorghum, Harvesting,	0605
Sorghum, Growth,	0113	Machinery see also, Combine harvesters	
Sorghum, Leaves, Composition,	0043	Threshers	
Sorghum, Leaves, Enzymes,	0078	Macrophomina phaseolina, Inoculation/Method; Sorghum,	0653
Sorghum, Photosynthesis,	0085	Macrophomina phaseolina; Sorghum,	0649
Sorghum, Protein synthesis,	0081	Macrophomina phaseolina/Resistance, Evaluation; Sorghum,	0653 0654
Sorghum, Seedlings/Growth,	0044	Evaluation; Sorghum, Genotypes,	0647
Lignins, Mutants, Effect; Sorghum (Forage),	1124	Magnesium: Potassium: Calcium, Use; Sorghum, Hybrids,	0447
Lime/Application, Effect; Sorghum (Forage), Soil ferti- lity,	1110	Magnesium/Content, Nitrogen fertilizers/Sidedressing, Effect; Sorghum,	0466
Effect; Sorghum (Forage), Yields,	1110	Maize dwarf mosaic virus, Greece; Sorghum halepense,	1090
Lime/Nitrogen, Effect; Sorghum (Forage), Yields,	1132	Remote sensing; Sorghum,	0681
Liming, Effect, Malaysia; Sorghum,	0315	Maize dwarf mosaic virus: Sugarcane mosaic virus, Protection (Cross); Sorghum,	0687
Line x tester analysis, Theses; Sorghum, Seed parents/Ident- ification,	0247	Maize dwarf mosaic virus/Resistance, USA; Sweet sorghums,	1069 1070
Line x tester analysis; Sorghum, Agronomic characters,	0235	Maize weevil see, Sitophilus zeamais	
Sorghum, Agronomic characters, Comb- ining ability,	0254	Malawi; Sorghum, Storage losses/Assessment,	0864
Sorghum (Forage), Yields,	1156	Malaysia; Sorghum, Liming, Effect,	0315
Sorghum (Male sterile), Gene action,	0180	Sorghum, Peat soils,	0315
Livestock; Sorghum, Rations,	0919	Sorghum, Soils/pH, Effect,	0315
Livestock/Excreta, Effect; Sorghum (Forage),	1145	Male sterility, Cytoplasm: Genes, Interaction; Sorghum,	0229
Livestock see also, Buffaloes		Environmental effects; Sorghum,	0099
Cattle		Male sterility; Sorghum,	0256
Sheep			
Swine			
Lodging, Combine harvesters, Effect; Sorghum,	0602		
Lodging/Resistance: Agronomic charac- ters, Inheritance, Theses; Sorghum,	0228		

Male sterility (Cytoplasmic): Cytoplasmic organelles;		USA/Georgia; Sorghum,	1016
Sorghum,	0250	Maturity,	
Male sterility/Development,		Effect, Australia; Sweet sorghums,	1046
(with) Durraas/Cytoplasm; Sorghum,		Sugar/Production,	
Hybrids,	0225	Effect, Australia; Sweet sorghums,	1046
Mali;		Yields,	
Sorghum, Agronomy, Research, ICRISAT,	0383	Effect; Sorghum, Hybrids, Forage/Quality,	1116
Sorghum, Marketing,	1031	Effect; Sorghum, Hybrids, Forage/Yields,	1116
Sorghum, Production,	1031	Maturity: Grain yield,	
Sorghum, Research, ICRISAT,	0014	Relationship; Sorghum,	0392
Sorghum, Supply balance,	1031	Maturity/Stage,	
Sorghum: Legumes, Intercropping,	0501	Effect; Sorghum, Composition,	0926
Malic enzymes see,		Effect; Sorghum, Dry matter/Digestibility,	0926
Enzymes (Malic)		Mechanization;	
Malt see also,		Sorghum, Postharvest technology,	0876
Wort		Melanaphis sacchari/Resistance,	
Malting see,		Taiwan; Sorghum,	0728
Brewing		Metabolism;	
Mancozeb;		Sorghum,	0069
Sorghum, Puceinia purpurea/Control,	0629	Sorghum, Phorate,	0045
Manganese: Iron,		Sorghum, Seedlings,	0044
Transformation, Irrigation, Effect,		Metabolites,	
(in) VertisoIs; Sorghum,	0448	Translocation; Sorghum, Leaves,	0127
Transformation, Manures, Effect,		Metals/Concentration,	
(in) VertisoIs; Sorghum,	0448	Sewage products, Effect; Sorghum,	
Manganese: Phosphorus,		Leaves,	0325
Effect; Sorghum, Growth,	0443	Methane/Production,	
Effect; Sorghum, Minerals and nutrients uptake,	0443	Brazil; Sweet sorghums,	1048
Manganese/Concentration,		Methiocarb,	
Calcium carbonate: organic matter,		East Africa; Sorghum, Bird pests/Control,	0809
Effect; Sorghum,	0455	Effect; Sorghum, Hybrids, Grain yield,	0072
Manures,		Effect; Sorghum, Hybrids, Minerals and nutrients uptake,	0072
Effect, (in) Rainfed farming, India/Maharashtra; Sorghum, Growth: Yields,	0403	Residues, Analysis, Senegal; Sorghum,	0082
Effect, (in) VertisoIs; Sorghum, Iron: Manganese, Transformation,	0448	Senegal; Sorghum, Bird pests/Control,	0082
Effect; Sorghum, Soils/Nitrogen,	0474	Methiocarb;	
Manures: Fertilizers,		Sorghum, Hybrids, Bird pests/Control,	0072
Effect, (in) VertisoIs; Soil physico-chemical properties,	0431	Methionine,	
Effect, (in) Vertisols; Sorghum, Hybrids, Yields,	0431	Effect, Poultry; Sorghum, Nutritive value,	0965
Effect, Upper Volta; Sorghum, Tropical soils, Soil fertility,	0321	Methyl bromide: Carbon dioxide,	
Effect, Upper Volta; Sorghum, Yields,	0321	Fumigation; Sorghum, Stored products pests/Control,	0797
Manures (Pig slurry),		Methyl methanesulphonate see,	
Effect; Sorghum, Nitrogen/Uptake,	0469	MMS	
Manures/Nitrogen content,		Metolachlor,	
Effect; Sorghum sudanense, Yields,	1113	Effect; Sorghum, Phospholipids, Synthesis,	0165
Manures/Straw,		Metolachlor;	
Effect; Sorghum, Nitrogen fertilizers,	0424	Sorghum, Weed control,	0594
Effect; Sorghum, Yields,	0424	Metolachlor: Alachlor,	
Marketing,		Toxicity, Soil moisture, Effect; Sorghum,	0569
India/Andhra Pradesh; Sorghum,	0869		
Mali; Sorghum,	1031		
Philippines; Sorghum,	1030		
USA; Sorghum,	1022		



Metolachlor:Alachlor;		Midge see,	
Sorghum (Volunteer), Control,	1096	Contarinia sorghicola	
Metolachlor: CONCEPT,		Migration,	
Combined application, Effect; Sorghum,	0555	USA/Texas; Sorghum, Schizaphis gram-	
Effect; Sorghum, Leaves/Elongation,	0555	inum,	0729
Effect; Sorghum, Weed control,	0568	Milling,	
Metolachlor: Propazine;		Review articles; Sorghum,	0987
Sorghum, Cassia obtusifolia/Control,	0564	Theses; Sorghum,	0860
Metolachlor/Toxicity,		Milling;	
(by) CONCEPT; Sorghum, Protection,	0575	Sorghum,	0856
(by) CONCEPT; Sorghum, Seedlings, Prot-			0874
ection,	0122	Mills;	
Effect; Sorghum, GA/Synthesis,	0166	Sorghum, Peeling,	0861
	0167		0873
Effect; Sorghum, Growth,	0166	Milo disease see,	
Effect; Sorghum, Seedlings, Ethylene/		Periconia	
Formation,	0122	Milos,	
Metolachlor/Uptake,		Amino acids, Poultry	0950
CONCEPT: Soil moisture, Effect; Sorghum,	0095	Anthers, Amino acids, Analysis	0849
Metriflufen,		Nicotinamide	0900
Leaching, (in) Soils; Sorghum,	0585	Starch/Product ion	1010
Metriflufen;		Mineral content;	
Sorghum halepense/Control,	1073	Sorghum, Leaves (Chlorotic),	0631
	1092	Mineral content/Leaves,	
Metriflufen/Translocation,		NPK fertilizers, Effect; Sorghum,	0434
Environmental effects; Sorghum hal-		Mineral fertilizers;	
epense/Control,	1085	Sweet sorghums,	1068
Mexico;		Mineral uptake see,	
Sorghum, Cultivation,	0374	Minerals and nutrients uptake	
Sorghum, Genotypes, Environmental		Minerals and nutrients,	
effects,	0374	Aluminium, Effect, Theses; Sorghum,	
Micromycetes see,		Genotypes,	0426
Microorganisms		Leaching, Control; Sorghum x Sorghum	
Micronutrient fertilizers,		sudanense, Hybrids, Roots,	0100
Effect, India/Maharashtra; Sorghum,		Minerals and nutrients: NPK fertiliz-	
Hybrids,	0441	ers,	
Microorganisms,		Effect, Middle East; Sorghum, Yields,	0465
Effect; Sweet sorghums, Syrup/Produ-		Minerals and nutrients uptake,	
ction,	1043	(in) Acid soils; Sorghum, Genotypes,	0422
Microorganisms;		Manganese: Phosphorus, Effect; Sorghum,	0443
Sorghum, Rhizosphere,	0345	Methiocarb, Effect; Sorghum, Hybrids,	0072
Microorganisms/Soils,		Minerals and nutrients uptake;	
NPK fertilizers: Ratooning, Effect;		Sorghum x Sorghum sudanense, Hybrids,	
Sorghum,	0327	Roots,	0100
Microorganisms/Soils;		Minerals and nutrients uptake: Growth,	
Sorghum,	0330	Trace elements, Effect; Sorghum,	0419
Microscopy;		Mite control,	
Sorghum, Grain, Composition,	0831	USA; Sorghum,	0722
Sorghum, Leaves/Surface,	0037	Mitochondria: Light,	
Microwave radiation,		Role, Review articles; Sorghum, Nitr-	
Response; Sorghum, Canopy/Moisture,	0053	ogen metabolism,	0143
Response; Sorghum, Dry matter,	0053	Mitosis;	
Response; Sorghum, Leaf area index,	0053	Sorghum, Leaves, Protoplasm,	0206
Microwave radiation/Data;		Mixed cropping,	
Sorghum, Biomass/Estimation: Classi-		Forage/Yields; Sorghum: Cowpeas,	1157
fication,	0130	ICRISAT; Sorghum, Canopy/Development:	
Middle East;		Light/Use,	0581
Sorghum, Yields, Minerals and nutri-		ICRISAT; Sorghum: Cowpeas: Mung beans,	0581
ents: NPK fertilizers, Effect,	0465	Yields, India/TamilNadu; Sorghum:	

Soybeans,	0502	Effect; Sorghum (Forage), Lignins,	1124
Yields; Sorghum: Legumes,	0514	Effect; Sorghum (Forage), Nutritive	
Yields; Sorghum: Soybeans,	0503	value,	1124
Mixed cropping;		Effect; Sorghum (Forage), Sugars,	1124
Sorghum, Weed control,	0581	Mutants (Brown midrib),	
Sorghum: Maize,	0507	Allelism, Tests; Sorghum,	0181
Sorghum: Phaseolus vulgaris,	0491	Effect; Sorghum, Dry matter/Digesti-	
Mixed cropping see also,		bility,	0192
Intercropping		Effect; Sorghum, Fibre content,	0192
Models,		Effect; Sorghum sudanense, Dry matter/	
Theses; Sorghum,	0311	Digestibility,	0192
Models;		Effect; Sorghum sudanense, Fibre	
Sorghum, Growth,	0308	content,	0192
Sorghum, Ratooning,	0531	Mutants (Chlorophyll deficient);	
Sorghum, Soils, Nitrogen content/		Sorghum,	0242
Change,	0323	Mutation see also,	
Sorghum, Supply balance,	1015	Induced mutation	
Sorghum, Water stress,	0313	Mycorrhizae,	
Sorghum, Yield loss/Assessment, Per-		Nitrogen, Effect; Sorghum,	0330
onosclerospora sorghi,	0640	Soil moisture, Effect; Sorghum,	0347
	0641	Mycorrhizae/Infection,	
Sweet sorghums, Biomass/Production,	1062	Effect; Sorghum sudanense, Nutrition,	1122
Models see also,		Mycorrhizae/Symbiosis,	
Simulation models		Phosphate fertilizers, Effect; Sorg-	
Moisture (Air) see,		hum,	0339
Air moisture		Mycoses,	
Moisture (Soil) see,		Africa; Sorghum,	0614
Soil moisture		French Guyana; Sorghum (Forage),	1104
Moisture/Canopy,		Review articles; Sorghum,	0622
Microwave radiation, Response; Sorg-		USA; Sorghum,	0669
hum,	0053	Mycoses;	
Moisture effects;		Sorghum, Panicles,	0616
Sorghum (Forage), Fibre content,	1119	Mycoses: Insect pests,	
Moisture stress see,		Effect; Sorghum, Phenolic content,	0851
Water stress		Mycoses/Control;	
Molds see,		Sorghum,	0624
Grain molds		Mycoses see also,	
Morphogenesis: Flowering: Growth;		Alternaria	
Sorghum,	0172	Aspergillus	
Movement: Growth: Feeding habits;		Colletotrichum	
Sorghum, Atherigona soccata, Larvae,	0763	Curvularia	
Mozambique;		Ephelis oryzae	
Sorghum, Germplasm/Collections,	0237	Foliar diseases	
Mulches,		Fusarium	
Effect; Sorghum, Roots/Growth,	0120	Glomus albidus	
Mulches see also,		Grain molds	
Straw mulches		Helminthosporium	
Mulching,		Leaf-spots	
Effect; Sorghum, Growth,	0160	Macrophomina	
India/Maharashtra; Sorghum, Growth:		Penicillium	
Yields,	0408	Periconia	
Mutagens see also,		Peronosclerospora	
EMS		Rusts	
Gamma radiation		Seed-borne fungi	
Hydrazine		Setosphaeria	
MMS		Spacelotheca	
Mutants,		Sphacelia	
Effect; Sorghum (Forage), Drymatter/		Stalk rot	
Digestibility,	1124	Tolyposporium	

Mycotoxins,		ICRISAT; Sorghum, Germplasm/Collections,	
Analysis; Sorghum, Feeds,	0956		0233
Early maturation, Effect, Nigeria;		ICRISAT; Sorghum, Land races/Collections,	
Sorghum, Grain molds,	0668		0233
Mythimna separata/Control,		Nigeria;	
Predators; Sorghum,	0776	Sorghum,	0025
NPK fertilizers,		Sorghum, Agronomy, Research,	0391
Effect, (under) Irrigation; Sorghum,		Sorghum, Atherigona soccata, Natural enemies,	0742
Hybrids: Varieties,	0456		0468
	0457	Sorghum, Crops/Residues,	
Effect, India/Maharashtra; Sorghum,		Sorghum, Food products, Protein quality,	0995
Hybrids, Yields,	0451		
Effect; Sorghum, Dry matter/Yields,	0456	Sorghum, Grainmolds, Mycotoxins,	
Effect; Sorghum, Grain yield,	0464	Early maturation, Effect,	0668
Effect; Sorghum, Leaves/Mineral content,		Sorghum, Hybrids,	0287
	0434	Sorghum, Koko, Nutritive value, Cooking, Effect,	0996
Effect; Sorghum, Nitrogen content,	0457	Sorghum, Ogi, Evaluation,	0979
Effect; Sorghum, Nitrogen uptake,	0457	Sorghum, Palatability/Tests, (for)	
Effect; Sorghum, Protein content,	0464	Consumer behaviour,	0989
Effect; Sorghum, Yields,	0434	Sorghum, Performance trials,	0296
Effect; Sweet sorghums, Yields,	1060	Sorghum, Phosphorus-potassium fertilizers/Requirements, Soils, Savannas,	0467
Response, (under) Rainfed farming,			
India/Maharashtra; Sorghum, Hybrids: Varieties,	0450	Sorghum, Production,	0024
NPK fertilizers: Minerals and nutrients,			0391
Effect, Middle East; Sorghum, Yields,	0465	Sorghum, Research,	0004
NPK fertilizers: Ratooning,			0296
Effect; Sorghum, Rhizosphere,	0327	Sorghum, Soil fertility, Rotational cropping, Effect,	0508
Effect; Sorghum, Soils/Microorganisms,	0327	Sorghum, Varieties, Savannas,	0286
NPK fertilizers/Application methods,		Sorghum, Weed control, Herbicides,	0577
Effect; Sorghum (Forage), Yields,	1129	Sorghum: Cotton: Groundnuts, Rotational cropping, Yields,	0508
NPK fertilizers/Uptake,			0509
Carbofuran, Effect; Sorghum, Hybrids,	0421		
Naphthalic anhydride;		Sorghum: Groundnuts, Rotational cropping, Phosphorus-potassium fertilizers/Requirements, Soils, Savannas,	0467
Sorghum, Protection, (from) Herbicides, Toxicity,	0579	Sorghum: Wheat, Rotational cropping, Yields, Fertilizers, Effect,	0468
Natural enemies,		Nitrapyrin: Etriazole,	
India/Punjab; Sorghum, Pyrilla perpusilla,	0799	Effect; Sorghum, Grain yield,	0162
Nigeria; Sorghum, Atherigona soccata,	0742	Effect; Sorghum, Nitrogen metabolism,	0162
Natural enemies see also,		Nitrate reductase/Activity,	
Predators		Nitrogen fertilizers, Effect; Sorghum, Genotypes,	0415
Nematode control,		Proline, Effect; Sorghum, Seedlings,	0140
Tropics; Sorghum,	0689	Nitrate reductase/Activity: Hybrid vigour,	
USA; Sorghum,	0688	Genetic analysis; Sorghum,	0217
Nematodes,		Nitrate reductase/Activity: Yields, Genetic analysis; Sorghum, Hybrids,	0217
Sudan; Durras,	0690	Nitrification inhibitors see also,	
Nephotettix cincticeps,		Etriazole	
Feeding habits; Sorghum,	0800	Nitrapyrin	
Taiwan; Sorghum,	0801	Nitrogen,	
Niacin see,		Effect; Sorghum, Mycorrhizae,	0330
Nicotinamide			
Nicaragua;			
Sorghum, Peeling,	0868		
Nicotinamide;			
Milos,	0900		
Sorghum,	0900		
Nigeria,			

Nitrogen-phosphorus fertilizers, Effect; Sorghum, Hybrids: Varieties, Yields,	0452	Effect, Pakistan; Sorghum, Growth,	1098
Nitrogen/Digestibility, Fibre content, Effect; Sorghum,	0986	Nitrogen fertilizers: Seed quality, Effect; Sorghum, Agronomic characters,	0428
Nitrogen/Lime, Effect; Sorghum (Forage), Yields,	1132	Effect; Sorghum, Grain yield,	0428
Nitrogen/Soils, Absorption; Sorghum,	0453	Nitrogen fertilizers: Water stress, Effect; Sorghum, Grain yield: Protein content,	0449
Losses, Effect, (under) Irrigation; Sorghum, Yields,	0460	Effect; Sorghum, Nitrogen metabolism,	0449
Manures, Effect; Sorghum,	0474	Nitrogen fertilizers/Application, Economics; Sorghum,	0438
Nitrogen/Uptake, Manures (Pig slurry), Effect; Sorghum,	0469	Nitrogen fertilizers/Sidedressing, Effect; Sorghum, Calcium/Content,	0466
Nitrogen content, NPK fertilizers, Effect; Sorghum,	0457	Effect; Sorghum, Magnesium/Content,	0466
Nitrogen content: Growth, Azospirillum/Inoculation, Effect; Sorghum,	0334	Effect; Sorghum, Potassium/Content,	0466
Nitrogen content/Change, Models; Sorghum, Soils,	0323	Nitrogen fertilizers/Timing, Effect; Sorghum, Forage,	1149
Nitrogen content/Leaves, Nitrogen fertilizers, Effect; Sorghum,	0470	Nitrogen fertilizers/Topdressing, Effect; Sorghum, Yields,	0463
Nitrogen content/Manures, Effect; Sorghum sudanense, Yields,	1113	Nitrogen fixation, Azospirillum, Humid tropics; Sorghum,	0341
Nitrogen fertilizers, Effect, Canada; Sorghum, Grain yield, Effect, ICRISAT; Sorghum: Pigeonpea, Intercropping,	0380	Azospirillum, organic matter, Effect; Sorghum,	0326
Effect, Philippines; Sorghum, Varieties, Yields,	0525	Azospirillum, Soil moisture, Effect; Sorghum,	0326
Effect, Theses; Sorghum (Forage), Yields,	0462	Azospirillum; Sorghum,	0343
Effect; Sorghum, Composition,	1126	Azospirillum/Inoculation, Israel; Sorghum,	0335
Effect; Sorghum, Digestibility,	0433	Azospirillum/Inoculation; Sorghum,	0334
Effect; Sorghum, Genotypes, Nitrate reductase/Activity,	0433	Azotobacter; Sorghum,	0336
Effect; Sorghum, Genotypes, Protein content,	0415	Bacteria, Induction; Sorghum nigricans,	0332
Effect; Sorghum, Grain yield,	0415	Bacteria, Theses; Sorghum,	0331
Effect; Sorghum, Leaves/Nitrogen content,	0470	Bacteria, USA; Sorghum,	0338
Effect; Sorghum, Nutritive value,	0470	Bacteria; Sorghum,	0328
Effect; Sorghum, Striga,	0692	Phosphobacterin, Role; Sorghum,	0342
Effect; Sorghum, Yields,	0423	Research, ICRISAT; Sorghum,	0344
	0438	Nitrogen fixation; Sorghum,	0337
Effect; Sorghum: Mung beans, Intercropping, Yields,	0480	Nitrogen fixing bacteria see, Bacteria	
Semi-arid tropics; Sorghum,	0418	Nitrogen metabolism, Azospirillum, Effect; Sorghum,	0329
Straw/Manures, Effect; Sorghum,	0424	Etradiazole: Nitrapyrin, Effect; Sorghum,	0162
Nitrogen fertilizers: Gypsum: Irrigation, Effect; Sorghum (Forage), Clay soils, Salts/Distribution,	1143	Light: Mitochondria, Role, Review articles; Sorghum,	0143
Nitrogen fertilizers: Insecticides, Effect; Sorghum, Ratooning, Yields,	0536	Nitrogen fertilizers: Water stress, Effect; Sorghum,	0449
Nitrogen fertilizers: Planting date, Effect, Pakistan; Sorghum, Forage/ Yields,	1098	Organic matter, Effect; Sorghum,	0329
		Nitrogen metabolism: Photosynthesis; Sorghum, Hybrid vigour,	0179
		Nitrogen uptake, NPK fertilizers, Effect; Sorghum,	0457
		Nitrophoska: Atrazine; Sorghum, Striga hermonthica/Control,	0695
		No-tillage see, Zero-tillage	

Nucleic acids:Proteins:Enzymes,		0959	0960
Changes, (during) Developmental stages; Sorghum, Grain,	0840	Processing, Effect, Cattle; Sorghum, Silage,	0961
Nucleotides see also,		Reconstitution: Soaking, Effect, Cattle; Sorghum,	0968
Adenosine triphosphate		Review articles; Sorghum,	0987
Nutrient transport,		Review articles; Sorghum, Breeding,	0177
Temperature effects; Sorghum, Phloem,	0157	Sahel; Sorghum, Varieties,	0295
Nutrient uptake see,		Salts/Treatment, Effect; Sorghum,	0993
Minerals and nutrients uptake		Sewage products/Soil treatment, Effect; Sorghum (Forage), Silage,	1105
Nutrition,		Sheep; Sorghum, Grain (Damaged),	0895
Mycorrhizae/Infection, Effect; Sorghum sudanense,	1122	Sheep; Sorghum, Silage,	0940
Theses; Sorghum,	0459	Sudan; Sorghum, Varieties,	0295
USA/Florida; Sorghum,	0319	Swine; Sorghum, Feeds,	0951
Nutrition;		Tannins, Effect; Sorghum,	0825
Sorghum (Forage),	1158	Tannins/Content, Effect, Poultry; Sorghum,	0945
Nutritive value,			0964
Ascorbic acid, Effect, Guinea pigs; Sorghum,	0933	Nutritive value;	
	0935	Sorghum,	0974
Bioassay, Poultry; Sorghum, Feeds,	0909	Sorghum, Breeding,	0236
Brewing, Effect; Sorghum,	0984		0252
Cattle; Sorghum,	0955	Sorghum, Forage, (as) Feed supplements,	0899
Cattle; Sorghum, Silage,	0898	Sorghum, High-yielding varieties,	1000
	0938	Sorghum, Silage,	0910
Cattle; Sorghum, Straw (Ammoniated),	0905		0949
Children; Sorghum, Flours (Malted),	0984	Sorghum, Varieties, Feeds,	0848
Comparison, Cattle; Sorghum:Maize, Silage,	0891	Sorghum, Varieties (Hurda),	1001
Comparison; Sorghum, Varieties,	0925	Sorghum (Fermented),	0981
Comparison; Sorghum (Forage), Fl hybrids,	1148	Sorghum x Sorghum sudanense, Hybrids, Forage,	1111
Composition, Effect; Sweet sorghums, Feeds,	1067	Sorghum x Sorghum sudanense, Hybrids, Silage,	0910
Concentrates, Effect, Cattle; Sorghum, Hay,	0948	Sweet sorghums, Feeds,	1068
Cooking, Effect, Nigeria; Sorghum, Koko,	0996	Nutritive value: Composition,	
Enzyme inhibitors, Effect; Sorghum,	0985	Comparison; Sorghum, Feeds,	0924
Farmers, Upper Volta; Sorghum,	0983	Fermentation, Effect; Sorghum (Forage),	1111
Feed additives, Effect, Cattle; Sorghum,	0897	Nutritive value: Digestibility,	
Feed additives, Effect, Poultry Sorghum,	0952	Sheep; Sorghum (Forage), Silage,	1140
Fermentation, Effect; Sorghum,	0990	Sodium hydroxide/Treatment, Effect, Cattle; Sorghum, Silage,	0917
Fibre content, Effect, Theses; Sorghum, Silage,	0930	Nutritive value: Tannins/Content, Salts/Treatment, Effect, Rodents; Sorghum,	0946
Formaldehyde/Treatment, Effect, Swine; Sorghum (Bird resistant),	0931	Nymphs/Rearing;	
Guinea pigs; Sorghum,	0932	Sorghum, Schizaphis graminum,	0735
	0934	Ogi,	
Improvement; Sorghum, Feeds,	0888	Evaluation, Nigeria; Sorghum,	0979
Leucine/Content, Effect; Sorghum,	0991	Oligonychus indicus/Control,	
Methionine, Effect, Poultry; Sorghum,	0965	Insecticides, India/Gujarat; Sorghum,	0785
Mutants, Effect; Sorghum (Forage),	1124	Oligonychus indicus/Resistance: Atherigona soccata/Resistance,	
Nitrogen fertilizers, Effect; Sorghum,	0432	Relationship; Sorghum,	0719
Phosphate fertilizers, Effect; Sorghum (Forage),	1141	Oligonychus partensis/Control,	
Poultry; Sorghum, Feed supplements,	0914	Insecticides; Sorghum,	0708
Poultry; Sorghum, Feeds,	0918	Optical properties,	
		Statistics; Sorghum halepense, Leaves,	1079

Organic matter,		Peat soils,	
Effect; Sorghum, Nitrogen fixation,		Malaysia; Sorghum,	0315
Azospirillum,	0326	Peeling,	
Effect; Sorghum, Nitrogen metabolism,	0329	Mills; Sorghum,	0861
Organic matter: Calcium carbonate,			0873
Effect; Sorghum, Iron/Concentration,	0455	Nicaragua; Sorghum,	0868
Effect; Sorghum, Manganese/Concentration,	0455	Penicillium citrinum: Aspergillus	
Effect; Sorghum, Yields,	0455	candidus,	
Origin: Evolution,		Infection; Sorghum,	0615
China; Sorghum,	0030	Peregrinus maidis,	
Oviposition;		Australia; Sorghum,	0679
Sorghum, Atherigona soccata,	0749	Performance,	
	0751 0761 0762	Argentina; Sorghum, Hybrids,	0283
P-Hydroxybenzaldehyde;		Brazil; Sorghum, Genotypes,	0268
Sorghum, Seedlings, Cuticle/Wax,	0852	Brazil; Sorghum saccharatum,	0268
PCNB;		Performance;	
Sorghum, Seed treatment,	0817	Sorghum, Hybrids,	0263
Pacific Islands;		Sorghum(Forage) x Sorghum sudanense	
Sorghum, High-yielding varieties,		(Rhodesian), Fl hybrids,	1159
Diseases: Insect pests: Weeds, Complexes,	0611	Sorghum sudanense (Rhodesian) x	
Pakistan;		Sorghum sudanense, Fl hybrids,	1159
Sorghum, Forage/Yields, Nitrogen		Performance trials,	
fertilizers: Planting date, Effect,	1098	Argentina; Sorghum,	0289
Sorghum, Growth, Nitrogen fertilizers:		Argentina; Sorghum, Hybrids: Varieties,	0264
Planting date, Effect,	1098	Argentina; Sorghum, Varieties,	0293
Sorghum, Insect pests, Biological		France; Sorghum, Varieties,	0273
control, Research,	0715	India; Sorghum, Hybrids: Varieties,	0281
Sorghum, Research,	0026	India/Rajasthan; Sorghum, Hybrids:	0290
Palatability,		Varieties,	0282
Poultry; Sorghum, Grain,	0927	Italy; Sorghum,	0270
Palatability/Tests,		Nigeria; Sorghum,	0296
(for) Consumer behaviour, Nigeria;		Sudan; Sorghum,	0302
Sorghum,	0989	Sudan; Sorghum, Varieties,	0262
Panicles,		USA/Arkansas; Sorghum,	0303
Anatomy; Sorghum halepense,	1089	USA/Georgia; Sorghum,	0299
Mycoses; Sorghum,	0616	USA/Iowa; Sorghum, Hybrids,	0265
Pantothenic acid;		USA/Louisiana; Sorghum, Hybrids,	0266
Sorghum,	0847		0300
Papua New Guinea;		USA/Mississippi; Sorghum,	0278
Sorghum, Agronomy, Research,	0395	USA/Nebraska; Sorghum,	0271
Paraquat: Glyphosate,		USA/New Mexico; Sorghum, Hybrids:	
Sprayers; Sorghum, Shattercane/Control,	0554	Varieties,	0274
Parasitic insects: Predators,		USA/New Mexico; Sorghum x Sorghum	
India/Karnataka; Sorghum, Contarinia		sudanense, Hybrids,	0274
sorghicola/Control,	0791	USA/oklahoma; Sorghum, Hybrids,	0269
Parasitic plants see,		USA/Tennessee; Sorghum, Varieties,	0279
Striga		USA/Texas; Sorghum, Hybrids,	0267
Particle size,			0277 0292 0297
Effect, Swine; Sorghum, Digestibility,	0954	Venezuela; Sorghum,	0285
Effect; Sorghum, Dry matter: Starch,		Virgin Islands (USA); Sorghum, Varieties,	
Digestibility,	0912		0280
Particle size: Temperature,		Performance trials;	
Effect; Sorghum, Phosphorus/Uptake,	0417	Sorghum, Hybrids,	0227
Pathogenicity: Isolation;		Pericarp: Testa/Colour,	
Sorghum x Sorghum sudanense, Hybrids,		Inheritance; Sorghum caudatum,	0246
Bacteria (Ratoon stunting),	0671	Periconia circinata/Toxins,	
		Effect, USA; Sorghum,	0650
		Effect; Sorghum, Root cap,	0648

Effect; Sorghum, Seedlings, Electrolytes/Leakage,	0651	Phenotypes/Classification;	
Uptake; Sorghum, Seedlings,	0655	Sorghum, Inbreeding/Lines,	0188
Perigrinus maidis/Control,		Philippines;	
Erythraeus, India/Karnataka; Sorghum,	0784	Sorghum, Foliar diseases/Resistance,	
Peronosclerospora sacchari,		Evaluation,	0644
Host range, Taiwan	0633	Sorghum, Marketing,	1030
Peronosclerospora sacchari/Resistance,		Sorghum, Postharvest technology,	0865
Taiwan; Sorghum,	0633	Sorghum, Production,	1029
Peronosclerospora sorghi,		Sorghum, Varieties, Yields, Nitrogen	
Cultural control, Theses; Sorghum,	0634	fertilizers, Effect,	0462
Developmental stages; Sorghum,	0635	Sorghum, Varieties, Yields, Population	
Epidemiology; Sorghum,	0636	density, Effect,	0462
Infection; Sorghum,	0638	Sorghum, Varieties (CMU-var 2) ,	0288
Models; Sorghum, Yield loss/Assessment,		Phloem,	
	0640	Nutrient transport, Temperature	
	0641	effects; Sorghum,	0157
Spores, Germination inhibitors, Effect; Sorghum,	0639	Phorate,	
Vegetative reproduction, Environmental effects; Sorghum,	0637	Absorption; Sorghum,	0045
Peronosclerospora sorghi;		Metabolism; Sorghum,	0045
Sorghum,	0631	Phosphate fertilizers,	
Peronosclerospora sorghi/Resistance,		Effect, Theses; Sweet sorghums,	1054
Inheritance, Theses; Sorghum,	0632	Effect; Sorghum, Mycorrhizae/Symbiosis,	0339
Pesticides,		Effect; Sorghum: Wheat, Rotational	
Effect, Theses; Sorghum, Seed treatment,	0823	cropping, Yields,	0458
		Effect; Sorghum (Forage), Nutritive	
Pests see,		value,	1141
Bird pests		Effect; Sorghum (Forage), Yields,	1141
Insect pests		Effect; Sorghum x Sorghum sudanense,	
pH/Reduction,		Hybrids, Yields,	1141
Roots, Role; Sorghum, Seedlings,	0440	Phosphate fertilizers;	
pH/Soils,		Sorghum sudanense,	1122
Effect, Malaysia; Sorghum,	0315	Phosphates,	
Phenolic compounds,		Effect; Sorghum,	0446
Analysis; Sorghum (Bird resistant)		Effect; Sorghum, Zinc/Uptake,	0461
, Grain,	0826	Phosphobacterin,	
Biosynthesis, Enzymic activity, Determination, (by) Chromatography;		Role; Sorghum, Nitrogen fixation,	0342
Sorghum,	0051	Phosphoenol pyruvate carboxylase;	
Chromatography; Sorghum, Grain,	0837	Sorghum, Leaves,	0125
Phenolic compounds see also,			0137 0170
Flavonoids		Phospholipids,	
Tannins		Synthesis, Metolachlor, Effect; Sorghum,	0165
Phenolic content,		Phosphorus-potassium fertilizers,	
Environmental effects; Sorghum,	0851	Effect, Taiwan; Sorghum,	0444
Insect pests: Mycoses, Effect; Sorghum,	0851	Phosphorus-potassium fertilizers/	
Phenology,		Requirements,	
Brazil; Sorghum,	0310	Soils, Savannas, Nigeria; Sorghum,	0467
Environmental effects, Theses; Sorghum,	0311	Soils, Savannas, Nigeria; Sorghum:	
		Groundnuts, Rotational cropping,	0467
Phenology;		Phosphorus: Manganese,	
Sorghum,	0307	Effect; Sorghum, Growth,	0443
Phenols: Sugars: Amino acids,		Effect; Sorghum, Minerals and nutrients uptake,	0443
Role; Sorghum, Puccinia purpurea/		Phosphorus/Content,	
Resistance,	0630	Analysis; Sorghum,	0829
Phenotypes/Classification,		Phosphorus/Leaching: Runoff/Losses,	
Role; Sorghum, Selection,	0187	Relationship; Sorghum sudanense,	
		Canopy,	1155

Phosphorus/Residues,		Planting/Guide,	
Effect; Sorghum,	0458	Australia; Sorghum, Hybrids,	0366
Phosphorus/Uptake,			0372 0378
(from) Rock phosphate; Sorghum,	0417	Planting date,	
	0420	Effect, (under) Dry farming; Sorghum,	
Particle size: Temperature, Effect;		Grain yield,	0475
Sorghum,	0417	Effect, Brazil; Sorghum, Development,	0310
Theses; Sorghum, Genotypes,	0425	Effect, Canada; Sorghum, Hybrids, Grain	
Phosphorylation;		yield,	0476
Sorghum,	0128	Effect, India/Punjab; Sorghum, Ather-	
Photoperiod,		igona soccata: Chilo partellus,	0610
Effect; Sorghum, Blissus leucopterus,	0808	Effect, India/Punjab; Sorghum, Colle-	
Photoperiodism: Growth substances;		totrichum graminicola/Incidence,	0610
Sorghum, Genotypes,	0074	Effect, Theses; Sorghum: Mung beans,	
	0075	Intercropping, Yields,	0484
Photosynthates/Trans location,		Effect. Theses; Sorghum (Forage), Yie-	
Water stress, Effect; Sorghum sudan-		lds,	1126
ense, Leaves,	0158	Effect; Sorghum, Forage,	1149
Photosynthesis,		Effect; Sorghum, Grain yield,	0478
Enzymes, Role; Sorghum, Leaves,	0131	Effect; Sorghum, Yields,	0479
Light/Angle, Effect; Sorghum alnum,		Effect; Sorghum (Forage), Insect pests/	
Leaves,	0171	Incidence,	1160
Light effects; Sorghum,	0085	Planting date: Irrigation,	
Plastids, Role; Sorghum,	0081	Effect; Sorghum, Grain yield,	0477
Photosynthesis;		Effect; Sorghum, Growth,	0477
Sorghum,	0046	Effect; Sorghum, Protein content,	0477
	0055 0150	Planting date: Nitrogen fertilizers,	
Sorghum, Leaves,	0078	Effect, Pakistan; Sorghum, Forage/	
Photosynthesis: Nitrogen metabolism;		Yields,	1098
Sorghum, Hybrid vigour,	0179	Effect, Pakistan; Sorghum, Growth,	1098
Photosynthesis/Rate,		Planting date: Seeding rates,	
Water stress, Effect; Sorghum, Hybrids,	0050	Effect; Sorghum, Atherigona soccata,	
Physiological studies,		Infestation,	0753
Theses; Sorghum, Temperature resist-		Planting date: Sowing depth,	
ance,	0168	Effect; Sorghum, Yields,	0410
Theses; Sorghum, Water stress,	0168	Plastids,	
Physiology,		Enzymes, Localization; Sorghum,	0151
Sudan; Sorghum,	0361	Protein/Solubility, Butanol; Sorghum,	0128
Physiology;		Role; Sorghum, Photosynthesis,	0081
Sorghum, Drought resistance,	0147	Plastids: Leaves,	
Sorghum, Hybrids, Drought resistance,	0117	Chlorophylls/Optical properties;	
Physiology: Yields/Stability: Anatomy,		Sorghum,	0097
Environmental effects, Theses; Sorg-	0377	Plastids/Protein synthesis,	
hum,		(for) Enzymes (Malic); Sorghum,	0080
Phytochromes,		Plinthite,	
Action; Sorghum, Chlorophylls/Synth-	0119	Characters; Sorghum,	0124
esis,		Ploughing,	
Effect; Sorghum, Carotenoids/Accumu-	0126	Effect, (in) Podzols; Sorghum, Yields,	0399
lation,		Podzols;	
Effect; Sorghum, Chlorophylls/Accum-	0126	Sorghum, Yields, Ploughing, Effect,	0399
ulation,		Poisoning,	
Phytochromes;		Hydrocyanic acid, Sheep; Sorghum,	0967
Sorghum,	0113	Pollen,	
Picloram: Atrazine: 2-4-D;		(effect on) Colletotrichum grami-	
Sorghum, Weed control,	0583	cola, Spores, Germination; Sorghum,	0645
Pigments see also,		Polyethylene glycol,	
Carotenoids		Effect; Sorghum, Germination, (in)	
Chlorophylls		Cold climate,	0052
Flavonoids			



Polyethylene glycol;		lizable), Evaluation,	0941
Sorghum, Seed treatment,	0052	Sorghum, Digestibility, Tannins/Content, Effect,	0945
Poophilus costalis,			0944
Upper Volta; Sorghum,	0798	Sorghum, Feed supplements,	0914
Population,		Sorghum, Feed supplements, Nutritive value,	0947
Environmental effects, Upper Volta;			0913
Sorghum, Atherigona soccata,	0743	Sorghum, Feed supplements, Rations,	0918
Population: Spacing,		Sorghum, Feeds,	0960
Effect, Botswana; Sorghum, Yields,	0400		0909
Population: Spacing: Water use,		Sorghum, Feeds, Nutritive value,	0927
Relationship; Sorghum,	0401		0952
Population/Random mating,		Sorghum, Feeds, Nutritive value, Bio-assay,	0965
Agronomic characters, Evaluation;			0945
Sorghum,	0182	Sorghum, Feeds, Nutritive value, Bio-assay,	0965
Genetic variation; Sorghum,	0182	Sorghum, Grain, Palatability,	0965
Selection, Grain yield: Protein content; Sorghum,	0249	Sorghum, Nutritive value, Feed additives, Effect,	0965
Selection (Recurrent), Effect, Theses; Sorghum,	0205	Sorghum, Nutritive value, Methionine, Effect,	0965
Population density,		Sorghum, Nutritive value, Tannins/Content, Effect,	0965
Effect, Canada; Sorghum, Hybrids, Grain yield,	0476		0964 0965
Effect, Philippines; Sorghum, Varieties, Yields,	0462	Precipitation,	0308
Effect, Theses; Sorghum: Mung beans, Intercropping, Yields,	0484	Effect; Sorghum, Growth,	
Effect; Sorghum, Grain yield,	0409	Predators,	
Effect; Sorghum, Yields,	0423	India/Andhra Pradesh; Sorghum, Insect pests,	0805
Effect; Sorghum: Pigeonpea, Intercropping, Yields,	0535	Predators;	
Population density: Spacing,		Sorghum, Mythimna separata/Control,	0776
Effect, Australia; Sorghum, Grain yield,	0412	Predators: Parasitic insects,	
Effect; Sorghum, Yields,	0481	India/Karnataka; Sorghum, Contarinia sorghicola/Control,	0791
Effect; Sorghum: Pearl millet, Intercropping, Yields,	0515	Predators see also,	
Studies; Sorghum: Pigeonpea, Intercropping,	0517	Erythraeus	
Porometers;		Xanthopimpla stemmator	
Sorghum, Stomata/Resistance, Measurement,	0118	Preservation;	
Postharvest losses/Control,		Sorghum, Silage,	0871
Technology; Sorghum,	0877	Pricing policies: Crops/Budgets,	
Postharvest losses see also,		Relationship, India/Karnataka; Sorghum,	1028
Storage losses			
Postharvest technology,		Processing,	
Mechanization; Sorghum,	0876	Cost analysis; Sorghum,	0870
Philippines; Sorghum,	0865	Economics; Sorghum,	0857
Potassium: Calcium: Magnesium,		Effect, Cattle; Sorghum, Silage, Digestibility,	0920
Use; Sorghum, Hybrids,	0447	Effect, Cattle; Sorghum, Silage, Nutritive value,	0961
Potassium/Content,		Effect; Sorghum, Carbohydrates,	0858
Nitrogen fertilizers/Sidedressing,		Effect; Sorghum, Dry matter: Starch, Digestibility,	0912
Effect; Sorghum,	0466	Effect; Sorghum, Dry matter/Digestibility,	0858
Poultry,		Effect; Sorghum, Proteins/Digestibility,	0875
Theses; Sorghum, Digestibility, Enzymes, Effect,	0976	India/Andhra Pradesh; Sorghum,	0869
Poultry;		Theses; Sorghum,	0863
Milos, Amino acids,	0950	Processing see also,	
Sorghum, Composition: Energy (Metabolizable), Evaluation,		Dehulling	
		Flaking	
		Milling	

Peeling		Protein content; Amino acids/Content,	
Reconstitution		Changes, (during) Developmental sta-	
Production,		ges; Sorghum, Seeds,	0149
Canada; Sorghum (Forage),	1165	Protein content: Grain yield,	
India; Sorghum,	1032	Genetics; Sorghum,	0249
Mali; Sorghum,	1031	Nitrogen fertilizers: Water stress,	
Nigeria; Sorghum,	0024	Effect; Sorghum,	0449
	0391	Protein content: Grain yield;	
Philippines; Sorghum,	1029	Sorghum, Gene action,	0190
Review articles; Sorghum,	1024	Sorghum, Genetic control,	0190
Sudan; Sorghum,	0375	Sorghum, Random mating/Population,	
	1017	Selection,	0249
USA; Sorghum,	1033	Sorghum, Selection (Divergent),	0190
USA/Missouri; Sorghum,	0390	Protein content: Starch/Content,	
Upper Volta; Sorghum,	1021	Analysis; Sorghum, Grain,	0844
Production;		Protein quality,	
Sorghum,	1023	Analysis; Sorghum, Fermented products,	0980
	1027	Nigeria; Sorghum, Food products,	0995
Production costs,		Protein quality;	
USA/Kansas; Sorghum,	1018	Sorghum,	0992
USA/Nebraska; Sorghum,	1019	Protein synthesis,	
USA/Texas; Sorghum,	1020	Light effects; Sorghum,	0081
Progeny forms;		Protein synthesis: Starch synthesis,	
Sorghum, Contarinia sorghicola, Rep-		Enzymes, Role; Sorghum, Grain,	0139
roduction,	0787	Protein synthesis/Plastids,	
Progeny testing,		(for) Enzymes (Malic); Sorghum,	0080
(for) Grain yield; Sorghum,	0208	Proteins,	
Programming,		Extraction; Sorghum, Crops/Residues,	1006
Semi-arid tropics; Sorghum, Yields/		Proteins: Chlorophylls,	
Gaps, Analysis,	1014	Complexes; Sorghum,	0046
Proline,		Proteins: Enzymes,	
Effect; Sorghum, Seedlings, Nitrate		Analysis; Sorghum, Species,	0039
reductase/Activity,	0140	Proteins: Enzymes;	
Propachlor,		Sorghum (Male sterile), Anthers,	0256
Effect; Sorghum, Growth: Yields,	0108	Proteins: Enzymes: Nucleic acids,	
Propachlor: Atrazine;		Changes, (during) Developmental sta-	
Sorghum, Weed control,	0556	ges; Sorghum, Grain,	0840
Propazine: Metolachlor;		Proteins: Flavonoids,	
Sorghum, Cassia obtusifolia/Control,	0564	Interaction; Sorghum,	0084
Protection,		Proteins/Digestibility,	
(from) Herbicides, Toxicity, (by) Nap-		Cattle; Sorghum, Grain,	0971
thalic anhydride; Sorghum,	0579	Processing, Effect; Sorghum,	0875
(from) Metolachlor/Toxicity, (by)		Swine; Sorghum,	0936
CONCEP; Sorghum,	0575	Proteins/Digestibility;	
(from) Metolachlor/Toxicity, (by)		Sorghum,	0982
CONCEP; Sorghum, Seedlings,	0122	Proteins/Rations,	
Protection;		Cattle; Sorghum, Silage,	0943
Sorghum,	0815	Proteins/Solubility,	
Protection (Cross);		Butanol; Sorghum, Plastids,	0128
Sorghum, Maize dwarf mosaic virus:		Proteins/Yields;	
Sugarcane mosaic virus,	0687	Sorghum (Forage),	1118
Protein content,		Protoplasm,	
Irrigation: Planting date, Effect;		Culture; Sorghum,	0054
Sorghum,	0477	Isolation; Sorghum, Leaves,	0135
NPK fertilizers, Effect; Sorghum,	0464	Mitosis; Sorghum, Leaves,	0206
Nitrogen fertilizers, Effect; Sorghum,		Protoplast see,	
Genotypes,	0415	Protoplasm	
Protein content;			
Sorghum, Endosperm: Flours,	1002		

Pseudomonas syringae/Control,		tent; Sorghum,	0249
Bulgaria; Sorghum,	0672	Selection (Recurrent), Effect, Theses;	
Psudaletia unipunctata/Resistance,		Sorghum,	0205
Evaluation; Sorghum,	0775	Rations,	
Puccinia purpurea/Control,		Effect, Cattle; Sorghum, Silage,	0896
Moncozeb; Sorghum,	0629	Livestock; Sorghum,	0919
Puccinia purpurea/Resistance,		Poultry; Sorghum, Feed supplements,	0947
Amino acids: Phenols: Sugars, Role;		Rations/Proteins,	
Sorghum,	0630	Cattle; Sorghum, Silage,	0943
Puerto Rico;		Ratooning,	
Sorghum: Soybeans, Intercropping,		Effect; Sorghum, Grain yield: Water	
Yields, Height, Effect,	0492	balance,	0531
Sorghum x Sorghum sudanense, Hybrids,		Models; Sorghum,	0531
Forage/Yields, Harvesting/Intervals,		Review articles; Sorghum,	0518
Effect,	1112	USA/Georgia; Sorghum, Hybrids,	0490
Pyrilla perpusilla,		Yields, Insecticides: Nitrogen fert-	
Natural enemies, India/Punjab; Sorg-		ilizers, Effect; Sorghum,	0536
hum,	0799	Yields, Weed control, Effect; Sorghum,	0592
Pythium graminicola,		Ratooning;	
Infection, Effect; Sorghum, Seedlings,		Sorghum,	0349
Emergence,	0663		0489
Pythium graminicola/Resistance;		Ratooning: NPK fertilizers,	
Sorghum, Seedlings,	0663	Effect; Sorghum, Rhizosphere,	0327
Rabi,		Effect; Sorghum, Soils/Microorganisms,	0327
India; Sorghum, Yields, Vertisols,	0322		
Radiations,		Rats see,	
Effect; Sorghum (Forage), Seedlings,		Rodents	
Hydrocyanic acid content,	1125	Reconstitution,	
Radiations;		Cattle; Sorghum, Grain,	0969
Sorghum, Seed treatment,	0820	Effect, Sheep; Sorghum, Digestibility,	0889
Radiations/Period;		Effect, Sheep; Sorghum, Feedlots/Per-	
Sorghum, Zygotes,	0173	formance,	0889
Radiations see also,		Effect; Sorghum, Composition,	0926
Gamma radiation		Effect; Sorghum, Dry matter/Digesti-	
Infrared radiation		bility,	0926
Microwave radiation		Reconstitution: Soaking,	
Ultraviolet radiation		Cattle; Sorghum,	0970
X-Rays		Effect, Cattle; Sorghum, Nutritive	
Radioisotopes;		value,	0968
Sorghum, Roots/Depth, Estimation,	0092	Recurrent selection see,	
Rain: Soils,		Selection (Recurrent)	
Effect, South Africa; Sorghum, Yields,	0368	Red stripe virus/Resistance;	
Rain/Use: Irrigation;		Sorghum, Germplasm/Screening,	0677
Sorghum,	0356	Remote hybridization see,	
Rainfed farming,		Hybridizing (Intergeneric)	
India/Maharashtra; Sorghum, Growth:		Remote sensing;	
Yields, Manures, Effect,	0403	Sorghum, Maize dwarf mosaic virus	0681
India/Maharashtra; Sorghum, Growth:		Remote sensing: Infrared radiation;	
Yields, Tillage, Effect,	0403	Sorghum, Irrigation scheduling,	0352
India/Maharashtra; Sorghum, Hybrids:		Reproduction,	
Varieties, NPK fertilizers, Response,	0450	Progeny forms; Sorghum, Contarinia	
Rainfed farming;		sorghicola,	0787
Sorghum, Hybrids, Intercropping, Yie-		Reproduction;	
lds,	0494	Sorghum, Atherigona soccata,	0773
Random mating/Population,		Research,	
Agronomic characters, Evaluation;		Brazil; Sorghum,	0005
Sorghum,	0182		0006
Genetic variation; Sorghum,	0182	Cooperative activities, ICRISAT;	
Selection, Grain yield: Protein con-		Sorghum,	0011
		Ethiopia; Sorghum,	0010

ICRISAT, Mali; Sorghum,	0014	Residues,	
ICRISAT, Mali; Sorghum, Agronomy,	0383	Analysis, Senegal; Sorghum, Methiocarb,	0082
ICRISAT, Senegal; Sorghum,	0015	Analysis; Sorghum (Forage), Diazinon,	1131
ICRISAT, Sudan; Sorghum,	0016	Effect, Theses; Sorghum,	0534
ICRISAT, Upper Volta; Sorghum,	0017	Residues/Crops,	
ICRISAT, Upper Volta; Sorghum, Breeding,	0199	Effect; Sorghum, Yields,	0404
ICRISAT, West Africa; Sorghum, Economics,	1025	Nigeria; Sorghum,	0468
ICRISAT; Intercropping,	0500	Proteins, Extraction; Sorghum,	1006
ICRISAT; Sorghum,	0012	Toxicity; Sorghum,	0142
	0013	Residues/Phosphorus,	
	0711	Effect; Sorghum,	0458
ICRISAT; Sorghum, Entomology,	0711	Resistance to injurious factors,	
ICRISAT; Sorghum, Nitrogen fixation,	0344	Evaluation; Sorghum,	0102
ICRISAT; Sorghum, Weeds,	0576	Review articles;	
India, Review articles; Sorghum, Agronomy,	0394	Sorghum, Water stress,	0093
India, Review articles; Sorghum, Fertilizers/Use,	0472	Review articles;	
India, Review articles; Sorghum, Soil fertility,	0472	Sorghum, Agronomy, Research, India,	0394
India; Sorghum,	0019	Sorghum, Atherigona soccata, Research,	0774
	0029	Sorghum, Atherigona soccata, Research,	
India; Sorghum, Dry farming,	0384	Sudan,	0741
India/Gujarat; Sorghum,	0018	Sorghum, Breeding, Nutritive value,	0177
India/Gujarat; Sorghum (Forage),	1150	Sorghum, Composition,	0987
India/Karnataka; Sorghum,	0022	Sorghum, Curvularia: Fusarium,	0670
India/Karnataka; Sorghum, Agronomy,	0381	Sorghum, Drought resistance,	0093
India/Maharashtra; Sorghum,	0020	Sorghum, Fertilizers/Use, Research,	
India/Rajasthan; Sorghum,	0282	India,	0472
India/Tamil Nadu; Sorghum,	0021	Sorghum, Food products,	0987
Kenya; Sorghum, Agronomy,	0397	Sorghum, Grain molds,	0670
Nigeria; Sorghum,	0004	Sorghum, Induced mutation, Cysteine:	
	0296	EMS: Gamma radiation: Hydrazine: MMS,	0241
Nigeria; Sorghum, Agronomy,	0391	Sorghum, Insect pests/Control, India,	0713
Pakistan; Sorghum,	0026	Sorghum, Insect pests/Resistance,	0712
Pakistan; Sorghum, Insect pests, Biological control,	0715	Sorghum, Milling,	0987
Papua New Guinea; Sorghum, Agronomy,	0395	Sorghum, Mycoses,	0622
Review articles; Sorghum, Atherigona soccata,	0774	Sorghum, Nitrogen metabolism, Light:	
Romania; Sorghum, Hybrids,	0291	Mitochondria, Role,	0143
Semi-arid tropics, India; Sorghum,	0558	Sorghum, Nutritive value,	0987
Herbicides,	0027	Sorghum, Production,	1024
Senegal; Sorghum,	0741	Sorghum, Ratooning,	0518
Sudan, Review articles; Sorghum, Atherigona soccata,	0741	Sorghum, Seed characters,	0987
USA/Mississippi; Sorghum,	0008	Sorghum, Soil fertility, Research,	
USSR; Sorghum,	0023	India,	0472
West Africa; Sorghum, Grasshoppers,	0802	Rhizosphere,	
Yemen Arab Republic; Sorghum,	0031	Microorganisms; Sorghum,	0345
Research;		NPK fertilizers: Ratooning, Effect;	
Sorghum,	0002	Sorghum,	0327
Sorghum, Dry farming,	0028	Rhopalosiphum maidis/Resistance;	
Sorghum, Intercropping,	0500	Sorghum, Breeding,	0737
	0506	Rhyzopertha dominica/Resistance;	
Sorghum, Intercropping, Semi-arid tropics,	0504	Sorghum, Grain,	0794
Sorghum (Forage),	1137	Rice leafhopper see,	
		Nephotettix cincticeps	
		Rice weevil see,	
		Sitophilus oryzae	
		Risk/Yields,	
		Semi-arid tropics, India; Sorghum,	1012
		Rock phosphate;	
		Sorghum, Phosphorus/Uptake,	0417
			0420

Rock phosphate: Superphosphate, Comparison; Sorghum,	0420	Yields, Phosphate fertilizers, Effect; Sorghum: Wheat,	0458
Rodents, Hoarding; Sorghum,	0813	Yields, Soilmoisture: Tillage, Effect; Sorghum: Rice,	0382
Rodents; Sorghum,	0812	Yields, Zero-tillage, Effect; Sorghum: Wheat,	0414
Sorghum, Nutritive value: Tannins/ Content, Salts/Treatment, Effect,	0946	Yields; Sorghum: Maize: Soybeans,	0512
Romania; Sorghum, Hybrids, Research,	0291	Rotational cropping; Sorghum: Oats,	0544
Sorghum halepense/Control, Fusilade: Kusagard,	1095	Sorghum: Wheat,	0533
Root cap, Periconia circinata/Toxins, Effect; Sorghum,	0648	Sorghum (Forage),	1110
Root rots see also, Periconia		Rottboellia exaltata/Control, Herbicides/Safeners, Use; Sorghum,	0579
Roots, Elasticity; Sorghum,	0164	Roughage, Cattle; Sorghum, Silage,	0958
Minerals and nutrients, Leaching, Control; Sorghum x Sorghum sudane- nse, Hybrids,	0100	Runoff, Land preparation, Effect, USA/Texas; Sorghum,	0405
Minerals and nutrients uptake; Sor- ghum x Sorghum sudanense, Hybrids,	0100	Runoff/Losses: Phosphorus/Leaching, Relationship; Sorghum sudanense, Canopy,	1155
Role; Sorghum, Seedlings, Iron/Chlor- osis,	0440	Rusts see also, Puccinia purpurea	
Role; Sorghum, Seedlings, pH/Reduction, Sodium, Absorption; Sorghum,	0114	SAT see, Semi-arid tropics	
Strigol, Extraction; Sorghum,	0696	Sahel; Sorghum, Varieties, Grain yield,	0295
Water stress; Sorghum,	0094	Sorghum, Varieties, Nutritive value,	0295
Roots: Leaves, Amino acids/Leakage: Sugars/Leakage, Toluene, Effect; Sorghum,	0159	Salinity/Soils, Effect; Sorghum, Emergence,	0048
Roots/Depth, Estimation, (by) Radioisotopes; Sorg- hum,	0092	Salts/Distribution, Gypsum irrigation: Nitrogen fertil- izers, Effect; Sorghum (Forage), Clay soils,	1143
Roots/Growth, Mulches, Effect; Sorghum,	0120	Salts/Treatment, Effect, Rodents; Sorghum, Nutritive value: Tannins/Content,	0946
Soil density: Soil compaction, Effect; Sorghum,	0314	Effect; Sorghum, Nutritive value, Effect; Sorghum, Tannins/Content,	0993
Rotational cropping, Dry matter/Yields, USA/Iowa; Sorghum, Effect, Nigeria; Sorghum, Soil ferti- lity.	0495	Effect; Sorghum, Tannins/Content,	0993
Effect; Sorghum, Height: Yields, Effect; Sorghum, Yields, Irrigation, USA; Sorghum: Maize, Phosphorus-potassium fertilizers/ Requirements, Soils, Savannas, Nige- ria; Sorghum: Groundnuts,	0508	Saudi Arabia; Sorghum, Upland cropping,	0498
Soil fertility: Zero-tillage; Sorghum: Rice,	0320	Savannas, Nigeria; Sorghum, Phosphorus-potass- ium fertilizers/Requirements, Soils,	0467
Yields, Fertilizers, Effect, Nigeria; Sorghum: Wheat,	0468	Nigeria; Sorghum, Varieties,	0286
Yields, India/Uttar Pradesh; Sorghum, Yields, Nigeria; Sorghum: Cotton; Gro- undnuts,	0508	Nigeria; Sorghum: Groundnuts, Rotati- onal cropping, Phosphorus-potassium fertilizers/Requirements, Soils,	0467
	0509	Schizaphis graminum, Feeding deterrents, Bioassay; Sorghum,	0731
		Host range, Theses; Sorghum,	0733
		Migration, USA/Texas; Sorghum,	0729
		Nymphs/Rearing; Sorghum,	0735
		Theses; Sorghum, Yield loss/Assessm- ent,	0733
		Schizaphis graminum; Sorghum,	0736
			0740

Schizaphis graminum:Drought;		Growth,	0079
Sorghum, Yield loss,	0734	Effect, USA/Louisiana; Sorghum, Seed-	
Schizaphis graminum/Control,		lings, Emergence,	0814
Insecticides; Sorghum,	0708	Effect; Sorghum, Weed control,	0567
Schizaphis graminum/Resistance,		Fungicides; Sorghum,	0628
Brazil; Sorghum, Genotypes,	0732		0816
Schizaphis graminum/Resistance;		Infrared radiation; Sorghum,	0068
Sorghum,	0726	PCKB; Sorghum,	0817
	0730 0731 0739	Pesticides, Effect, Theses; Sorghum,	0823
Sclerotium/Control,		Radiations; Sorghum,	0820
(by) Sodium chloride; Sorghum, Seeds,		Seed treatment;	
Sphacelia sorghi,	0657	Sorghum, Atherigona soccata/Control,	
Seed-borne fungi,		Insecticides,	0770
Sudan; Sorghum,	0662	Seed weight,	
Seed-borne fungi/Control,		Changes, (during) Developmental sta-	
Fungicides; Sorghum,	0658	ges; Sorghum,	0149
Seed characters,		Seeding rates,	
Inheritance; Sorghum,	0191	Effect; Sorghum, Genotypes, Seed pro-	
Review articles; Sorghum,	0987	duction,	0884
Seed characters;		Seeding rates: Planting date,	
Sorghum,	0830	Effect; Sorghum, Atherigona soccata,	
Seed development,		Infestation,	0753
Selection, Effect; Sorghum,	0231	Seedling vigour,	
Seed development: Flowering,		Evaluation; Sorghum,	0103
Air moisture, Effect, Taiwan; Sorghum,	0056	Seedlings,	
Seed longevity,		Cuticle/Wax, P-Hydroxybenzaldehyde;	
Storage/Conditions, Effect; Sorghum,	0885	Sorghum,	0852
Seed parents/Identification,		Electrolytes/Leakage, Periconia	
Line x tester analysis, Theses; Sor-		circinata/Toxins, Effect; Sorghum,	0651
ghum,	0247	Emergence, Pythium graminicola, Inf-	
Seed production,		ection, Effect; Sorghum,	0663
India; Sorghum,	0878	Emergence, Seed treatment, Effect,	
	0882	USA/Louisiana; Sorghum,	0814
Irrigation, Effect; Sorghum, Genotypes,	0884	Ethylene/Formation, Metolachlor/	
Seeding rates, Effect; Sorghum, Geno-		Toxicity, Effect; Sorghum,	0122
types,	0884	Flavonoids/Synthesis, Ultraviolet	
Seed production;		radiation, Effect; Sorghum,	0070
Sorghum, Hybrids,	0881	Hydrocyanic acid content, Radiations,	
	0883	Effect; Sorghum (Forage),	1125
Sorghum (Male sterile), F1 hybrids,	0886	Induced mutation; Sorghum,	0242
Sorghum x Sorghum sudanense, Hybrids,	0886	Iron/Chlorosis, Roots, Role; Sorghum,	0440
Seed production/Techniques;		Metabolism; Sorghum,	0044
Sorghum,	0880	Nitrate reductase/Activity, Proline,	
Seed quality:Nitrogen fertilizers,		Effect; Sorghum,	0140
Effect; Sorghum, Agronomic characters,	0428	Periconia circinata/Toxins, Uptake;	
Effect; Sorghum, Grain yield,	0428	Sorghum,	0655
Seed size,		Protection, (from) Metolachlor/Toxi-	
Effect; Sorghum, Germination: Yields,	0370	city, (by) CONCEP; Sorghum,	0122
Genetics; Sorghum,	0183	Pythium graminicola/Resistance;	
Seed size;		Sorghum,	0663
Sorghum, Gene action,	0183	Triclopyr: 2-4-5-T: 3-6-dichloropic-	
Seed size: Grain yield;		olinic acid, Toxicity; Sorghum,	0550
Sorghum, Gene action,	0226	pH/Reduction, Roots, Role; Sorghum,	0440
Seed storage;		Seedlings/Growth,	
Sorghum,	0885	Light effects; Sorghum,	0044
Seed treatment,		Seed treatment, Effect, Theses; Sorg-	
(with) Polyethylene glycol; Sorghum,	0052	hum,	0079
Effect, Theses; Sorghum, Germination,	0079	Solar radiation (Eclipse), Effect;	
Effect, Theses; Sorghum, Seedlings/		Sorghum,	0240

Seedlings/Growth;		Sorghum, Yields, Climatic change, Effect,	0312
Sorghum, Fl hybrids, Ascorbic acid:			
Chlorophylls, Changes,	0179	Sorghum, Yields/Gaps, Analysis, Programming,	1014
Seedlings/Line,			
Effect; Sorghum, Yields,	0407	Senegal;	
Seeds,		Sorghum, Bird pests/Control, Methiocarb,	0082
Amino acids/Content: Protein content, Changes, (during) Developmental stages; Sorghum,	0149	Sorghum, Methiocarb, Residues, Analysis,	0082
Soils, Effect; Sorghum halepense,	1093	Sorghum, Research,	0027
Sowing/Quality; Sorghum,	0879	Sorghum, Research, ICRISAT,	0015
Sphacelia sorghi, Sclerotium/Control, (by) Sodium chloride; Sorghum,	0657	Sorghum, Tetranychids,	0783
Sugarcane mosaic virus, Effect; Sorghum,	0686	Sorghum, Yield loss, Bird pests,	0810
Selection,		Senescence see,	
(for) Yields, Theses; Sorghum,	0248	Aging	
Effect; Sorghum, Seed development,	0231	Sequential cropping see,	
Grain yield: Protein content; Sorghum, Random mating/Population,	0249	Rotational cropping	
Phenotypes/Classification, Role; Sorghum,	0187	Sesamia cretica,	
Selection (Directional),		Biological control, Egypt; Sorghum,	0782
Grain yield; Sorghum,	0208	Setosphaeria,	
Selection (Divergent),		Sudan; Sorghum,	0618
Grain yield: Protein content; Sorghum,	0190	Sewage products,	
Selection (Recurrent),		Effect; Sorghum, Leaves, Metals/Concentration,	0325
Effect, Theses; Sorghum, Random mating/Population,	0205	Effect; Sorghum, Yields,	0325
Semi-arid tropics,		Sewage product6/Soil treatment, Effect; Sorghum (Forage), Silage, Nutritive value,	1105
Brazil; Sorghum (Forage), Yields,	1120	Shattercane	1078
Evaluation; Sorghum, Growth/Simulation models,	0089	Shattercane: Sorghum halepense, Effect; Sorghum, Yields,	0598
India; Sorghum, Fertilizers/Use, Economics,	0437	Shattercane/Control,	
India; Sorghum, Herbicides. Research,	0558	Glyphosate: Paraquat, Sprayers; Sorghum,	0554
India; Sorghum, High-yielding varieties, Fertilizers/Use,	0436	Sheep;	
India; Sorghum, Luvisols, Cropping systems,	0505	Sorghum, Digestibility, Reconstitution, Effect,	0889
India; Sorghum, Production, (in) Vertisols, Watersheds/Technology, Economics,	0526	Sorghum, Digestibility, Sodium hydroxide/Treatment, Effect,	0889
India; Sorghum, Production, Soil management,	0520	Sorghum, Feed supplements,	0973
India; Sorghum, Production, Vertisols,	0520	Sorghum, Feed lots/Performance, Reconstitution, Effect,	0889
India; Sorghum, Soil management,	0505	Sorghum, Feed lots/Performance, Sodium hydroxide/Treatment, Effect,	0889
India; Sorghum, Threshers, Economics,	0606	Sorghum, Grain (Damaged), Nutritive value,	0895
India; Sorghum, Vertisols, Cropping systems,	0505	Sorghum, Poisoning, Hydrocyanic acid,	0967
India; Sorghum, Weed control, Atrazine,	0558	Sorghum, Silage,	0929
India; Sorghum, Yields/Risk,	1012	Sorghum, Silage, Nutritive value,	0940
India/Andhra Pradesh; Sorghum: Pigeonpea, Intercropping, Yield increase,	0540	Sorghum (Forage), Silage, Nutritive value: Digestibility,	1140
Research; Sorghum, Intercropping,	0504	Sorghum (Forage): Maize, Silage, Comparison,	1140
Upper Volta; Sorghum: Cowpeas, Intercropping,	0532	Shootfly see,	
Semi-arid tropics;		Atherigona	
Sorghum, Nitrogen fertilizers,	0418	Sidedressing/Nitrogen fertilizers, Effect; Sorghum, Calcium/Content,	0466
		Effect; Sorghum, Magnesium/Content,	0466

Effect; Sorghum, Potassium/Content, Silage,	0466	ids, Weed control,	0549
(as) Roughage, Cattle; Sorghum,	0958	Simulation models/Growth,	
Ammonia, Effect; Sorghum (Forage), Cattle; Sorghum,	1133	(for) Semi-arid tropics, Evaluation; Sorghum,	0089
Comparison, Cattle; Sorghum: Alfalfa, Comparison, Sheep; Sorghum (Forage)	0890	Sitophilus oryzae/Resistance, Evaluation; Sorghum,	0795
:Maize,	0957	Sitophilus oryzae/Resistance; Sorghum, Grain,	0794
Composition, Fibre content, Effect, Theses; Sorghum,	1140	Sitophilus zeamais/Resistance; Sorghum,	0796
Composition, Lactobacillus plantarum/ Inoculation, Effect; Sorghum,	0930	Sludge see,	
Digestibility, Cattle; Sorghum,	0908	Sewage products	
Digestibility, Processing, Effect, Cattle; Sorghum,	0937	Soaking: Reconstitution,	
Digestibility: Nutritive value, Sheep; Sorghum (Forage),	0920	Cattle; Sorghum,	0970
Digestibility: Nutritive value, Sodium hydroxide/Treatment, Effect, Cattle; Sorghum,	1140	Effect, Cattle; Sorghum, Nutritive value,	0968
Dry matter/Digestibility; Sorghum,	0917	Sodium,	
Feed additives, Cattle; Sorghum,	0949	Absorption; Sorghum, Roots, Translocation; Sorghum,	0114
Feed additives; Sorghum,	0893	Sodium: Calcium,	0114
Feed additives; Sorghum (Forage), Feeds; Sorghum (Forage), Nutritive value, Cattle; Sorghum,	0892	Effect; Sorghum, Germination,	0048
	0894	Sodium chloride;	
	1106	Sorghum, Seeds, Sphacelia sorghi, Sclerotium/Control,	0657
	1128	Sodium hydroxide/Treatment,	
	0898	(effect on) Cattle/Lactation; Sorghum, Silage,	0917
	0938	Effect, Cattle; Sorghum, Silage, Digestibility: Nutritive value,	0917
Nutritive value, Comparison, Cattle; Sorghum: Maize,	0891	Effect, Sheep; Sorghum, Digestibility,	0889
Nutritive value, Fibre content, Effect, Theses; Sorghum,	0930	Effect, Sheep; Sorghum, Feedlots/Performance,	0889
Nutritive value, Processing, Effect, Cattle; Sorghum,	0961	Effect; Sorghum, Straw/Digestibility,	0911
Nutritive value, Sewage products/ Soil treatment, Effect; Sorghum (Forage),	1105	Soil-borne diseases/Control,	
Nutritive value, Sheep; Sorghum,	0940	Fungicides, USA/Louisiana; Sorghum,	0814
Nutritive value; Sorghum,	0910	Soil compaction: Soil density,	
	0949	Effect; Sorghum, Roots/Growth,	0314
Nutritive value; Sorghum x Sorghum sudanense, Hybrids,	0910	Soil density: Soil compaction,	
Preservation; Sorghum,	0871	Effect; Sorghum, Roots/Growth,	0314
Proteins/Rations, Cattle; Sorghum,	0943	Soil depth,	
Rations, Effect, Cattle; Sorghum,	0896	Effect; Sorghum, Yields,	0406
Sheep; Sorghum,	0929	Soil fertility,	
Sodium hydroxide/Treatment, (effect on) Cattle/Lactation; Sorghum,	0917	Fertilizers: Manures, Effect, Upper Volta; Sorghum, Tropical soils,	0321
Storage, Cattle; Sorghum,	0859	Lime/Application, Effect; Sorghum (Forage),	1110
Silage/Production,		Research, India, Review articles; Sorghum,	0472
USA/Louisiana; Sorghum, Hybrids,	0266	Rotational cropping, Effect, Nigeria; Sorghum,	0508
Zero-tillage, Effect; Sorghum, Hybrids,	1139	Taiwan; Sorghum,	0444
Zero-tillage; Sorghum (Forage),	1109	USA/Florida; Sorghum,	0319
Silage/Production;		Soil fertility: Zero-tillage;	
Sorghum, Varieties,	1163	Sorghum: Rice, Rotational cropping,	0320
Silage/Quality,			0453
Theses; Sorghum (Forage),	1147	Soil management,	
Simazine: Atrazine: 2-4-D,		India; Sorghum, Production,	0539
India/Andhra Pradesh; Sorghum, Hybr-		Semi-arid tropics, India; Sorghum,	0505
			0520



Soil moisture,		Soils/Nitrogen content:Yields,	
Effect;Sorghum,Alachlor:Metolachlor,		Relationship; Sorghum,	0323
Toxicity,	0569	Soils/pH,	
Effect;Sorghum,Growth,	0347	Effect,Malaysia;Sorghum,	0315
Effect;Sorghum,Hybrids,Growth:Water		Soils/Salinity,	
relations:Yields,	0057	Effect;Sorghum,Emergence,	0048
Effect;Sorghum,Mycorrhizae,	0347	Soils see also,	
Effect;Sorghum,Nitrogen fixation,		Acid soils	
Azospirillum,	0326	Calcareous soils	
Effect;Sorghum,Water use,	0347	Clay soils	
Effect;Sorghum,Yields,	0324	Podzols	
India/Maharashtra; Sorghum,	0153	Solonetz	
Spacing:Tillage,Effect;Sorghum,	0488	Tropical soils	
Soil moisture:CONCEP,		Vertisols	
Effect;Sorghum,Metolachlor/Uptake,	0095	Solanum karsensis/Control,	
Soil moisture:Tillage,		Atrazine:2-4-D; Sorghum,	0574
Effect;Sorghum:Rice,Rotational		Solar radiation,	
cropping,Yields,	0382	Effect,Bibliographies;Sorghum,	0304
Soil physicochemical properties,			0305
Fertilizers:Manures,Effect,(in)		Solar radiation(Eclipse),	
Vertisols	0431	Effect;Sorghum,Chromosome manipu-	
Tillage,Effect;Sorghum,	0411	lation,	0240
Soil physicochemical properties;		Effect;Sorghum,Seedlings/Growth,	0240
Sorghum,	0320	Solonetz;	
Soil temperature:Air temperature:		Sorghum,Hybrids,Cultivation,	0301
Leaf temperature,		Somatic cells see,	
Canopy,Effect;Sorghum,	0309	Cells(Somatic)	
Timing(Day),Effect;Sorghum,	0309	Sorghum(Bird resistant),	
Soil testing,		Digestibility,Formaldehyde/Treatm-	
Iron:Zinc;Sorghum,	0316	ent,Effect,Swine	0931
Soil treatment/Sewage products,		Dry matter/Digestibility	0921
Effect;Sorghum(Forage),Silage,Nut-		Grain,Flavonoids/Content,Chromato-	
ritive value,	1105	graphy	0835
Soils,		Grain,Phenolic compounds,Analysis	0826
(in)Irrigated farming,Australia;		Grain,Tannins/Changes,(during)Dev-	
Sorghum,Atrazine/Dissipation,	0590	elopmental stages	0834
Effect;Sorghum halepense,Seeds,	1093	Hybrids,Grain,Tannins	0843
Nitrogen content/Change,Models;		Nutritive value,Formaldehyde/Trea-	
Sorghum,	0323	tment,Effect,Swine	0931
Savannas,Nigeria;Sorghum,Phosphorus-		Sorghum(Fermented),	
potassium fertilizers/Requirements,	0467	Nutritive value	0981
Savannas,Nigeria;Sorghum:Groundnuts,		Sorghum(Forage),	
Rotational cropping,Phosphorus-		Agronomic characters,Genetic vari-	
potassium fertilizers/Requirements,	0467	ation	1154
Sulphur,USA/Florida;Sorghum,	0319	Agronomic characters,Theses	1147
Soils;		Agronomic characters:Yields,Genetic/	
Sorghum,Metriflufen,Leaching,	0585	Relationship	1134
Soils:Rain,		Bacterioses,French Guyana	1104
Effect,South Africa;Sorghum,Yields,	0368	Clay soils,Salts/Distribution,Gyp-	
Soils/Microorganisms,		sum:Irrigation:Nitrogen fertiliz-	
NPK fertilizers:Ratoouing,Effect;		ers,Effect	1143
Sorghum,	0327	Combining ability	1107
Soils/Microorganisms;			1156
Sorghum,	0330	Composition	1158
Soils/Nitrogen,		Composition:Nutritive value,Ferme-	
Absorption;Sorghum,	0453	ntation,Effect	1111
Losses,Effect,(under)Irrigation;		Diazinon,Residues,Analysis	1131
Sorghum,Yields,	0460	Dry matter/Digestibility,Mutants,	
Manures,Effect;Sorghum,	0474	Effect	1124

Dry matter/Yields	1118	Yields,NPK fertilizers/Application	
Excreta/Livestock, Effect	1145	methods,Effect	1129
Fl hybrids, Nutritive value, Comparison	1148	Yields,Nitrogen fertilizers, Effect, Theses	1126
Feeds, Cattle, Theses	1102	Yields,Phosphate fertilizers,Effect	1141
Fibre content, Moisture effects	1119	Yields,Planting date, Effect, Theses	1126
Genotypes, Environmental effects	1120	Yields,Semi-arid tropics,Brazil	1120
Growth,Argentina	1152	Yields:Defoliation/Management,Effect	1115
Growth, Theses	1127	Sorghum (Forage) : Maize,	
	1135	Comparison	1100
Growth,Water table,Effect	1130	Silage,Comparison, Sheep	1140
Growth:Digestibility:Yields,Agronomic characters, Effect	1121	Sorghum (Forage) see also,	
High-yielding varieties, India	1099	Sorghum x Sorghum sudanense	
Hybrid vigour	1107	Sorghum (Forage) x Sorghum sudanense (Rhodesian),	
	1156	Fl hybrids, Performance	1159
Hybrids,Yields	1108	Sorghum(Male sterile),	
Hydrocyanic acid content, Evaluation	1142	Anthers, Amino acids, Analysis	0849
Insect pests/Incidence, Planting date,Effect	1160	Anthers,Enzymes:Proteins	0256
Irrigation, USSR	1146	Fl hybrids,Seed production	0886
Lignins, Mutants, Effect	1124	Florets/Abortion, Causes	0116
Mycoses, French Guyana	1104	Gene action, Line x tester analysis	0180
Nutrition	1158	Helminthosporium sorghicola/Resistance, Evaluation	0643
Nutritive value, Mutants, Effect	1124	Sorghum (Volunteer),	
Nutritive value, Phosphate fertilizers, Effect	1141	Control,Alachlor:Metolachlor	1096
Production, Canada	1165	Sorghum alnum,	
Proteins/Yields	1118	Leaves, Photosynthesis, Light/Angle, Effect	0171
Research, India/Gujarat	1150	Sorghum arundinaceum,	
Research	1137	Agronomy, Sudan	0371
Rotational cropping	1110	Atherigona soccata, Kenya	0752
Seedlings,Hydrocyanic acid content, Radiations, Effect	1125	Emergence: Establishment, Irrigation: Sowing, Effect	0077
Silage,Ammonia,Effect	1133	Insect pests/Control, Sudan	0703
Silage, Digestibility:Nutritive value, Sheep	1140	Sorghum caudatum,	
Silage,Feed additives	1106	Germplasm/Collections, Ethiopia	0232
Silage, Feeds	1128	Pericarp: Testa/Colour, Inheritance	0246
Silage,Nutritive value, Sewage products/Soil treatment, Effect	1105	Sorghum durra see,	
Silage/Product ion, Zero-tillage	1109	Durras	
Silage/Quality, Theses	1147	Sorghum halepense,	
Soil fertility,Lime/Application, Effect	1110	(for) Energy	1075
Sowing	1144	Allelopathy, (on)Amaranthus retroflexus	1087
Sugars, Mutants, Effect	1124	Allelopathy, (on)Maize	1087
Toxins	1164	Chemical control	1074
Uses, Argentina	1152	Growth, Glyphosate, Effect	1080
Varieties, Comparison	1117	Leaves, optical properties, Statistics	1079
Varieties, Composition, India/Haryana	1101	Maize dwarf mosaic virus, Greece	1090
Yields,Genetic variation	1151	Panicles, Anatomy	1089
Yields, Harvesting/Timing, Effect	1162	Seeds, Soils, Effect	1093
Yields,Herbicides,Effect	0551	Variation	1088
Yields, Insect pests,Cultural control,Effect	1160	Sorghum halepense: Shattercane, Effect; Sorghum, Yields	0598
Yields,Lime/Application,Effect	1110	Sorghum halepense/Control,	
Yields,Lime/Nitrogen,Effect	1132	(in) Sugarcane	1083
Yields,Line x tester analysis	1156	DSMA:Hoeing:Weeding	1081
		Ecology (Argentina)	1071
		Fluazifop-butyl	1082

Fusilade:Kusagard, Romania	1095	Evaluation	1142
Glyphosate	1076	Hybrids, Performance trials, USA/ New Mexico	0274
Herbicides	1077 1080 1097	Hybrids, Roots, Minerals and nutrie- nts, Leaching, Control	0100
Metriflufen	1084 1086 1091 1094	Hybrids, Roots, Minerals and nutrie- nts uptake	0100
Metriflufen/Trans location, Environ- mental effects	1092	Hybrids, Seed production	0886
Tillage, Effect	1085	Hybrids, Silage, Nutritive value	0910
Sorghum nervosum, Taxonomy, China	1072	Hybrids, Yields, Phosphate fertiliz- ers, Effect	1141
Sorghum nigricans, Nitrogen fixation, Bacteria, Induction	0040	Sorghum x Sorghum sudanense:Festuca arundinacea, Intercropping, Forage/Yields	1103
Sorghum saccharatum, Bibliographies	0332	South Africa; Sorghum, Byproducts, Feeds,	0942
Performance, Brazil	1047	Sorghum, Yields, Rain: Soils, Effect,	0368
Sorghum subglabrescens see, Milos	0268	Sowing; Sorghum (Forage),	1144
Sorghum sudanense, Canopy, Phosphorus/Leaching: Runoff/ Losses, Relationship	11.5	Sowing: Irrigation, Effect; Sorghum arundinaceum, Emerg- ence: Establishment,	0077
Dry matter/Digestibility, Mutants (Brown midrib), Effect	0192	Sowing/Methods, Effect, (in) Irrigated farming; Sorg- hum, Striga, Infestation,	0693
Fibre content, Mutants (Brown midrib) , Effect	0192	Sowing/Methods; Sorghum: Bermuda grass, Intercropping,	0527
Hydrocyanic acid, Evaluation	1123	Sowing/Quality; Sorghum, Seeds,	0879
Leaves, Translocation/Photosynthates, Water stress, Effect	0158	Sowing depth: Planting date, Effect; Sorghum, Yields,	0410
Nutrition, Mycorrhizae/Infection, Effect	1122	Spacing, Effect, India/Maharashtra; Sorghum, Hybrids, Yields,	0451
Phosphate fertilizers	1122	Effect; Sorghum, Grain yield,	0409
Striga/Resistance	0691	Effect; Sorghum, Water use,	0401
Yields, Manures/Nitrogen content, Effect	1113	Effect; Sorghum: Legumes, Intercropp- ing, Yields,	0530
Sorghum sudanense (Rhodesian) x Sorg- hum sudanense, Fl hybrids, Performance	1159	Effect; Sorghum: Maize: Millet, Ferti- lizers/Uptake,	0402
Sorghum sudanense x Sorghum see, Sorghum x Sorghum sudanense		Effect; Sweet sorghums, Yields,	1055
Sorghum x Millets, Hybrids, Enzymes	0212	Spacing; Sorghum: Soybeans, Intercropping,	0528
Sorghum x Rice, Hybridizing (Intergeneric)	0259	Spacing: Population, Effect, Botswana; Sorghum, Yields,	0400
Hybrids, DNA/Reassociation	0259	Spacing: Population density, Effect, Australia; Sorghum, Grain yield,	0412
Sorghum x Sorghum sudanense, Hybrids, Bacteria (Ratoon stunting) , Isolation: Pathogenicity	0671	Effect; Sorghum, Yields,	0481
Hybrids, Corynebacterium	1136	Effect; Sorghum: Pearl millet, Inter- cropping, Yields,	0515
Hybrids, Forage, Nutritive value	1111	Studies; Sorghum: Pigeonpea, Inter- cropping,	0517
Hybrids, Forage/Yields, Comparison	1161	Spacing: Tillage, Effect; Sorghum, Soil moisture,	0488
Hybrids, Forage/Yields, Harvesting/ Intervals, Effect, Puerto Rico	1112	Effect; Sorghum, Yields,	0488
Hybrids, Forage/Yields, Harvesting/ Timing, Effect	1162	Spacing: Water use: Population, Relationship; Sorghum,	0401
Hybrids, Hay, Feed supplements, Cattle	1138		
Hybrids, Hydrocyanic acid/Toxicity, Cattle	1153		

Spacing/Studies,		Cattle	
(in) Intercropping; Sorghum,	0529	Stem borers see,	
Spain;		Chilo partellus	
Sorghum, Varieties,	0294	Sesamia cretica	
Sweet sorghums, Fuel/Production,	1056	Stems,	
Species,		Carbohydrateb/Fermentation, Inheri-	
Enzymes: Proteins, Analysis; Sorghum,	0039	tance, Theses; Sorghum,	0185
Relationship; Sorghum,	0039	Fermentation; Sorghum,	0827
Tropics , Australia; Sorghum,	0038	Storage/Time, Analysis; Sorghum,	0827
Sphacelia sorghi,		Sucrose; Sweet sorghums,	1036
Alkaloids, Biosynthesis; Sorghum,	0656	Vascular bundles; Sorghum,	0036
Sclerotium/Control, (by) Sodium chl-		Stomata/Resistance,	
oride; Sorghum, Seeds,	0657	Measurement, (by) Porometers; Sorghum,	0118
Sphacelotheca reiliana/Resistance,		Storage,	
Theses; Sorghum,	0626	Cattle; Sorghum, Silage,	0859
Sphacelotheca sorghi,		India/Andhra Pradesh; Sorghum,	0869
India; Sorghum,	0627	Storage/Conditions,	
Sphacelotheca sorghi/Control,		Effect; Sorghum, Seed longevity,	0885
Fungicides; Sorghum,	0628	Storage/Time,	
Spikelets,		Analysis; Sorghum, Stems,	0827
Contarinia sorghicola, Hibernation;		Storage losses/Assessment,	
Sorghum,	0786	Malawi; Sorghum,	0864
Environmental effects; Sorghum,	0306	Stored products pests/Control,	
Spodoptera frugiperda/Resistance,		Carbon dioxide: Methyl bromide, Fum-	
Evaluation; Sorghum,	0777	igation; Sorghum,	0797
Spores,		Stored products pests see also,	
Germination; Sorghum, Pollen, (effect		Rhyzopertha	
on) Colletotrichum graminicola,	0645	Sitophilus	
Germination inhibitors, Effect; Sor-		Straw (Ammoniated),	
ghum, Peronosclerospora sorghi,	0639	Nutritive value, Cattle; Sorghum,	0905
Sprayers;		Straw/Digestibility,	
Sorghum, Shattercane/Control, Glypho-		Sodium hydroxide/Treatment, Effect;	
osate: Paraquat,	0554	Sorghum,	0911
Sprinkler irrigation,		Straw/Manures,	
ICRISAT; Sorghum, Water stress/Stud-		Effect; Sorghum, Nitrogen fertilizers,	0424
ies,	0141	Effect; Sorghum, Yields,	0424
Sprinkler irrigation: Surface irriga-		Straw mulches,	
tion,		Effect; Sorghum, Water stress,	0317
Effect; Sorghum, Grain yield,	0350	Effect; Sorghum, Water use efficiency,	0324
Stalk rot/Incidence,		Effect; Sorghum, Yields,	0324
Tillage, Effect; Sorghum,	0652	Straw mulches;	
Starch,		Sorghum, Water stress/Reduction,	0317
Thermal properties; Sorghum,	0824	Striga,	
Starch: Dry matter,		Infestation, Effect; Sorghum, Genoty-	
Digestibility, Particle size, Effect;		pes, Growth,	0700
Sorghum,	0912	Infestation, Effect; Sorghum, Genoty-	
Digestibility, Processing, Effect;		pes, Yields,	0700
Sorghum,	0912	Infestation, Sowing/Methods, Effect,	
Starch/Content: Protein content,		(in) Irrigated farming; Sorghum,	0693
Analysis; Sorghum, Grain,	0844	Nitrogen fertilizers, Effect; Sorghum,	0692
Starch/Production;		Striga;	
Milos,	1010	Sorghum, Yield loss,	0694
Starch synthesis: Protein synthesis,		Striga/Resistance,	
Enzymes, Role; Sorghum, Grain,	0139	Evaluation, ICRISAT; Sorghum,	0698
Statistical analysis;		Evaluation; Sorghum,	0697
Sorghum, Intercropping,	0513	ICRISAT; Sorghum, Breeding,	0698
Statistics,		Striga/Resistance;	
Argentina; Sorghum, Hybrids,	0283	Sorghum sudanense,	0691
Steers see,			

Striga asiatica,		Infection, Growth substances, Effect;	
Germination, Strigol, Effect	0696	Sorghum,	0685
Striga asiatica/Resistance,		infrastructure; Sorghum,	0680
ICRISAT; Sorghum, Breeding,	0699	Sugarcane mosaic virus;	
Striga hermonthica;		Sorghum, Yield loss,	0684
Sorghum,	0691	Sugarcane mosaic virus:Maize dwarf	
Striga hermonthica/Control,		mosaic virus,	
Atrazine:Nitrophoska; Sorghum,	0695	Protection (Cross); Sorghum,	0687
Effect; Sorghum, Grain yield,	0695	Sugars,	
Strigol,		Mutants, Effect; Sorghum (Forage),	1124
Effect; Striga asiatica, Germination,	0696	Sugars:Amino acids; Phenols,	
Extraction; Sorghum, Roots,	0696	Role; Sorghum, Puceinia purpurea/	
Substrates effect;		Resistance,	0630
Sorghum, Enzymes,	0049	Sugars/Leakage:Amino acids/Leakage,	
Subtropics see,		Toluene, Effect; Sorghum, Leaves:Roots,	0159
Tropics		Sulphur,	
Sucrose;		Effect; Sorghum, Hybrids, Iron/Uptake:	
Sweet sorghums, Stews,	1036	Yields,	0416
Sudan,		USA/Florida; Sorghum, Soils,	0319
Review articles; Sorghum, Atherigona		Superphosphate:Rock phosphate,	
soccata, Research,	0741	Comparison; Sorghum,	0420
Sudan;		Supply and demand see,	
Durras, Nematodes,	0690	Supply balance	
Sorghum, Agronomy,	0361	Supply balance,	
Sorghum, Performance trials,	0302	Mali; Sorghum,	1031
Sorghum, Physiology,	0361	Models; Sorghum,	1015
Sorghum, Production,	0375	Surface irrigation:Sprinkler irriga-	
	1017	tion,	
Sorghum, Research, ICRISAT,	0016	Effect; Sorghum, Grain yield,	0350
Sorghum, Seed-borne fungi,	0662	Sweet sorghums,	
Sorghum, Setosphaeria,	0618	Alcohols/Production, Brazil	1063
Sorghum, Varieties,	0272		1066
Sorghum, Varieties, Grain yield,	0295	Alcohols/Production, Byproducts,	
Sorghum, Varieties, Nutritive value,	0295	(as) Feeds	1061
Sorghum, Varieties, Performance tri-		Alcohols/Production, Thailand	1051
als,	0262	Alcohols/Production, USA	1040
Sorghum, Weed control, Herbicides,	0563	AleohoIs/Production	1008
Sorghum arundinaceum, Agronomy,	0371		1039 1042 1049 1058
Sorghum arundinaceum, Insect pests/		Biomass; Height: Leaf area index,	
Control,	0703	Relationship	1062
Sudan grass see,		Biomass/Production, Japan	1050
Sorghum sudanense		Biomass/Production, Models	1062
Sudax see,		Biomass/Production	1058
Sorghum x Sorghum sudanense			1064
Sugar/Production,		Feeds, Cattle	1044
Evaluation; Sweet sorghums, Varieties,	1045	Feeds, Nutritive value, Composition,	
Maturity, Effect, Australia; Sweet		Effect	1067
sorghums,	1046	Feeds, Nutritive value	1068
USA; Sweet sorghums,	1037	Fermentation, Alcohols/Production,	
Sugar/Product ion;		Theses	1057
Sweet sorghums,	1034	Fertilizers, Effect, Theses	1059
	1041	Fuel/Production, Spain	1056
Sugar sorghums see,		Irrigation, USA/Texas	1035
Sweet sorghums		Maize dwarf mosaic virus/Resistance,	
Sugarcane aphid see,		USA	1069
Melanaphis sacchari			1070
Sugarcane mosaic virus,		Methane/Production, Brazil	1048
Effect; Sorghum, Seeds,	0686	Mineral fertilizers	1068
Growth inhibitors; Sorghum,	0678	Phosphate fertilizers, Effect, Theses	1054

Steins, Sucrose	1036	tance,	0728
Sugar/Production, Maturity, Effect, Australia	1046	Sorghum, Nephotettix cincticeps,	0801
Sugar/Production, USA	1037	Sorghum, Peronosclerospora sacchari/Resistance,	0633
Sugar/Product ion	1034	Sorghum, Phosphorus-potassium fertilizers, Effect,	0444
	1041		0444
Syrup/Production, Microorganisms, Effect	1043	Sorghum, Soil fertility,	0154
Syrup/Production, USA	1037	Sorghum, Yields, Defoliation, Effect,	0580
Varieties, Alcohols/Production	1052	Weed control, Herbicides,	0202
Varieties, Biomass/Production	1052	Tan colour,	
Varieties, Sugar/Production, Evaluation	1045	Inheritance; Sorghum,	0838
Varieties, USA	1038	Tannins,	0825
Yields, Evaluation, Australia	1045	Analysis; Sorghum, Grain,	0921
Yields, Maturity, Effect, Australia	1046	Composition; Sorghum,	0825
Yields, NPK fertilizers, Effect	1060	Effect; Sorghum, Dry matter/Digestibility,	0842
Yields, Spacing, Effect	1055	Effect; Sorghum, Nutritive value,	0888
Yields, Weed control, Effect	1055	Evaluation; Sorghum, Varieties,	0843
Yields	1068	Tannins;	
		Sorghum, Feeds,	
Sweet sorghums	1053	Sorghum (Bird resistant), Hybrids,	
	1065	Grain,	
Sweet sorghums see also,		Tannins/Changes,	
Sorghum saccharatum		(during) Developmental stages; Sorghum (Bird resistant), Grain,	0834
Swine;			
Sorghum, Amino acids,	0975	Tannins/Content,	
Sorghum, Digestibility, Particle size, Effect,	0954	Analysis; Sorghum,	0830
Sorghu, Digestibility, Tannins/Content, Effect,	0902	Effect, Poultry; Sorghum, Digestibility,	0945
Sorghum, Energy/Digestibility,	0936	Effect, Poultry; Sorghum, Nutritive value,	0945
Sorghum, Feeds,	0928		0964 0965
Sorghum, Feeds, Nutritive value,	0951	Effect, Swine; Sorghum, Digestibility,	0902
Sorghum, Proteins/Digestibility,	0936	Salts/Treatment, Effect; Sorghum,	0993
Sorghum (Bird resistant), Digestibility, Formaldehyde/Treatment, Effect,	0931	Tannins/Content: Bird pests/Resistance, Environmental effects; Sorghum, Hybrids,	0811
Sorghum (Bird resistant), Nutritive value, Formaldehyde/Treatment, Effect,	0931	Tannins/Content: Nutritive value, Salts/Treatment, Effect, Rodents; Sorghum,	0946
Symbiosis/Mycorrhizae,			
Phosphate fertilizers, Effect; Sorghum,	0339	Tannins see also,	
		Flavonoids	
Synchronization;		Tanzania;	
Sorghum, Hybrids, Flowering,	0104	Sorghum: Chickpea, Intercropping,	0485
Synkaryogenesis;			
Sorghum, Dihaploids/Development,	0224	Taxiphyllin,	
Syrup/Production,		Biosynthesis; Sorghum,	0067
Microorganisms, Effect; Sweet sorghums,	1043	Taxonomy,	
USA; Sweet sorghums,	1037	China; Sorghum nervosum,	0040
Taiwan;		Taxonomy;	0193
Peronosclerospora sacchari, Host range,	0633	Technology;	
Sorghum, Flowering: Seed development, Air moisture, Effect,	0056	Sorghum, Postharvest losses/Control,	0877
Sorghum, Longiunguis sacchari/Resistance, Inheritance,	0727	Temperature: Particle size, Effect; Sorghum, Phosphorus/Uptake,	0417
Sorghum, Melanaphis sacchari/Resistance,		Temperature effects,	
		Theses; Sorghum, Emergence: Germination,	0115

Temperature effects;		Effect,	0483
Sorghum, Growth,	0157	Sorghum, Harvesting/Index, (for) Yields,	0248
Sorghum, Phloem, Nutrient transport,	0157	Sorghum, Herbicides, Toxicity, CONCEP,	
Sorghum, Tillering,	0088	Effect,	0572
Temperature resistance,		Sorghum, High-yielding varieties,	
Physiological studies, Theses; Sorghum,	0168	Composition,	0845
Tempering;		Sorghum, High-yielding varieties,	
Sorghum, Grain, Water uptake/Rate,	0854	Cooking quality,	0845
	0855	Sorghum, Hybrids, Flowering, Agronomic practices,	0134
Testa/Colour: Pericarp,		Sorghum, Hybrids, Growth, Intercropping, Effect,	0519
Inheritance; Sorghum caudatum,	0246	Sorghum, Hybrids, Growth, Irrigation, Effect,	0519
Tetranychids,		Sorghum, Hybrids, Yields, Intercropping, Effect,	0519
Senegal; Sorghum,	0783	Sorghum, Hybrids, Yields, Irrigation, Effect,	0519
Tetraploids (Induced),		Sorghum, Leucaena/Leaves, Effect,	0459
(from) Diploids; Sorghum,	0213	Sorghum, Milling,	0860
Thailand;		Sorghum, ModeIs,	0311
Sorghum, Atherigona soccata, Insect biology,	0756	Sorghum, Nitrogen fixation, Bacteria,	0331
Sorghum, Atherigona soccata/Control, Carbofuran,	0756	Sorghum, Nutrition,	0459
Sweet sorghums, Alcohols/Production,	1051	Sorghum, Peronosclerospora sorghi, Cultural control,	0634
Thermal properties;		Sorghum, Peronosclerospora sorghi/Resistance, Inheritance,	0632
Sorghum, Flours,	0824	Sorghum, Phenology, Environmental effects,	0311
Sorghum, Starch,	0824	Sorghum (Processing),	0863
Theses;		Sorghum, Random mating/Population, Selection (Recurrent), Effect,	0205
Sorghum, Agronomic characters: Lodging/Resistance, Inheritance,	0228	Sorghum, Residues, Effect,	0534
Sorghum, Alcohols/Production,	1011	Sorghum, Schizaphis graminuin, Host range,	0733
Sorghum, Anatomy: Physiology: Yields/Stability, Environmental effects,	0377	Sorghum, Seed parents/Identification, Line x tester analysis,	0247
Sorghum, Atherigona soccata/Resistance, Inheritance,	0754	Sorghum, Seed treatment, Pesticides, Effect,	0823
Sorghum, Calocoris angustatus/Control,	0804	Sorghum, Seedlings/Growth, Seed treatment, Effect,	0079
Sorghum, Caryopsis, Development,	0110	Sorghum, Selection, (for) Yields,	0248
Sorghum, Cooking quality,	0860	Sorghum, Silage, Composition, Fibre content, Effect,	0930
Sorghum, Digestibility, Enzymes, Effect, Poultry,	0976	Sorghum, Silage, Nutritive value, Fibre content, Effect,	0930
Sorghum, Drought resistance,	0169	Sorghum, Sphacelotheca reiliana/Resistance,	0626
Sorghum, Emergence: Germination, Temperature effects,	0115	Sorghum, Stems, Carbohydrates/Fermentation, Inheritance,	0185
Sorghum, Establishment, Effect,	0534	Sorghum, Temperature resistance, Physiological studies,	0163
Sorghum, Fusarium moniliformo, Ecology.	0620	Sorghum, Tillage, Effect,	0534
Sorghum, Genotypes, Composition, Water stress, Effect,	0145	Sorghum, Water stress, Physiological studies,	0168
Sorghum, Genotypes, Growth, Aluminium, Effect,	0426	Sorghum, Weed control, (by) Intercropping.	0587
Sorghum, Genotypes, Leaves/Elongation, Water stress, Effect,	0145	Sorghum, Yield loss, Calocoris angu-	
Sorghum, Genotypes, Minerals and nutrients, Aluminium, Effect,	0426		
Sorghum, Genotypes, Phosphorus/Uptake,	0425		
Sorghum, Germination, Seed treatment, Effect,	0079		
Sorghum, Grain molds/Resistance, Evaluation,	0660		
Sorghum, Growth: Yields, Intercropping,			

status,	0804	Tissues,	
Sorghum, Yield loss/Assessment, Grain		Trace elements/Analysis, (by) X-Rays;	
moIds,	0660	Sorghum,	0442
Sorghum, Yield loss/Assessment, Sch-		Toluene,	
izaphis graminum,	0733	Effect; Sorghum, Cell structure,	0159
Sorghum, Yields, Weed control/Methods,		Effect; Sorghum, Leaves: Roots, Amino	
Effect,	0547	acids/Leakage: Sugars/Leakage,	0159
Sorghum: Mung beans, Intercropping,		Tolyposporium ehrenbergii/Resistance,	
Yields, Planting date, Effect,	0484	Iraq; Sorghum,	0625
Sorghum: Mung beans, Intercropping,		Topdressing/Nitrogen fertilizers,	
Yields, Population density, Effect,	0484	Effect; Sorghum, Yields,	0463
Sorghum: Kung beans: Pigeonpea: Soyb-		Toxicity,	
eans, Intercropping,	0499	(by) Naphthalic anhydride; Sorghum,	
Sorghum: Stylosanthes guianensis,		Protection, (from) Herbicides,	0579
Intercropping, Growth: Yields,	0483	CONCEP, Effect, Theses; Sorghum, Herb-	
Sorghum (Forage), Agronomic charact-		icides,	0572
ers,	1147	CONCEP, Effect; Sorghum, Herbicides,	0569
Sorghum (Forage), Feeds, Cattle,	1102	Soil moisture, Effect; Sorghum, Alac-	
Sorghum (Forage), Growth,	1127	hlor: Metolachlor,	0569
	1135	Toxicity;	
Sorghum (Forage), Silage/Quality,	1147	Sorghum, Crop/Residues,	0142
Sorghum (Forage), Yields, Nitrogen		Sorghum, Fungi,	0617
fertilizers, Effect,	1126	Sorghum, Insecticides,	0111
Sorghum (Forage), Yields, Planting		Sorghum, Seedlings, Triclopyr: 2-4-	
date, Effect,	1126	5-T: 3-6-dichloropicolinic acid,	0550
Sweet sorghums, Fermentation, Alcoh-		Toxicity/Aluminium,	
ols/Production,	1057	Calcium carbonate: Calcium sulphate,	
Sweet sorghums, Fertilizers, Effect,	1059	Effect; Sorghum,	0124
Sweet sorghums, Phosphate fertiliz-		Toxicity/Biphenyl,	
ers, Effect,	1054	Carbon (Activated), Effect; Sorghum,	0144
Threshers,		Toxicity/Hydrazine,	
Economics, Semi-arid tropics, India;		Cysteine, Effect; Sorghum,	0245
Sorghum,	0606	Toxicity/Hydrocyanic acid,	
Thylakoids/Membranes,		Cattle; Sorghum x Sorghum sudanense,	
Acid phosphatase, Isolation; Sorghum,	0129	Hybrids,	1153
Milage,		Toxicity/Metolachlor,	
Effect, (in) Rainfed farming, India/		(by) CONCEP; Sorghum, Protection,	0575
Maharashtra; Sorghum, Growth: Yields,	0403	(by) CONCEP; Sorghum, Seedlings, Prot-	
Effect, Theses; Sorghum,	0534	ection,	0122
Effect; Sorghum, Grain yield,	0411	Effect; Sorghum, GA/Synthesis,	0166
Effect; Sorghum, Soil physicochemical			0167
properties,	0411	Effect; Sorghum, Growth,	0166
Effect; Sorghum, Stalk rot/Incidence,	0652	Effect; Sorghum, Seedlings, Ethylene/	
Effect; Sorghum halepense/Control,	1072	Formation,	0122
Tillage: Soil moisture,		Toxicity see also,	
Effect; Sorghum: Rice, Rotational		Poisoning	
cropping, Yields,	0382	Toxins;	
Tillage: Spacing,		Sorghum (Forage),	1164
Effect; Sorghum, Soil moisture,	0488	Toxins/Periconia circinata,	
Effect; Sorghum, Yields,	0488	Effect, USA; Sorghum,	0650
Tillage see also,		Effect; Sorghum, Root cap,	0648
Ploughing		Effect; Sorghum, Seedlings, Electrol-	
Tillering,		ytes/Leakage,	0651
Temperature effects; Sorghum,	0088	Uptake; Sorghum, Seedlings,	0655
Timing (Day),		Toxins see also,	
Effect; Sorghum, Air temperature:		Mycotoxins	
Leaf temperature: Soil temperature,	0309	Toxoptera graminum/Resistance;	
Effect; Sorghum, Chilo partellus,		Sorghum, Breeding,	0737
Emergence,	0778		



Trace elements,		Sorghum, Nitrogen fixation, Bacteria,	0338
Effect; Sorghum, Growth: Minerals		Sorghum, Periconia circinata/Toxins,	
and nutrients uptake,	0419	Effect,	0650
Trace elements/Analysis,		Sorghum, Production,	1033
(by) X-Rays; Sorghum, Tissues,	0442	Sorghum, Transport,	1022
Trade,		Sorghum, Weed control,	0566
Argentina; Sorghum,	1026	Sorghum: Maize, Rotational cropping,	
Translocation;		Irrigation,	0487
Sorghum, Leaves, Metabolites,	0127	Sweet sorghums, Alcohols/Production,	1040
Sorghum, Sodium,	0114	Sweet sorghums, Maize dwarf mosaic	
Translocation/Photosynthates,		virus/Resistance,	1069
Water stress, Effect; Sorghum sudan-			1070
ense, Leaves,	0158	Sweet sorghums, Sugar/Production,	1037
Transpiration,		Sweet sorghums, Syrup/Production,	1037
Farnesol, Effect; Sorghum,	0105	Sweet sorghums, Varieties,	1038
Transpiration;		USA/Arkansas;	
Sorghum,	0045	Sorghum, Performance trials,	0303
Sorghum, Leaves,	0148	USA/Florida;	
Transport,		Sorghum, Nutrition,	0319
USA; Sorghum,	1022	Sorghum, Soil fertility,	0319
USA/Georgia; Sorghum,	1016	Sorghum, Soils, Sulphur,	0319
Trianthema portulacastrum,		USA/Georgia;	
Allelopathy; Sorghum,	0578	Sorghum, Hybrids, Ratooning,	0490
Triclopyr: 2-4-5-T: 3-6-dichloropicol-		Sorghum, Marketing,	1016
inic acid,		Sorghum, Performance trials,	0299
Toxicity; Sorghum, Seedlings,	0550	Sorghum, Transport,	1016
Trisomies,		USA/Iowa;	
Effect; Sorghum, Cytology,	0211	Sorghum, Hybrids, Performance trials,	0265
Tropical Africa;		Sorghum, Rotational cropping, Dry	
Sorghum, Breeding, Insect pests/Res-		matter/Yields,	0495
istance,	0702	Sorghum, Weed control, Herbicides,	0560
Tropical soils,		USA/Kansas;	
Soil fertility, Fertilizers: Manures,		Sorghum, Insect pests/Control,	0705
Effect, Upper Volta; Sorghum,	0321	Sorghum, Production costs,	1018
Tropical soils;		USA/Louisiana;	
Sorghum,	0318	Sorghum, Hybrids, Grain yield,	0266
Tropics,		Sorghum, Hybrids, Performance trials,	0266
Australia; Sorghum, Species,	0038		0300
Tropics;		Sorghum, Hybrids, Silage/Production,	0266
Sorghum, Disease control,	0819	Sorghum, Seedlings, Emergence, Seed	
Sorghum, Insect pests/Control,	0704	treatment, Effect,	0814
	0724	Sorghum, Soil-borne diseases/Control,	
Sorghum, Nematode control,	0689	Fungicides,	0814
Tropics see also,		USA/Mississippi;	
Humid tropics		Sorghum, Performance trials,	0278
Semi-arid tropics		Sorghum, Research,	0008
USA;		USA/Missouri;	
Sorghum, Disease control,	0822	Sorghum, Production,	0390
Sorghum, Exports,	1033	USA/flebraska;	
Sorghum, Gene pools,	0189	Sorghum, Performance trials,	0271
Sorghum, Genetic variation,	0189	Sorghum, Production costs,	1019
Sorghum, Germplasm,	0189	USA/New Mexico;	
Sorghum, Hybrids, Cropping systems,	0493	Sorghum, Hybrid: Varieties, Perform-	
Sorghum, Insect pests/Control,	0722	ance trials,	0274
	0723	Sorghum x Sorghum sudanense, Hybrids,	
Sorghum, Marketing,	1022	Performance trials,	0274
Sorghum, Mite control,	0722	USA/oklahoma;	
Sorghum, Mycoses,	0669	Sorghum, Hybrids, Performance trials,	0269
Sorghum, Nematode control,	0688		

USA/Tennessee;		luation; Sorghum,	0757
Sorghum, Varieties, Performance trials,	0279	Biomass/Production; Sweet sorghums, Comparison; Sorghum (Forage),	1052 1117
USA/Texas;		Composition, India/Haryana; Sorghum (Forage),	1101
Sorghum, Bugs, Host range,	0803	Feeds, Composition; Sorghum,	0848
Sorghum, Dry farming,	0405	Feeds, Nutritive value; Sorghum,	0848
Sorghum, Hybrids, Performance trials,	0267	France; Sorghum,	0260
	0277 0292 0297		
Sorghum, Production costs,	1020	Grain yield, Sahel; Sorghum,	0261 0275 0276
Sorghum, Runoff, Land preparation, Effect,	0405	Grain yield, Sudan; Sorghum,	0295
Sorghum, Schizaphis graminum, Migration,	0729	Nutritive value, Comparison; Sorghum,	0295
Sorghum, Weed control, Herbicides,	0562	Nutritive value, Sahel; Sorghum,	0295
Sorghum, Yield increase, Land preparation, Effect .	0405	Nutritive value, Sudan; Sorghum, Performance trials, Argentina; Sorghum,	0293
Sweet sorghums, Irrigation,	1035	Performance trials, France; Sorghum,	0273
USSR;		Performance trials, Sudan; Sorghum,	0262
Sorghum, Hybrids,	0284	Performance trials, USA/Tennessee; Sorghum,	0279
Sorghum, Research,	0023	Performance trials, Virgin Islands (USA); Sorghum,	0280
Sorghum (Forage), Irrigation,	1146	Savannas, Nigeria; Sorghum,	0286
Ultrastructure;		Silage/Production; Sorghum,	1163
Sorghum, Sugarcane mosaic virus,	0680	Spain; Sorghum,	0294
Ultraviolet radiation,		Sudan; Sorghum,	0272
Effect; Sorghum, Seedlings, Flavonoids/Synthesis,	0070	Sugar/Production, Evaluation; Sweet sorghums,	1045
Ultraviolet radiation: Light, Effect; Sorghum, Growth,	0112	Tannins, Evaluation; Sorghum,	0842
Upland cropping,		USA; Sweet sorghums,	1038
Saudi Arabia; Sorghum,	0498	Weed control, Herbicides; Sorghum,	0595
Upland cropping;		Yields, Nitrogen fertilizers, Effect, Philippines; Sorghum,	0462
Sorghum,	0534	Yields, Population density, Effect, Philippines; Sorghum,	0462
Upper Volta;		Zinc/Uptake, Comparison; Sorghum,	0461
Atherigona soccata, Host range,	0743	Varieties: Hybrids,	
Sorghum, Atherigona soccata, Population, Environmental effects,	0743	NPK fertilizers, Effect, (under) Irrigation; Sorghum,	0456
Sorghum, Breeding, Research, ICRISAT,	0199		0457
Sorghum, Food intake, Farmers,	0983	NPK fertilizers, Response, (under) Rainfed farming, India/Maharashtra; Sorghum,	0450
Sorghum, Nutritive value, Farmers,	0983	Performance trials, Argentina Sorghum,	0264
Sorghum, Poophilus costalis,	0798	Performance trials, India; Sorghum,	0281
Sorghum, Production,	1021		0290
Sorghum, Research, ICRISAT,	0017	Performance trials, India/Rajasthan; Sorghum,	0282
Sorghum, Tropical soils, Soil fertility, Fertilizers: Manures, Effect,	0321	Performance trials, USA/New Mexico; Sorghum,	0274
Sorghum, Yields, Fertilizers: Manures, Effect,	0321	Yields, Nitrogen-phosphorus fertilizers, Effect; Sorghum,	0452
Sorghum: Cowpeas, Intercropping, Semi-arid tropics,	0532	Varieties (CMU-var 2), Philippines; Sorghum,	0288
Uses,		Varieties (Hurda),	
Argentina; Sorghum (Forage),	1152	Nutritive value; Sorghum,	1001
India/Andhra Pradesh; Sorghum,	0869		
Uses;			
Sorghum,	0387		
	0998 1005		
Variation;			
Sorghum halepense,	1088		
Varieties,			
Alcohols/Production; Sweet sorghums,	1052		
Atherigona soccata/Resistance, Eva-			

Varieties see also,		Viroses	
High-yielding varieties		Vitamins B/Content,	
Vascular bundles;		Analysis; Sorghum, Fermented products,	0980
Sorghum, Stems,	0036	Vybrids,	
Vectors/Control;		Apomixis; Sorghum,	0222
Sorghum, Viroses,	0675	Water balance: Grain yield,	
Vegetation/Index: Grain yield: Leaf		Ratooning, Effect; Sorghum,	0531
area index,		Water management,	
Relationship; Sorghum,	0398	Australia; Sorghum, Cropping systems	
Vegetative reproduction,		(Strip),	0537
Environmental effects; Sorghum, Per-		Water relations,	
onosclerospora sorghi,	0637	Bibliographies; Sorghum,	0061
Venezuela,			0062 0063 0064
Bibliographies; Sorghum,	0001	Water relations;	
Venezuela;		Sorghum,	0141
Sorghum,	0098	Water relations: Yields: Growth,	
Sorghum, Irrigation,	0348	Soil moisture, Effect; Sorghum, Hybr-	
Sorghum, Performance trials,	0285	ids,	0057
Vertisols,		Water requirements,	
(in) Rabi, India; Sorghum, Yields,	0322	Lysimeters/Observations, India/Mah-	
Cropping systems, Semi-arid tropics,		arashtra; Sorghum,	0153
India; Sorghum,	0505	Water requirements;	
India/Madhya Pradesh; Sorghum, Crop-		Sorghum,	0353
ping systems,	0541		0355 0358
India/Madhya Pradesh; Sorghum, Prod-		Water stress,	
uction,	0541	Effect, (during) Developmental stages;	
Management, India; Sorghum, Production,	0539	Sorghum, Grain yield,	0133
Semi-arid tropics, India; Sorghum,		Effect, ICRISAT; Sorghum, Emergence,	0047
Production,	0520	Effect, ICRISAT; Sorghum, Yields,	0136
Watersheds/Technology, Economics,		Effect, Theses; Sorghum, Genotypes,	
Semi-arid tropics, India; Sorghum,		Composition,	0145
Production,	0526	Effect, Theses; Sorghum, Genotypes,	
Vertisols;		Leaves/Elongation,	0145
Soil physicochemical properties,		Effect; Sorghum, Carbohydrates (Sol-	
Fertilizers: Manures, Effect,	0431	uble),	0163
Sorghum, Hybrids, Yields, Fertilizers:		Effect; Sorghum, Genotypes, Growth	
Manures, Effect,	0431	substances,	0076
Sorghum, Iron: Manganese, Transforma-		Effect; Sorghum, Hybrids, Evapotrans-	
tion, Irrigation, Effect,	0448	piration,	0307
Sorghum, Iron: Manganese, Transforma-		Effect; Sorghum, Hybrids, Grain yield,	0307
tion, Manures, Effect,	0448	Effect; Sorghum, Hybrids, Photosynth-	
Sorghum, Production, Cropping systems,	0542	esis/Rate,	0050
Viral diseases see,		Effect; Sorghum sudanense, Leaves,	
Viroses		Translocation/Photosynthates,	0158
Virgin Islands (USA);		Models; Sorghum,	0313
Sorghum, Varieties, Performance tri-		Physiological studies, Theses; Sorg-	
als,	0280	hum,	0168
Viroses,		Reveiw articles; Sorghum,	0093
Egypt; Sorghum,	0676	Straw mulches, Effect; Sorghum,	0317
Hosts; Sorghum.	0682	Water stress;	
Vectors/Control; Sorghum,	0675	Sorghum, Roots,	0094
Viroses;		Water stress: Nitrogen fertilizers,	
Sorghum,	0683	Effect; Sorghum, Grain yield: Protein	
Viroses see also,		content,	0449
Maize dwarf mosaic virus		Effect; Sorghum, Nitrogen metabolism,	0449
Peregrinus maidis		Water stress/Reduction,	
Red stripe virus		(by) Straw mulches;	0317
Sugarcane mosaic virus			
Virus diseases see,			

Water stress/Studies, (under) Sprinkler irrigation, ICRISAT; Sorghum,	0141	Herbicides Hoeing Weeding	
Water table, Effect; Sorghum (Forage), Growth,	1130	Weeding: DSMA: Hoeing; Sorghum halepense/Control,	1081
Water uptake/Rate, (during) Tempering; Sorghum, Grain,	0854 0855	Weeding: Hoeing, India/Andhra Pradesh; Sorghum, Hybr- ids, Weed control,	0549
Water use, Soil moisture, Effect; Sorghum, Spacing, Effect; Sorghum,	0347 0401	Weeding: Hoeing; Sorghum, Weed control,	0593
Water use: Population: Spacing, Relationship; Sorghum,	0401	Weeds, Bibliographies; Sorghum,	0559
Water use efficiency, Straw mulches, Effect; Sorghum,	0324	Competition studies, India/Maharas- htra; Sorghum,	0570
Water use efficiency; Sorghum,	0355	Effect; Sorghum, Grain yield, Hungary; Sorghum,	0599 0571
	0356 0357 0380	Research, ICRISAT; Sorghum, Yemen Arab Republic; Sorghum,	0576 0596
Watersheds/Technology, Economics, Semi-arid tropics, India; Sorghum, Production, (in) VertisoIs,	0526	Weeds: Diseases: Insect pests, Complexes, Asia; Sorghum, High-yield- ing varieties,	0611
Weed control, (by) Intercropping, Theses; Sorghum, (by) Mixed cropping; Sorghum, Argentina; Sorghum, Atrazine, Semi-arid tropics, India; Sorghum,	0587 0581 0584 0558	Complexes, Pacific Islands; Sorghum, High-yielding varieties,	0611
Atrazine: 2-4-D; Sorghum, Atrazine: 2-4-D; Picloram; Sorghum, Atrazine: 2-4-D; Simazine, India/And- hra Pradesh; Sorghum, Hybrids,	0593 0583 0549	Weeds/Density, Effect; Sorghum, Herbicides/Absorpt- ion,	1096
Atrazine: Propachlor; Sorghum, CONCEP: Metolachlor, Effect; Sorghum, Effect; Sorghum, Ratooning, Yields, Effect; Sweet sorghums, Yields, Herbicides, Nigeria; Sorghum, Herbicides, Sudan; Sorghum,	0556 0568 1055 0577 0563	Weeds see also, Asclepias syriaca Cassia obtusifolia Gomphrena decumbens Helianthus annuus Rottboellia exaltata Shattercane Solanum karsensis Sorghum halepense Trianthema portulacastrum	
Herbicides, Taiwan; Sorghum: Sugarcane. Intercropping,	0580	West Africa; Sorghum, Economics, Research, ICRISAT,	1025
Herbicides, USA/Iowa; Sorghum, Herbicides, USA/Texas; Sorghum, Herbicides; Sorghum,	0560 0562 0548	Sorghum, Grasshoppers, Research, Sorghum, Insect pests, Biological control,	0802 0709 0721
	0552 0565 0574 0591 0600	Sorghum, Insect pests/Control,	0710
Herbicides; Sorghum, Varieties, Hoeing: Weeding, India/Andhra Pradesh; Sorghum, Hybrids,	0595 0549	Wort, Fermentation/Tests; Sorghum,	1009
Hoeing: Weeding; Sorghum, ICRISAT; Sorghum, India/Maharashtra; Sorghum, Metolachlor; Sorghum, Seed treatment, Effect; Sorghum, USA; Sorghum,	0593 0576 0570 0594 0567 0566	X-Rays; Sorghum, Tissues, Trace elements/ Analysis,	0442
Weed control; Sorghum,	0545	Xanthopimpla stemmator; Sorghum, Chilo partellus/Control,	0780
	0546 0582 0597	Yemen Arab Republic; Sorghum, Germplasm/Collections, Sorghum, Research, Sorghum, Weeds,	0197 0031 0596
Sorghum: Pigeonpea, Intercropping,	0588	Yemen People's Democratic Republic; Sorghum, Germplasm/Collections,	0218
Weed control/Methods, Effect, Theses; Sorghum, Yields,	0547	Yield characters see, Agronomic characters	
Weed control see also,			

Yield forecasting;		Height, Effect, Puerto Rico; Sorghum:	
Sorghum,	0358	Soybeans, Intercropping,	0492
Yield increase,		Herbicides, Effect; Sorghum (Forage),	0551
(by) Growth substances; Sorghum,	0087	India/Tamil Nadu; Sorghum: Soybeans,	
Azospirillum/Inoculation, Israel;		Mixed cropping,	0502
Sorghum,	0335	India/Uttar Pradesh; Sorghum, Rotat-	
Constraints, India/Gujarat; Sorghum,	0369	ional cropping,	0482
Land preparation, Effect, USA/Texas;		Insect pests, Cultural control, Eff-	
Sorghum,	0405	ect; Sorghum (Forage),	1160
Semi-arid tropics, India/Andhra		Insecticides: Nitrogen fertilizers,	
Pradesh; Sorghum: Pigeonpea, Inter-		Effect; Sorghum, Ratooning,	0536
cropping,	0540	Intercropping, Effect, Theses; Sorghum,	
Yield increase;		Hybrids,	0519
Sorghum, Breeding,	0216	Irrigation, Effect, Theses; Sorghum,	
Sorghum, Germplasm (Exotic),	0184	Hybrids,	0519
Yield loss,		Lime/Application, Effect; Sorghum	
Bird pests, Senegal; Sorghum,	0810	(Forage),	1110
Calocoris angustatus, Theses; Sorghum,	0804	Lime/Nitrogen, Effect; Sorghum (Fora-	
Contarinia sorghicola; Sorghum,	0789	ge),	1132
Drought: Schizaphis graminum; Sorghum,	0734	Line x tester analysis; Sorghum	
Striga; Sorghum,	0694	(Forage),	1156
Sugarcane mosaic virus; Sorghum,	0684	Manures/Nitrogen content, Effect;	
Yield loss/Assessment,		Sorghum sudanense,	1113
Atherigona soccata; Sorghum,	0716	Maturity, Effect, Australia; Sweet	
Grain molds, Theses; Sorghum,	0660	sorghums,	1046
Insect pests; Sorghum,	0716	Minerals and nutrients: NPK fertil-	
Peronosclerospora sorghi, Models;		izers, Effect, Middle East; Sorghum,	0465
Sorghum,	0640	NPK fertilizers, Effect, India/Maha-	
	0641	rashtra; Sorghum, Hybrids,	0451
Schizaphis graminum, Theses; Sorghum,	0733	NPK fertilizers, Effect; Sorghum,	0434
Yields,		NPK fertilizers, Effect; Sweet sorg-	
2-4-D: MCPA, Effect; Sorghum,	0573	hums,	1060
(under) Rainfed farming; Sorghum,		NPK fertilizers/Application methods,	
Hybrids, Intercropping,	0494	Effect; Sorghum (Forage),	1129
Calcium carbonate: Organic matter,		Nigeria; Sorghum: Cotton: Groundnuts,	
Effect; Sorghum,	0455	Rotational cropping,	0508
Carbofuran, Effect; Sorghum, Hybrids,	0421		0509
Climatic change, Effect, Semi-arid		Nitrogen-phosphorus fertilizers,	
tropics; Sorghum,	0312	Effect; Sorghum, Hybrids: Varieties,	0452
Comparison, Dry farming; Sorghum:		Nitrogen fertilizers, Effect, Phili-	
Barley: Wheat,	0389	ppines; Sorghum, Varieties,	0462
Crops/Residues, Effect; Sorghum,	0404	Nitrogen fertilizers, Effect, Theses;	
Defoliation, Effect, Taiwan; Sorghum,	0154	Sorghum (Forage),	1126
Defoliation, Effect; Sorghum,	0362	Nitrogen fertilizers, Effect; Sorghum,	0423
	0376 0379 0607		0438 0473
Evaluation, Australia; Sweet sorghums,	1045	Nitrogen fertilizers, Effect; Sorghum:	
Farm inputs, Effect; Sorghum, Genoty-		Mung beans, Intercropping,	0480
pes,	0234	Nitrogen fertilizers/Topdressing,	
Fertilizers, Effect, Nigeria; Sorghum:		Effect; Sorghum,	0463
Wheat, Rotational cropping,	0468	Phosphate fertilizers, Effect; Sorg-	
Fertilizers: Irrigation, Effect; Sor-		hum: Wheat, Rotational cropping,	0458
ghum,	0429	Phosphate fertilizers, Effect; Sorg-	
Fertilizers: Manures, Effect, (in)		hum (Forage),	1141
Vertisols; Sorghum, Hybrids,	0431	Phosphate fertilizers, Effect; Sorg-	
Fertilizers: Manures, Effect, Upper		hum x Sorghum sudanense, Hybrids,	1141
Volta; Sorghum,	0321	Planting date, Effect, Theses; Sorghum:	
Genetic variation; Sorghum (Forage),	1151	Mung beans, Intercropping,	0484
Harvesting/Timing, Effect; Sorghum		Planting date, Effect, Theses; Sorghum	
(Forage),	1162	(Forage),	1126

Planting date, Effect; Sorghum,	0479	Sorghum:Maize:Soybeans, Rotational	
Planting date:Sowing depth, Effect;		cropping,	0512
Sorghum,	0410	Sorghum: Pigeonpea, Intercropping,	0481
Ploughing, Effect, (in) Podzols; Sorghum,			0517
	0399	Sorghum: Soybeans, Intercropping,	0528
Population: Spacing, Effect, Botswana;		Sorghum: Soybeans, Mixed cropping,	0503
Sorghum,	0400	Sorghum (Forage), Hybrids,	1108
Population density, Effect, Philippines;		Sweet sorghums,	1068
Sorghum, Varieties,	0462	Yields: Agronomic characters,	
Population density, Effect, Theses;		Genetic/Relationship; Sorghum (Forage),	1134
Sorghum: Mung beans, Intercropping,	0484	Yields: Defoliation/Management,	
Population density, Effect; Sorghum,	0423	Effect; Sorghum (Forage),	1115
Population density, Effect; Sorghum:		Yields: Drought resistance,	
Pigeonpea, Intercropping,	0535	Relationship, ICRISAT; Sorghum,	0136
Population density: Spacing, Effect;		Yields: Germination,	
Sorghum,	0481	Seed size, Effect; Sorghum,	0370
Population density: Spacing, Effect;		Yields: Growth,	
Sorghum: Pearl millet, Intercropping,	0515	Furadon, Effect; Sorghum,	0132
Rain: Soils, Effect, South Africa;		Growth inhibitors, Effect; Sorghum,	0083
Sorghum,	0368	Herbicides, Application timing, Eff-	
Rotational cropping, Effect; Sorghum,	0488	ect; Sorghum,	0567
Seedlings/Line, Effect; Sorghum,	0407	Intercropping, Effect, Theses; Sorghum,	0483
Semi-arid tropics, Brazil; Sorghum		Manures, Effect, (in) Rainfed farming,	
(Forage),	1120	India/Maharashtra; Sorghum,	0403
Sewage products, Effect; Sorghum,	0325	Mulching, India/Maharashtra; Sorghum,	0408
Soil depth, Effect; Sorghum,	0406	Propachlor, Effect; Sorghum,	0108
Soil moisture, Effect; Sorghum,	0324	Theses; Sorghum: Stylosanthes guiy-	
Soil moisture: Tillage, Effect; Sorghum:		nensis, Intercropping,	0483
Rice, Rotational cropping,	0382	Tillage, Effect, (in) Rainfed farming,	
Soils/Nitrogen, Losses, Effect, (under)		India/Maharashtra; Sorghum,	0403
Irrigation; Sorghum,	0460	Yields: Growth: Digestibility,	
Sorghum halepense: Shattercane, Eff-		Agronomic characters, Effect; Sorghum	
ect; Sorghum,	0598	(Forage),	1121
Spacing, Effect, India/Maharashtra;		Yields: Growth: Water relations,	
Sorghum, Hybrids,	0451	Soil moisture, Effect; Sorghum, Hybr-	
Spacing, Effect; Sorghum: Legumes,		ids,	0057
Intercropping,	0530	Yields: Height,	
Spacing, Effect; Sweet sorghums,	1055	Rotational cropping, Effect; Sorghum,	0512
Spacing: Tillage, Effect; Sorghum,	0488	Yields: Iron/Uptake,	
Straw/Manures, Effect; Sorghum,	0424	Farmyard manure, Effect; Sorghum,	
Straw mulches, Effect; Sorghum,	0324	Hybrids,	0416
Striga, Infestation, Effect; Sorghum,		Iron, Effect; Sorghum, Hybrids,	0416
Genotypes,	0700	Sulphur, Effect; Sorghum, Hybrids,	0416
Theses; Sorghum, Harvesting/Index,	0248	Yields: Kitrate reductase/Activity,	
Theses; Sorghum, Selection,	0248	Genetic analysis; Sorghum, Hybrids,	0217
Vertisols, (in) Rabi, India; Sorghum,	0322	Yields: Soils/Nitrogen content,	
Water stress, Effect, ICRISAT; Sorghum,	0136	Relationship; Sorghum,	0323
Weed control, Effect; Sorghum, Rato-		Yields/Dry matter,	
oning,	0592	NPK fertilizers, Effect; Sorghum,	0456
Weed control, Effect; Sweet sorghums,	1055	USA/Iowa; Sorghum, Rotational cropp-	
Weed control/Methods, Effect, Theses;		ing,	0495
Sorghum,	0547	Yields/Dry matter;	
Zero-tillage, Effect; Sorghum,	0404	Sorghum (Forage),	1118
Zero-tillage, Effect; Sorghum: Wheat,		Yields/Forage,	
Rotational cropping,	0414	Comparison; Sorghum x Sorghum suda-	
Yields;		nense, Hybrids,	1161
Sorghum,	0386	Harvesting/Intervals, Effect, Puerto	
	0393	Rico; Sorghum x Sorghum sudanense,	
Sorghum: Legumes, Mixed cropping,	0514		

Hybrids,	1112	Yields/Stability:Anatomy:Physiology,	
Harvesting/Timing, Effect; Sorghum		Environmental effects, Theses; Sorg-	
x Sorghum sudanense, Hybrids,	1162	hum,	0377
Maturity, Effect; Sorghum, Hybrids,	1116	Yields see also,	
Nitrogen fertilizers:Planting date,		Grain yield	
Effect, Pakistan; Sorghum,	1098	Zero-tillage,	
Yields/Forage;		Effect; Sorghum, Hybrids, Silage/Pro-	
Sorghum,	0130	duction,	1139
	1114	Effect; Sorghum, Yields,	0404
Sorghum: Cowpeas, Mixed cropping,	1157	Effect; Sorghum: Wheat, Rotational	
Sorghum x Sorghum sudanense: Festuca		cropping, Yields,	0414
arundinacea, Intercropping,	1130	Zero-tillage;	
Yields/Gaps,		Sorghum (Forage), Silage/Production,	1109
Analysis, Programming, Semi-arid		Zero-tillage: Soil fertility;	
tropics; Sorghum,	1014	Sorghum: Rice, Rotational cropping,	0320
Yields/Proteins;			0453
Sorghum (Forage),	1118	Zinc: Iron;	
Yields/Risk,		Sorghum, Soil testing,	0316
Semi-arid tropics, India; Sorghum,	1012	Zinc/Uptake,	
Yields/Stability;		Comparison; Sorghum, Varieties,	0461
Sorghum: Pigeonpea, Intercropping,	0521	Phosphates, Effect; Sorghum,	0461
	0523	Zygotes,	
		Radiations/Period; Sorghum,	0173









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International Crops Research Institute for the Semi-Arid Tropics

ICRISAT Patancheru P.O.

Andhra Pradesh 502 324, India