

A REPORT ON

NATIONAL SEMINAR ON GENETICS OF PENNISETUMS AND AICPMIP WORKSHOP

(2-5 May 1990, APAU, Rajendranagar, Hyderabad)

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In view of the Golden Jubilee Celebration of the Indian Society of Genetics and Plant Breeding this year, the AICPMIP Workshop was combined with the second National Seminar on the Genetics of Pennisetums. The National Seminar was held on 2-3 May, and the AICPMIP Workshop on 4-5 May. Both events were very well organized at the Directorate of Rice Research, Rajendranagar, Hyderabad. We present below the highlights of various sessions.

I. SECOND NATIONAL SEMINAR ON GENETICS OF PENNISETUMS

- As compared to the first National Seminar on Genetics of Pennisetums, held in 1978 at PAU, Ludhiana, this seminar was of much greater importance because (1) it constituted a part of the Golden Jubilee Year Celebration of the Indian Society of Genetics and Plant Breeding and (2) it was linked with the AICPMIP Workshop (including QRT presentation). Among others, it was attended by four past presidents of the Indian Society of Genetics and Plant Breeding: these dignitaries included Drs. S.S. Rajan, B.R. Murty, K.S. Gill, and R.S. Paroda.

- There were six sessions covered on two days (2,3 May) which included Germplasm Resources; Breeding Methods; Cytogenetics and Male-sterility; Biochemical and Physiological Genetics and Quality Improvement; Biotechnology, Disease and Stress Resistance; and Quantative Genetics. In all, 16 key note papers and 41 contributory papers were presented.

- Presentation of key note papers from ICRISAT included those of M.H. Mengesha on germplasm resources in pearl millet, and S. Appa Rao on mobilization and utilization of pearl millet germplasm in Germplasm Resources session; F.R. Bidinger on studies on the d_2 dwarfing gene in pearl millet in Breeding Methods session; and K.N. Rai on prospects and limitations of cytoplasmic diversification of male-sterile lines of pearl millet in Cytogenetics and Male-sterility session. The contributory papers included those of Eva Weltzien on gain from selection using different criteria in Rajasthan landrace of pearl millet in Germplasm Resources session; and B.S. Talukdar on genetic variability and combining ability of ICRISAT pollinators in Quantitative Genetics Session.

- As for the ICRISAT presentations, Genetic Resources Unit was commended for its excellent research efforts and cooperation with the national programs (including Appa Rao's winning Dr. Harbhajan Singh Memorial Award); problems associated with the classification of cytoplasmic male-sterility sources and difficulties regarding their utilization in breeding program became clearer, though mounting pressure for cytoplasmic diversification continued; and some value of breeding dwarf

varieties for high-management conditions was suggested to be a possibility worth trying.

Much of the discussion revolved around cytoplasmic male-sterility, downy mildew resistance, and alternative uses of pearl millet. The A4 system from monodii was highlighted for use in applied breeding program; an ethidium bromide - induced cms system found at PAU was shown to be different from A₁ but was also found to be unstable. Considerable work at the University of Mysore is underway to use tissue culture techniques to breed for resistance to downy mildew (and also to ergot on a small scale). These studies are, however, at very preliminary stages, and we may need to monitor the progress at this university for possible adoption at ICRISAT Center. CFTRI at Mysore has excellent infrastructure for researches of millet grains for various food preparations and alternative uses. We have developed a line from a photosensitive Ghana germplasm which has > 20 g 1000⁻¹ seed mass but is soft-textured. Dr. N.G. Malleshi from CFTRI has requested for 2 kg seed of this line to evaluate for popping quality and to examine the effect of paraboiling on grain hardening and storage quality. We shall multiply the seed of this line in November planting and supply it to him in March 1991.

II. AICPMIP WORKSHOP

A. QUINQUENNIAL REVIEW TEAM REPORT

The opening session of the AICPMIP meeting, Chaired by Dr. R.S. Paroda, DDG (Crops) ICAR, was devoted to a report from Dr. S.S. Rajan, the chairman of the AICPMIP Quinquennial Review Team (QRT) on its provisional recommendations, and a long but productive discussion of these findings. The QRT has done a very thorough review of the Millet Coordinated Project and made some excellent suggestions for change which, if implemented, should greatly increase the effectiveness of the project. The subsequent discussion, which included a presentation of ICRISAT's present and future relationship to the Coordinated Project by Dr. Y.L. Nene, indicated a generally high level of support for the QRT's recommendations.

Policy recommendations

- Specific goals for progress to be achieved in the next 10 years need to be fixed, by both the Coordinated Project and individual research centers.
- Project activities need to be organized on a zonal basis, in order to breed materials with proper maturities for the different zones.
- The coordinated trials should better reflect the wide variety of environmental and cultural conditions in which the crop is produced across the country, rather than having fixed treatments/controls as is done at present.

- A systematic mechanism needs to be developed for the identification of research priorities as none exists at present.
- Greater effort needs to be put into finding higher income-generating uses for pearl millet, because of the increasing concentration of pearl millet in marginal areas with few opportunities for diversification.

Research recommendations

- Additional effort should be put into population improvement, both to produce varieties as well as to expand the genetic base of the crop.
- Both agronomic and breeding researches should be approached from a regional or zonal basis, i.e., by focusing research on systems or plant types with the greatest potential for the zone.
- Target yield levels should be defined for various zones and cropping systems.
- Greater effort needs to be made in the evaluation and use of the germplasm, including the use of trait-specific gene pools.
- Landraces from Western Rajasthan need to be collected before they are lost.
- There is a need for a better understanding and use of genetic variability for photoperiod response in the crop.

- A proper set of differentials for the identification of downy mildew pathotypes need to be developed, as a part of more detailed studies on the nature of the host-pathogen relationship.
- Fertilizer levels in trials should be adjusted for the zone and cropping system in which the trial is conducted, and the trials should work with new rather than established varieties.

Organizational recommendations

- Senior scientists should be associated with both discipline and zonal breeding and research projects to provide specific guidance to the projects.
- A number of changes need to be made in the present system of variety and hybrid testing: test sites should be selected on the basis of the area sown to millet in district/zone they represent, rate of data return needs to be improved, (especially from Rajasthan and U.P.), and a better organization of the testing program from the Coordinating Unit is needed.
- There is a need for more basic studies on the crop, particularly in the area of crop-weather interactions, and disease-weather interactions, etc.
- The national AICPMIP meetings should be held only once in 2 or 3 years. Annual meetings should be on a zonal or problem basis, and encourage the wider participation especially of junior scientists.

- The Project Coordinator should have greater responsibility of followup, in the areas of project records, trial management, centralized procurement of supplies, and publication of a newsletter, etc.
- Certain Project centers should be strengthened and encouraged to concentrate on a specialized research areas. For example, PAU should concentrate on breeding fodder varieties and male sterile lines, and centers in western Rajasthan, and Rahuri, and Palem stations should be strengthened.

(B). BREEDING GROUP MEETING

Plant Breeding group meeting was conducted under the Chairmanship of Dr. S.S. Rajan, with Dr. P.N. Behl as Co-chairman and Dr. G. Harinarayana as Rapporteur.

Trial constitution

- It was decided that Pearl Millet White Grain Trial (PMWGT) will not be conducted separately, resulting in its merging with Initial Hybrid Trial (IPMHT-1).
- Early trial, which used to include both early-maturing hybrids and open-pollinated varieties (≤ 49 days to 50% bloom) was split up into two trials. (1) Pearl Millet Early Hybrid Trial (PMEHT VII) and (2) Pearl Millet Early Population Trial (PMEPT IX).

- A new trial of released hybrids and open-pollinated varieties (Pearl Millet Released Entries Trial : PMRET X) was constituted to evaluate the relative yields and adaptation of released varieties and hybrids on a large scale.
- A Germplasm Resource Nursery VII has been proposed from this year which will include diverse sources of useful traits (including yield, yield components, morpho-physiological traits, adaptation traits, disease resistance). ICRISAT is to contribute 20 entries this year.
- Fodder trials, conducted so far independently, have now been integrated with the AICPMIP testing system.

ICRISAT'S contribution to trials

- ICRISAT's contributions to various breeding yield trials in AICPMIP include a total of 21 test entries (excluding 2 released hybrids, 3 released open-pollinated varieties, 9 male-sterile lines) (Table 1).
- Due to a large number of private agencies entering their materials into AICPMIP testing system, each center was allowed to contribute only one entry to each of IPMHT-1, PMEHT VIII, and PMEPT IX and not more than two entries to IPMPT IV.
- For the first time, we have contributed a hybrid (ICMH 90953) to the Initial Fodder Bajra Trial.

Performance of ICRISAT entries

- A topcross hybrid (ICMH 88088) bred on 81A yielded 100 kg ha⁻¹ more grains and flowered two days earlier than ICMH 451 in the Advanced Hybrid Trial (Table 2). A single cross hybrid (ICMH 88735) bred on ICMA 88004 also yielded 100 kg ha⁻¹ more grains but flowered seven days earlier than ICMH 451 in the Initial Hybrid Trial.
- In the Advanced Population Trial, ICMV 87402 was the highest yielding entry which yielded 2106 kg ha⁻¹ grain (237 kg ha⁻¹ more than WC-C75). This variety, however, was withdrawn because after 3 years of testing AICPMIP does not retain entries any longer in the trial and we did not consider appropriate to submit a proposal for its release because (a) the proposal of ICMV 84400 is already under consideration and (b) the proposal of RCB-IC9 (a variety developed cooperatively by Rajasthan Agricultural University and ICRISAT) was submitted by our cooperator (Dr. G.K. Arya). In the Initial Population Trial, ICMV 87111 yielded 190 kg ha⁻¹ more grains and flowered two days earlier than WC-C75. All the varieties in this trial, however, yielded, at least, 100 kg ha⁻¹ less than ICMV 84400.
- In the Early Trial, RCB-IC 892 (bred cooperatively by Rajasthan Agricultural University and ICRISAT) was the highest yielding open-pollinated variety; it yielded about 350 kg ha⁻¹ more and flowered four days earlier than WC-C75. In the same trial, ICMH 87003 (bred on 863A) was the highest yielding among ICRISAT-bred hybrids: it yielded 370 kg ha⁻¹

more and flowered three days earlier than WC-C75. The highest yielding entry in this trial was a hybrid (MLBH 20) bred by Mahindra Seeds Co. it yielded 480 kg ha⁻¹ more grains and flowered five days earlier than WC-C75.

Minikits

- Two hybrids (HHB67, VBH 4) and an open pollinated variety (RCB-IC 9) were identified for release by the Variety Identification Committee. These will be evaluated in minikits during 1991-1992.
- HHB67 is bred by HAU on our male-sterile line 843A, VBH 4 is bred by Vijay Seeds Company on our male-sterile lines 81A; and RCB-IC 9 is the product of a cooperative research program involving Rajasthan Agric. University and ICRISAT.

Breeder seed production

- The projected breeder seed production of 3136 kg for a total of 26 entries (6 pairs of A/B lines, 9 R-lines and 5 open-pollinated varieties) during 1990 (for seed supply in 1991) is given in Table 3.
- ICRISAT has been assigned to produce 1944 kg of breeder seed (62% of the total projected production). The parental components of ICMH 451 will account for 34% of our production target, and ICTP 8203 and WC-C75 together will account for another 31% of our production target.

- The cultivation of BK560 has been allowed by the Govt. of India to be continued for another 2-3 years, resulting in 5141 A/B topping the seed production list of male-sterile lines.

Denotification

- Based on breakdown to downy mildew or seed production problems, several cultivars released by AICPMIP were denotified. These include hybrids BJ-104, BD 111, BD763, MBH110, MBH130, X5, MHB 45 and synthetic PSB-8.

C. PATHOLOGY GROUP MEETING

- This meeting was chaired by Dr. H.S. Shetty (Mysore), Technical Program Expert, Pathology. Dr. B.L. Jalali (HAU), a member of the QRT, attended the meeting as an observer. The following main points emerged from the meeting.

The group welcomed the suggestion of Dr. Y.L. Nene and its affirmation by Dr. R.S. Paroda for holding a meeting jointly by ICRISAT and ICAR on downy mildew at ICRISAT Center. Dr. H.S. Shetty (Mysore) and Dr. S.D. Singh (ICRISAT) will develop the program for the meeting.

- The ICRISAT-ICAR project on "Nature of resistance to downy mildew in pearl millet" will be initiated from the 1990 rainy season. Dr. H.S. Shetty will coordinate this project.
- On the suggestions of Dr. Paroda, Dr. Harinarayana and other breeders, the group agreed to relax the acceptable downy mildew incidence limit from 5% to 7%. This limit of 7%

will be acceptable when the susceptible check has 70% incidence. The acceptable limit for an entry should be proportionate (1:10) to the incidence in the susceptible check cultivar. For example, when the susceptible check shows 90% incidence the acceptable limit for an entry can be 9%. It was suggested therefore, that weighted mean downy mildew incidence of entries in relation to the susceptible check should be reported. The overall mean incidence of entries across locations in each zone (A & B) should be considered while deciding the performance of entries for resistance to downy mildew. The disease nursery with <50% incidence on the susceptible check should not be considered as an effective location.

In case of a resistant hybrid ($\leq 7\%$ downy mildew incidence) whose one parent is susceptible, the group felt that the resistance of such hybrids will break down earlier, and suggested that downy mildew resistance be introduced in the susceptible parent.

The results of the 1989 Pearl Millet Disease Monitoring Nursery (PMDMN), coordinated by ICRISAT, were quite useful (A summary report of this nursery is available with RPT). Two changes in the entries were suggested for the 1990 PMDMN, BJ 104 and MBH 110 to be replaced by HHB 67 and Pusa 23.

Screening for downy mildew remains the major activities, but screening for smut and ergot by artificial inoculation and for rust and blast under natural disease pressures will

continue for breeding trial entries.

Studies on epidemiology of downy mildew will include a) Seed transmission in BK 560, b) oospore germination, c) physiologic specialization, and d) chemical control.

Some members showed concern about poor reporting of data in the AICPMIP and made several suggestions to the TPL, Dr. K.B. Pawar, to improve the reporting.

D. PLANT PHYSIOLOGY GROUP MEETING

- The Plant Physiology Group met under the chairmanship of Dr. A. Shiv Raj, Head, Dept. of Plant Physiology, APAU. The technical program of the year 1990 was discussed, modified as necessary, and agreed upon by the group. Major changes included the initiation of work on drought tolerance and photoperiod response, the evaluation of inbred lines selected for high biomass production and for yield under terminal drought stress, and the continuation of the multilocation testing of varieties and hybrids for drought tolerance, which was initiated by ICRISAT as a cooperative trial several years ago. These changes should greatly increase the relevance of the physiology work to that of the millet breeding group.

Two of the research trials are a part of the ICAR/ICRISAT collaborative research initiative which began this year - the multilocation drought testing and the the basic research on terminal drought tolerance. The ICRISAT Millet Physiology Research Unit will participate in these, and will

try to help focus the AICPMIP drought research on practical objectives which can help in the breeding program. To this end it was agreed to arrange a visit to ICRISAT for the AICPMIP physiologists during the summer season to observe the drought research underway on all ICRISAT mandate crops, and to see ICRISAT's work on crop modeling and crop physiology.

Table 1. ICRISAT-bred entries contributed to 1990 AICFNP trials.

Entry name	Pedigree	Status
Initial Pearl Millet Hybrid trial (IPMHT I)		
1. ICMH 89010	ICMA 88004 X ICMR 89010	New
Advanced Pearl Millet Hybrid trial (APMHT II)		
1. ICMH 87003 (MH 310)	863A x ICMR 87003	Transferred from PMHT VIII
2. ICMH 88088 (MH 312)	81A x ICMR 88088	Retained
Initial Pearl Millet Population trial (IPMPT IV)		
1. ICMV 87107	EC II Co variety	New
2. ICMV 89410	MC C10 bulk	New
Advanced Pearl Millet Population trial (APMPT V)		
1. ICMV 86104 (MP 192)	MC	Retained
2. ICMV 87111 (MP 206)	EC II	Promoted from IPMPT-IV
3. ICMV 88402 (MP 207)	MC C8	Promoted from IPMPT-IV
4. ICMV 88908 (MP 208)	BSEC	Promoted from IPMPT-IV
Pearl Millet Early Hybrid Trial (PMHT-VIII)		
1. ICMH 88735 (MH 356)	ICMA 88004 x ICMR 87003	Transferred from IPMHT I
2. ICMH 89951 (MH 393)	843A x ICMR 89951	Retained
3. ICMH 89988 (MH 394)	ICMA 88004A x ICMR 89951	Retained
4. ICMH 90952	ICMA 88004 x BSEC TCP2-C2	New
Pearl Millet Early Population Trial (PMPT-IX)		
1. ICMV 88130 (MP 204)	EC 87	Retained
2. ICMV 88907 (MP 205)	BSEC	Retained
3. ICMV 88904 (MP 221)	BSEC	Retained
4. ICMV 89117	EC II	New
5. ICMV 89115	EC II	New
Initial Fodder Bajra Trial		
1. ICMH 90853	ICMA 88006 x HITIP TCP	New
Advanced Fodder Bajra Trial		
1. ICMV 84400		Retained
2. ICMV 84108		Retained

Entry name	Pedigree	Status
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Pearl Millet Released Entries Trial (FMRET-I)

1. ICMH 451
2. ICMH 423
3. WC-C75
4. ICMS 7703
5. ICTP 8203

Pearl Millet Parental trial (FMPT-III A)

1. 81A
2. 863A
3. 841A
4. 842A
5. 843A
6. ICMA 88004
7. ICMA 88006
8. ICMA 89111
9. AFM 1163

Checks

1. ICMH 451
 2. WC-C75
 3. ICTP 8203
 4. ICMS 7703
 5. ICMH 423
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Table 2. Grain yield (kg/ha) and time to 50% bloom (d) of ICRISAT-bred entries selected from 1989 AICFNIIP-trials for further testing in 1990.

Entry	Pedigree	Grain yield (kg ha ⁻¹) and rank				All India Time to bloom		
		Zone A		Zone B			All India	
Advanced Hybrid Trial								
ICMH 88088	81AxICMR 88088*	2184	3	2343	5	2323	5	53
ICMH 451(Check)		2013	8	2249	8	2219	8	55
Initial Hyb. Trial								
ICMH 88735	ICMA 88004xICMR 87003	1936	23	2368	5	2318	5	49
ICMH 451(Check)		1758	35	2273	8	2213	12	56
Advanced Pop. Trial								
ECB-IC 9		1656	3	2030	3	1983	3	55
ICMV 86104		1610	7	2024	4	1973	4	54
WC-C75(check)		1632	4	1903	5	1869	5	54
Initial Pop. Trial								
ICMV 87111		2748	5	1945	3	2096	2	52
ICMV 88402		3000	2	1894	5	2068	3	54
ICMV 88908		2688	6	1773	10	1935	8	50
WC-C75 (Check)		2634	7	1762	9	1907	9	54
ICMV 84400 (Check)		2874	3	1965	1	2202	1	54
Early Trial								
ICMH 87003	863A x ICMR 87003	1882	15	2354	8	2229	10	51
ICMH 89951	843A x ICMR 89951*	1646	31	2225	18	2136	17	47
ICMH 89988	ICMA 88004 x ICMR 89951*	1655	30	2296	14	2170	16	49
ICMV 88130	EC 87	1655	6	2065	5	1979	4	50
ICMV 88907	BSEC	1678	5	2101	3	2019	3	48
ICMV 88904	BSEC	1695	4	2050	6	1967	5	50
ECB IC 891	BSEC	1957	1	2169	2	2061	2	49
ECB IC 892	EC87	1957	2	2298	1	2203	1	50
GHB 30(Check)		1419	34	1849	33	1751	34	52
HHB 67(")		2149	1	1983	28	1977	28	46
WC-C75(")		1581	7	1953	8	1859	8	54

* Topcross pollinator

Table 3. Allocation of Breeder Seed Production¹.

S.No.	Centre	Breeder	Variety	Qty. (kg)
1.	Jamnagar	H.R. Dave	J 1188	10
			J 2002	30
2.	Patancheru	K.N. Rai	81A	262
			81B	155
			ICMP 451	249
			843A	98
			843B	52
			834A	64
			834B	27
			ICMP 501	30
			ICTP 8203	360
			WC-C75	270
			ICMV 87901	48
			ICMS 7703	52
3.	Hisar	R.L. Kapoor	H-90/4-5	39
			H-77/833-2	50
4.	Coimbatore	S. Palanisamy	732 A	38
			732 B	21
5.	New Delhi	O.P. Govila	5141 A	415
			5141 B	210
			K 560 230	190
			D 23	152
6.	Jaipur	G.K. Arya	RCB 2	1
7.	Pune	G. Harinarayana	PNBM-83090	36

¹ Year of Indent (1990) and year of supply (1991).