

PRIORITIES IN POST HARVEST RESEARCH SUPPORT FOR SORGHUM AND
MILLET IN EASTERN AFRICA

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Presented to

6TH REGIONAL SORGHUM AND MILLET WORKSHOP

EASTERN AFRICA REGIONAL SORGHUM AND MILLET NETWORK

Somalia, 20-27 July, 1988

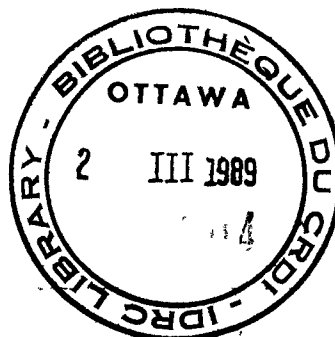
INTRODUCTION

Sorghum and millet are important to a substantial number of farm households in the East African region, especially in the semi-arid areas. Most cultivars of these drought resistant grains represent food for the household, and cash income if there is a market for the sale of surplus production. Some cultivars are grown for brewing, which offers another source of cash.

Sorghum and millet remain relatively neglected, though their potential contribution to national food sufficiency or food security is now receiving increasing attention by policymakers. Some countries are developing policy statements about the drought resistant grains, and have increased the allocation of resources to applied research aimed at improving and increasing their production. Such emphasis should also result in the fullest utilization of the potential of the semi-arid areas.

This paper will:

- argue that a more rigorous analysis of the total food system of the drought resistant grains is needed;
- indicate that some key constraints to increased production and utilization lie in the post production sector of the food system.
- identify some important recent events which relate to the post harvest sector of the drought resistant grains;
- identify the important research issues from a post harvest and a food/feed system perspective.



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WHAT IS THE CORE PROBLEM WITH THE SORGHUM AND MILLET FOOD SYSTEMS?

Since this network focusses on sorghum and millet, your clients must surely be those farmers who grow these commodities. It is these clients, therefore, who should be the major source for defining the parameters of each national improvement effort. Other inputs, of course, are derived from the national agricultural policy, and from the national agricultural research system. In talking with national researchers, I often have difficulty in getting a very clear statement about the key objectives of a particular commodity's improvement effort, and I am often overwhelmed with specialist terminology and statements about technical objectives.

Perhaps it is useful to ask a different initial question such as: What is the main change which we would like to bring about through our work towards improved technologies, be they in the production or the post production domain? An increased tonnage of annual production? A reduction of the land area required to achieve a constant level of production, thus freeing some land for the planting of other crops? The development of a substantial urban demand for surplus production so that the farmer can have a cash income? A reduction in levels of rural malnutrition? A better quality of life for the small farmer who seeks to survive in harsh areas? A reversal of the rural urban drift?

It is possible that any one of these questions could represent the core objective concerning sorghum and millet for a particular country or part of it. Each of these questions, however, implies the need for very different applied research strategies covering both the production and the post production domain, and requires different mixes of scientific disciplines, policy action and extension work. As well; a critical mass of national personnel, and an enabling policy climate are required if the problem is to be successfully solved.

Do we know enough about the intentions of the national planners? What role do they foresee for sorghum and millet? Have they defined the changes which they would like to have brought about? Does the national food policy specify the strategies for producer prices, for the marketing (collection, storage and distribution) system, for the appropriate intervention point for processing machinery and the creation of employment, for the optimal distribution system of the processed products? Are the national policymakers aware of the options open to them as a result of the availability of new technologies?

After defining the core problem, it is necessary to identify the major constraints which need to be overcome, and to identify the key intervention points for outcome-oriented applied research .

Do we know enough about the farmer-perceived constraints to improving or increasing the production of the drought resistant grains? At this point we should note that the farmer has to be viewed as both a producer and as a consumer of the grains. As a consumer, the farmer will define the criteria for an improved cultivar in terms of storage, processing, cooking and eating characteristics. As a producer, the farmer will probably select low input requirements, high yield, storeability and saleability (for different end uses). Has the discipline of Farming Systems Research been brought in to a sufficient degree to help to define these constraints and the criteria of improvement more clearly? Are the researchers on the production side establishing links with post harvest workers in order to identify these criteria?

One point which struck me forcibly during this network's 1984 meeting is the wide range of agro-ecological zones in which sorghum and millet are grown. Somewhat unscientifically, perhaps, I concluded that some of you were working to improve sorghum for the semi-arid areas, while others had dry or even distinctly wetland areas in mind. Do the farmers in these different zones have identical expectations about what constitutes an improved cultivar or variety?

Are they concerned with storing the crop for feeding their family year round, or do they produce primarily for quick sale to distant rural or urban markets? Are there expectations that the crop be easy to process; at the farm level, the village level or the urban level? Are there preferred qualities in the grain which facilitate cooking them into edible food? Is the taste of the cooked food important to the eater? What is the extent of the competition among the prevailing cereals in a particular country? Does the potential buyer of surplus production (if there are any buyers) have alternate, or even preferred, cereal choices? Have these preferences changed with time, as a result of the introduction of new technologies, or as a result of deliberate or accidental policy?

I think that the answers to these questions are often not well enough known, or at least not explicitly stated. Without clarity about these issues, interventions can turn out to be less than useful.

For instance several countries in Southern Africa have changed the producer price structure for sorghum and millet, in the hope of increasing quantities produced and of thus stabilizing the food supply. Farmer response was excellent, and resulted in the national grain marketing system's purchase of sizeable surplus stocks. Food supply was, however, effectively unaltered; there were no buyers for the centrally located surplus stocks, because of the absence of processing equipment to transform the grain into a ready-to-cook form. Urban households were not interested in doing the manual processing, when they had access to processed maize meal. The single intervention was not sufficient.

CRITICAL ASSUMPTIONS ABOUT THE WORK OF EARSAM

The EARSAM co-ordinator presented a very useful overview of EARSAM to a recent workshop which was reviewing the phenomenon of networks. The paper makes the following introductory points: Food production in Eastern Africa is not keeping pace with population growth. Shortages of basic foods have become common place, and the region is now a net importer of food grains. Increases in food production will have to come from improved cultivars and improved farming practices. Sorghum is the first or second most important cereal in most of the countries of the region. Sorghum and millet are grown on marginal agricultural land where maize, wheat and rice do not consistently produce a reasonable harvest.

Rearranging the relevant sections of Dr. Guiragossian's paper in the format of the Logical Framework Planning Model might result in the following:

EARSAM's overall goal is to contribute to stabilization of food supplies in the region, and to improved nutrition and income for the farmers in the drier areas of the region.

The purpose of EARSAM is to improve the production of sorghum and millet, through strengthened national sorghum and millet programs.

The expected outputs from the network are: improved sorghum and millet varieties and hybrids, along with improved agronomic practices that will result in higher and stable economic yields in the semi-arid environments.

The inputs are: systematic regional testing programmes of available elite breeding materials and technology in all important ecological zones; assistance in training and manpower development; provision of some needed supplies and facilities to upgrade research capabilities; regional workshops and monitoring tours to share breeding material, research findings and ideas, and to foster closer collaboration among national programmes.

One can see the following linkages: the inputs logically lead to the outputs; the outputs fulfil the purpose and contribute to satisfying the goal. A complete Log Frame analysis, in addition to the narrative summary presented for the four linked categories, requires further elaboration for each of the four levels: the Objectively Verifiable Indicators (what measurements will be made to demonstrate achievement), the Means of Verification (sources of information and methods used in the measurement), and Important Assumptions. I would like to focus on the latter only.

It is by defining and examining the key assumptions, often called "killer assumptions", that one can identify whether the activities posited are enough to achieve the ultimate goal, or whether other, parallel, work is necessary. Let us list some candidate assumptions affecting the purpose-goal linkage:

-that the farmer agrees with the scientist's claim that the new varieties are indeed "improved" as far as her/his family are concerned; otherwise she/he will not adopt the new technology;

-that it makes economic sense for the farmer to produce increased amounts of the crop; that there are customers interested in buying surplus production;

-that increased production of sorghum and millet will indeed stabilize the food supply; we know that food supplies will become stabilized only if the increased volumes of grain produced are actually viewed and used as food and/or are easily convertible into edible forms by/for the food deficient segments of the society;

-that the nutritional contents of the improved cultivar is indeed a limiting factor; perhaps it is more useful to optimize the nutritional contents of each meal being prepared.

From this short list we can see that some of the killer assumptions emerge from areas outside the production domain, and that is why increasing attention has to be paid to processing and utilization, as well as to national policy as it is actually being practiced. Some of the above assumptions apply to many of the member countries, and help to identify the gaps in knowledge and the need for some critically relevant activities to run in parallel with the work of EARSAM.

THE UP-DATE

This section will review some important events which relate to the total food system of sorghum and millet, and which have regional or Africa-wide significance.

In June 1986, the Sokoine University of Agriculture (SUA) hosted a regional workshop, ambitiously titled "New Sorghum Food Products: a strategy for the semi-arid areas". Publication of the proceedings has regrettably been delayed, but is now imminent. The workshop participants, mainly from Eastern and Southern Africa, indicated their wish to form an information sharing network. The Post Production Food Industry Advisory Unit (PFIAU), one of the Food Security Projects co-ordinated by Zimbabwe on behalf of the nine SADCC (Southern Africa Development Co-ordination Conference) countries, undertook to provide a level of co-ordination.

In October 1987 UNICEF, SIDA, and IDRC co-sponsored an international conference in Nairobi on Household Level Food Technologies for Improved Young Child Feeding. In addition to the primary technology of breast feeding, the participants examined the practice of fermenting (souring) and of germinating (for reduction of the dietary bulk) cereals for feeding young children; several papers also dealt with nutritional status of young children, and asked questions about the most effective techniques/interventions for ensuring adoption of any improvements. Sorghum and millet, as examples of locally available cereals, featured prominently in the presentations and discussions.

Also in October 1987 a small planning workshop took place in Bulawayo to clarify the research and development problems related to the drought resistant grains. Participating were representatives from Zimbabwe, from SADCC, and from a donor group with an extremely long name, the Group for the Assistance on Systems relating to Grains after Harvest (GASGA).

February 1988 saw an international workshop, again in Bulawayo, on Policy, Practice and Potential Relating to Uses of Sorghum and Millets. The workshop dealt with primary and secondary processing, with feed, and with non-food industrial opportunities. A small group of persons from SADCC countries met the following month to identify practical research which can be done within the region to follow up on the workshop's wide ranging recommendations.

In early May IDRC held a small workshop in Dakar on Small Scale Milling Systems (incorporating mechanical dehullers). This planning meeting reviewed the progress of eight specific applied research projects in which dehullers and the drought resistant grains featured prominently. The participants developed a framework for comprehensive case studies which they will prepare for a follow up meeting in November 1989. Four of the case studies will come from Eastern and Southern Africa, and four from West Africa.

And at the end of May there was the Symposium on the Processing of Sorghum and Millet, which is held every four years by study group 32 of the International Association for Cereal Science and Technology (ICC).

THE IMPORTANT RESEARCH ISSUES

The level of international and regional networking has certainly increased, and there is an indication that workers in the production sector, the post production sector and the policy sector are talking to each other.

At national level, however, there is still a strong degree of fragmentation between workers in these three interdependent sectors. We know that a technological change in one part of the

food system opens up new opportunities in other parts. Is it possible to bring these three areas more closely together, so that they become an effective and interactive national network on the drought resistant grains? Should one look to these national networks to generate an applied research agenda, and ensure that it is being pursued?

What might be the main elements of such a research agenda?

First, there has to be clear agreement about the change which should be brought about with regard to the production and utilization of sorghum and millet. What or who are the targets for change. Can they be quantified?

Second, the required technologies, whether new or modified, have to be identified and described. Should the breeder aim for a high tannin sorghum variety with the tannin located only in the pericarp and testa, and with a sufficiently vitreous endosperm capable of being dehulled manually or by machine for ease of removing the antinutritional components before being ingested?

Third, a least cost, minimum time research strategy has to be formulated and followed. This means careful sequencing of research, indicating the points of information flow, and the interdependency between different disciplines. Both the short and long term targets for each piece of research will have to be carefully defined.

We could conceive of the following strategy. For the production (improvement) research, define the technical target in terms of the needs of the group who now eat most of the semi-arid grains: the producer/consumer. Criteria of storeability, processability, and palatability will then become as important as high yield, pest and disease resistance, and low input requirements. Whether the desired solution should be a hybrid or not depends on whether the farmer can obtain and afford a fresh supply of seed each year. The development and wide scale introduction of small, affordable and manageable machinery to dehull and pulverize the grain would be a necessary related intervention.

If the farmer also seeks the opportunity to sell some surplus, then an additional criterion is introduced. Saleability depends on the existence of a demand, and whether the buyer has particular characteristics in mind. Urban housewives will not choose to spend time pounding the grain, but they might buy a processed, ready-to-cook form. One would try intervening with appropriate machinery to generate a first level of demand by urban consumers for a 'traditional' form, such as the simple coarse flour (or meal) from which the soft and stiff porridges are cooked.

One could next look at composite flours of cereal and legume for enhanced nutritional effectiveness. The use of small scale processing equipment would reduce the financial risk of the

initial experimental trials, and would ensure easier replicability to many parts of a country. The policymaker can then adjust producer prices, and can ensure the lowest cost system of transport and distribution of the grain, or its processed form, from rural to urban areas.

Next, one might look at secondary processing, towards inexpensive products with maximum convenience aspects. Very little work has been done in Africa on this area of utilization. Figure 1 depicts the present rural food system of the semi-arid grains, and indicates potential sources of demand from the urban domain.

If the post harvest sector can demonstrate a sustained demand for surplus production, and can begin to identify different end products, then the improvement teams can focus on a new target, the development of total agronomic packages for the small farmer so that she/he can produce for a particular product target. To help bring about that change, represented in Figure 2, the policymaker would have to ensure that the marketing and distribution system institutes new grading and pricing standards so that the processor can reliably obtain that grain which is most suitable for the end product. One also will have to improve on-farm storage, either for year-round consumption, or to await favourable market prices, for sale of surplus.

Has the foregoing been a trivial example, because we all know that an evolution of the kind I have described is already happening? However, the evolution has occurred very slowly, and I wonder whether we would be further ahead if such an integrated applied research strategy, in cases discernible with the eyes of hindsight, had been deliberately developed fifteen years ago.

Perhaps some member countries of EARSAM still do not have such a strategy. Should the production researcher, viewed by national agricultural systems as the key intervention point, take a more active role? Should she/he initiate a detailed analysis of the kind above, mobilize the needed complementary work in policy, in processing and utilization, and ensure that its relevance is sustained?

I am often approached to support research on a component technology. It is relatively easy for the researcher, if she/he is adequately trained in the necessary techniques, to work on an impressive range of technical problems. It is much more difficult to select from among the long list of possible problems those critical ones which, if solved, will make a significant difference to the intended beneficiaries. Very often the proposer is unable to answer the basic question. "I can see that you are proposing work on a technical problem, but what is the underlying food problem which your work will help to solve?"

The most important issue with regard to sorghum and millet is to establish that integrated research agenda at the national level.

APPENDIX

IDRC supported research on post production systems of sorghum and millet in EARSAM region:

The Post Production Systems (PPS) group within IDRC has supported a number of projects related to processing and utilization in the region covered by EARSAM. Taking the countries in alphabetical order, the following list is offered:

Burundi and Rwanda: no project activity, but several inquiries from individuals or organizations about dehulling.

Ethiopia: Sorghum Milling, executed by the University of Addis Ababa's Institute for Development Research, terminated September 1987. Sorghum Utilization, executed by the Ethiopia Nutrition Institute (ENI), terminated December 1987.

Kenya: Pearled Sorghum Market Survey, and Sorghum Processing Pilot, both to be executed by the Kenya Industrial Research and Development Institute (KIRDI), just begun.

Somalia: no actual project, but ongoing contact with the sorghum and millet improvement programme, which has a small batch dehuller at Bonka Research Station. Agricultural Research have inquired about possible support for research on underground storage.

Sudan: Sorghum Milling, initiated by the Food Research Centre (FRC), terminated in 1984.

Tanzania: A second phase of Sorghum Milling was completed by the Small Industries Development Organization (SIDO) in September 1987. A second phase of Sorghum Utilization has just begun with the Department of Food Science and Technology at Sokoine University of Agriculture (SUA). A Grain Storage project, also at SUA, completed in December, 1986.

Uganda: Grain Dehulling was initiated in 1985 by the National Research Council, in close collaboration with the Sorghum and Millet Research group at Serere Research Station. It is hoped that a measure of stability will soon return to the target area to permit the work to continue after a hiatus of about 18 months.

Some of these projects have succeeded better than others, but none seem to have made a significant impact on their country. Many of the projects, in retrospect, are/were too removed from the work of national sorghum and millet improvement programmes, and the desired linkages between the production and post production sectors have often failed to come about, or appear not to have achieved a sustained interaction.

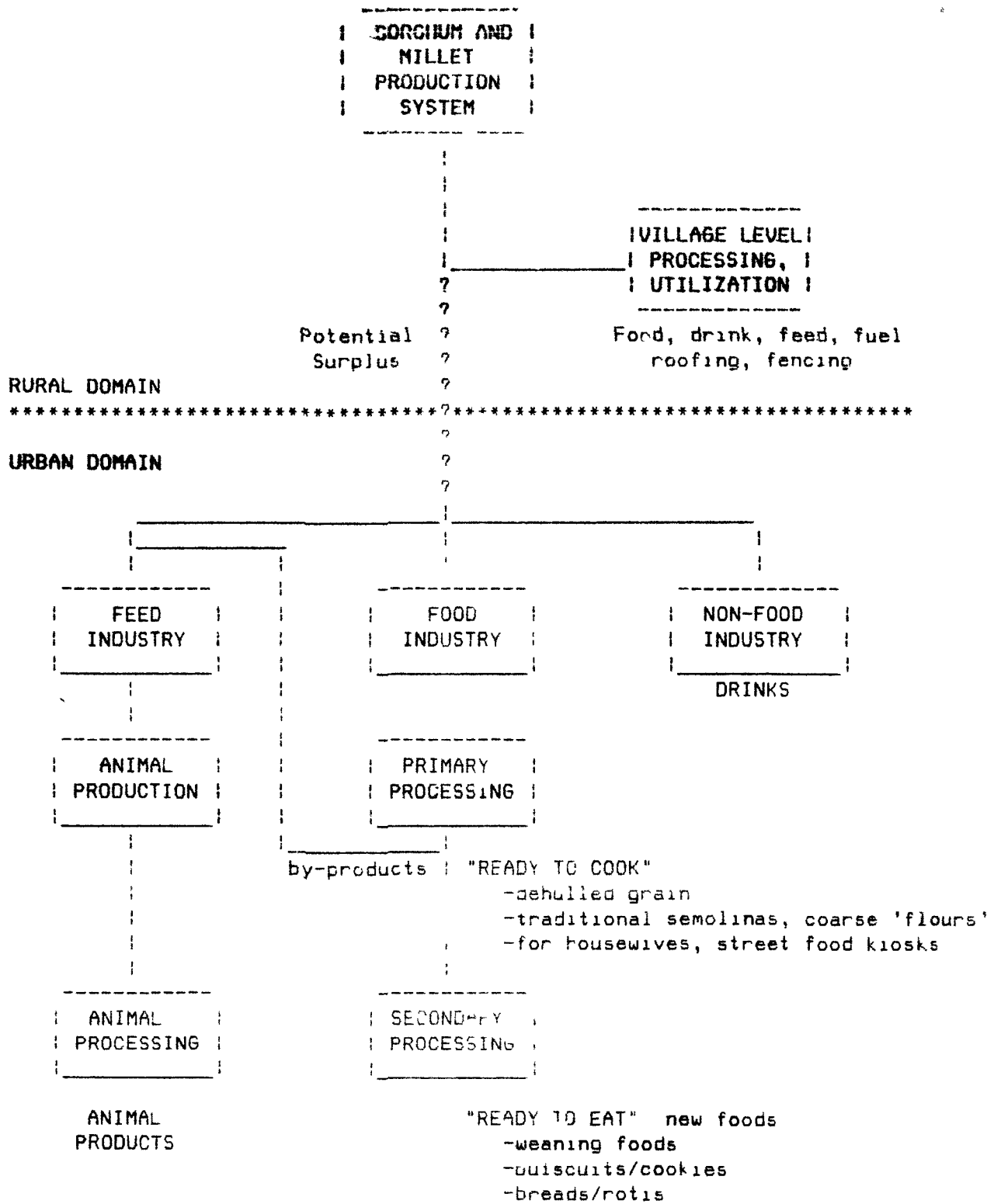


FIGURE 1

Complete utilization of the sorghum and millet plant in the rural domain.
 Potential urban utilization of surplus production.

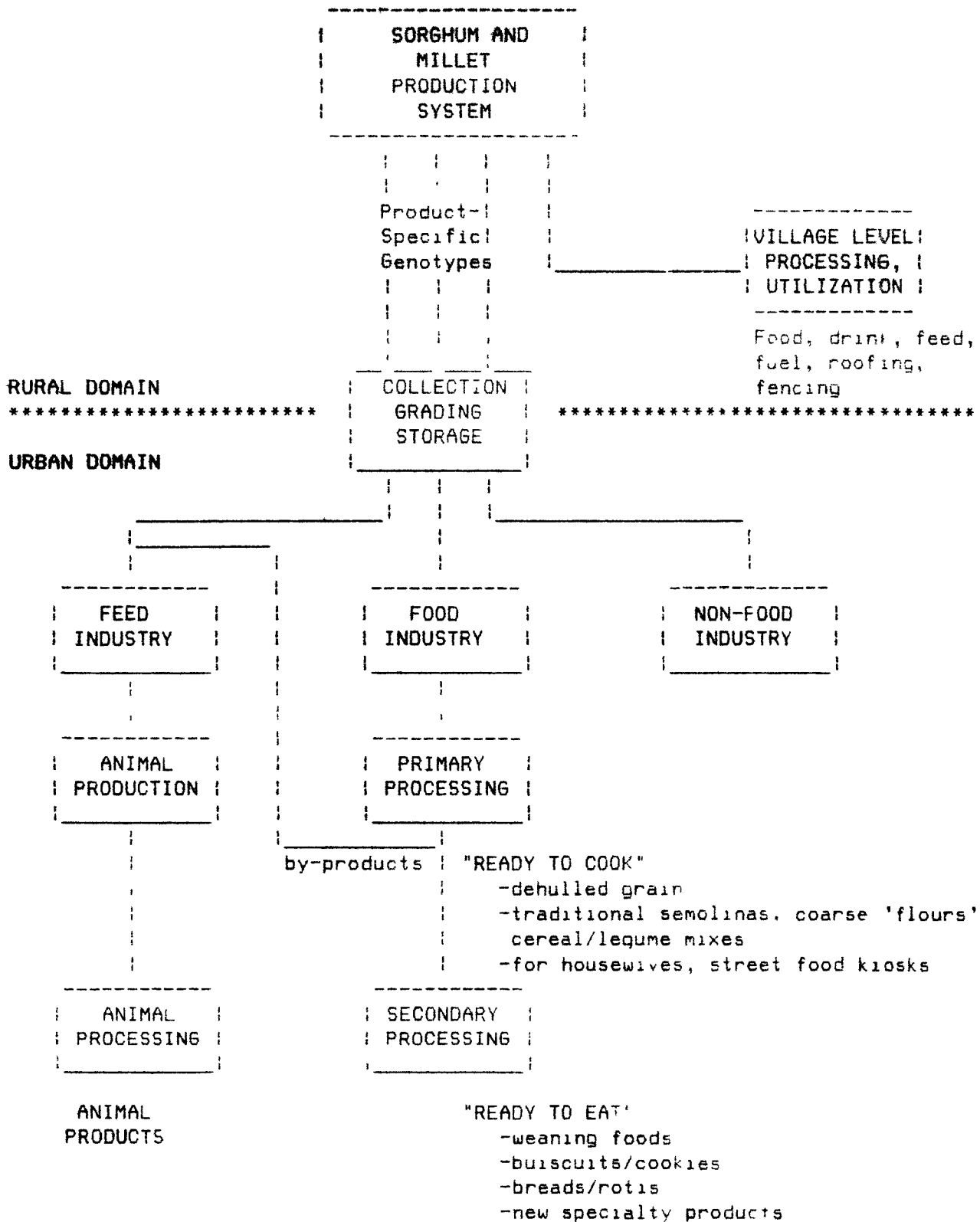


FIGURE 2

The production system using different genotypes specifically suited for unique end products, in the rural domain, or for special purpose industries.