

# Project Coordinator Review

**54<sup>th</sup> Annual Group Meeting**

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ICAR - All India Coordinated Research Project on Pearl Millet  
Jodhpur, Rajasthan - 342 304



# REVIEW OF PEARL MILLET RESEARCH

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is the staple nutritious food of majority of the poor and small land holders, as well as feed and fodder for livestock in rainfed regions of the country. Pearl millet excels all other cereals due to its unique features - C<sub>4</sub> plant with high photosynthetic efficiency, high dry matter production capacity and is grown under the most adverse agro-climatic conditions with less inputs in short duration where other crops like sorghum and maize fail to produce economic yields. In India, pearl millet is the fourth most widely cultivated food crop after rice, wheat and maize. During 2017-18, pearl millet was grown in 7.4 million ha with an average production of 9.13 million tonnes and productivity of 1237 kg/ha (Directorate of Millets Development, 2019). The major pearl millet growing states are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana which account for more than 90% of pearl millet acreage in the country and commonly grown in rainy (kharif) season (June/July–September/October). It is also cultivated during summer season (February–May) in parts of Gujarat, Rajasthan and Uttar Pradesh; and during the post-rainy (rabi) season (November–February) at a small scale in Maharashtra and Gujarat.

Pearl millet is a good source of energy, carbohydrate, fat, ash, dietary fibres, iron and zinc. It is a rich source of vitamins like thiamine, riboflavin and niacin and minerals (2.3mg/100g) like potassium, phosphorous, magnesium, iron, zinc, copper and manganese. With low prolamine fraction, pearl millet is gluten free grain and is the only grain that retains its alkaline properties after being cooked which is ideal for people with gluten allergy. It has high proportions of slowly digestible starch (SDS) and resistant starch (RS) which contribute to low glycemic index (GI) and is much sought after in the recent trends of transformation in diets, food habits and the food industry. Due to the excellent nutritional properties and resilience to climate change, pearl millet along with other millets is renamed as a nutri-cereal (Gazette of India, No. 133 dtd 13th April, 2018) for production, consumption and trade and included in Public Distribution System. The minimum support price (MSP) of pearl millet is increased to Rs 1950 per quintal (raised by Rs 525 which is 36.84 %) compared to the previous years MSP at Rs 1425 resulting in highest returns of 96.97% of returns over the cost incurred when compared to all other crops. To bring millets into mainstream for exploiting the nutritional rich properties and promoting their cultivation, Govt. of India has also declared Year 2018 as the “Year of Millets”.

Research on Pearl millet improvement in India is carried through the All India Coordinated Research Project on Pearl Millet (AICRP-PM) administered by Indian Council of Agricultural Research (ICAR) through a network of 13 AICRP centers in Rajasthan, Gujarat, Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Punjab, Haryana and Tamil Nadu. The AICRP-PM centers located in 12 State Agricultural Universities (SAU's) and University of Mysore pursue mandated activities and strategic research on pearl millet in the areas of germplasm utilization, improvement, production, protection and value addition etc. As the growing conditions for pearl millet vary from near-optimum with high external inputs to highly drought-prone environments, prioritization of research in cognizance of production constraints and differential requirement of various crop growing regions led to formation of three zones viz., A<sub>1</sub>, A and B. Zone A<sub>1</sub> is comprised of parts of Rajasthan, Gujarat and Haryana receiving less than 400 mm annual rainfall.

Through ICAR- All India Coordinated Research Project on Pearl millet, a total of 167 hybrids and 61 varieties were identified and released for cultivation in different agro-ecological zones of the country. Pearl millet is the first crop where

MAS strategies and tools have been applied to develop "Improved HHB 67". Since its inception in 1974, the ICAR- All India Coordinated Research Project on Pearl Millet has developed a number of production and protection technologies specific to different agro-ecological regions which proved useful in enhancing the productivity of improved cultivars to commercial farming scales and thus increased the profitability of pearl millet cultivation.

Along with yield improvement, focus on the nutritional improvement was also taken care in Pearl millet. In order to develop varieties/hybrids with enhanced Fe and Zn and mainstream biofortification, a landmark decision was taken by the Pearl millet researchers to include Fe and Zn concentrations in the promotion criteria for promoting entries in the coordinated trials during the 52<sup>nd</sup> Annual Group Meeting of ICAR- AICRP on Pearl millet at PAU, Ludhiana. Refinement of technologies for processing of grain, development of value added products along with development of sound extension support for popularization of these technologies and products; spread of pearl millet cultivation in nontraditional areas and pearl millet hybrid seed production in North - Western part of the country is the need of the hour.

In the last year, QRT was constituted to review the progress of ICAR- AICRP on Pearl millet during 2012-17 under the chairmanship of Dr. P. Raghava Reddy, Former Vice Chancellor, ANGRAU and renowned members from different disciplines. Interactions were done with the AICRP on Pearl millet scientists during different time periods starting from last year Annual group meeting at Jodhpur, AICRP centre evaluations for different zones during June, AICRP centre visits during crop growth periods in September and October etc. Interaction meetings with private sector, seed production and processing units, different line departments involved in pearl millet seed production, marketing etc were also carried out. The report along with the QRT recommendations is in final stage of submission.

## CROP IMPROVEMENT

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The results of the research conducted during 2018-19 in different disciplines is summarized below:

### Hybrids notified

Pearl millet hybrids were notified and released for cultivation in various agro-ecologies of the country viz.,

- Hybrid PB 1705 was released for cultivation in medium maturity group for the states of Rajasthan, Gujarat, Haryana, Punjab, Delhi, Uttar Pradesh and Madhya Pradesh.
- Two hybrids HHB 299 and AHB 1200 were released as biofortified (high iron and zinc) dual purpose hybrids with high grain and dry fodder yield potential in A1, A and B zones.
- Hybrid BHB 1202, Balwan (NBH 4903) and GK 1116 were released for the state of Rajasthan and Pusa 1201 released for National Capital Region of Delhi.

The following eight hybrids were identified for cultivation in various agro-ecologies of the country during 53<sup>rd</sup> Annual Group Meeting at Agriculture University, Mandor, Jodhpur viz., PB 1756, DHBH 1397, PB 1720, MP 7878, HHB 311, RHB 234, AHB 1269 and RHB 233.

## Genetic enhancement

A significant progress was made during the year 2018-19 in genetic enhancement of crop. A total of 111 new experimental cultivars and 41 released hybrids/ varieties were evaluated in 13 trials during kharif and summer 2018 at 55 test locations in the four agro-climatic zones of the country. These genotypes expressed a wide range of grain and stover productivity (Table1).

**Table 1: Details of breeding trials on Pearl millet conducted during 2018**

Zone	Trials	No. of test entries& Checks	Range	
			Grain Yield (kg/ha)	Stover Yield (kg/ha)
A <sub>1</sub>	IHT Early	20	1281-2054	4186-5457
	AHPT Early	05	1553-1821	3606-4254
A	IHT Medium	37	2277-3798	6540-10774
	IHT Late	35	2240-4114	7866-12687
	AHT Medium	05	2465-2975	5870-9559
	AHT Late	06	3590-3933	8405-10861
	PT	13	1930-2769	6196-8832
B	IHT Medium	37	2322-4426	5403-9120
	IHT Late	35	2499-4883	5287-9982
	PT	10	1728-2692	3629-5207
Summer	SHT	12	4345-5235	7230-8571

## Utilization of male-sterile (A) and restorers (R) lines

A wide range of A and R lines were used in order to develop new experimental hybrids for evaluation. The hybrids evaluated during 2018 were based on 73 A-lines (by name) and 93 R-lines (by name). This is contributing significantly towards genetic diversification of parental lines and ultimately pearl millet hybrids for different agro ecologies in the country.

## Assessment of grain quality- Fe, Zn, Protein and Fat

During the 52<sup>nd</sup> AGM of ICAR-AICRP on Pearl millet at PAU, Ludhiana a landmark decision of including minimum Fe (42 ppm) & Zn (32 ppm) in promotion criteria was taken. From last year, this criterion was implemented.

In Coordinated experimental trials, those entries with high grain yield along with the checks were analysed for grain iron and zinc content across the locations. The iron and zinc content ranged from (38-89ppm) and (19-55 ppm) respectively over different trials and locations.

A total of 29 test entries were assessed for quality parameters like protein and fat. The values ranged from 8.0–15.5% in protein content. (This demonstrates that there exists enough opportunity to select for protein content in addition to high grain and stover yields).

## **Breeder seed production**

During 2018-19, breeder seed production of 32 parental lines (A, B & R) of hybrids and 10 OPVs was undertaken. A total of 54.97 q of breeder seed was produced which was much higher than the indented quantity of breeder seed (8.64 q) from Department of Agriculture and Cooperation, Ministry of Agriculture and Farmers Welfare (GOI).

## **DUS test and registration of cultivars with PPV & FRA**

A total of 40 candidate varieties including 23 for second year and 13 for first year and 4 farmers varieties along with 14 reference/example varieties were tested at ICAR-AICRP on Pearl Millet, Jodhpur and MPKV, Rahuri. Observations on candidate and reference varieties for twenty six characters were recorded as per general and specific DUS guidelines of pearl millet.

Monitoring of the DUS trials was done under the chairmanship of Dr. B. S Rajpurohit, Professor & Director Education, AU, Jodhpur on 11/10/2018 at Mandor, and at Rahuri monitoring of DUS trials in Pearl Millet was done under the chairmanship of Dr. H. T. Patil, Bajra Breeder, COA, Dhule on 16/10/2018.

## **ICAR-ICRISAT partnership research**

A total of 93 R lines and 84 B lines were assessed by breeders in five trials at 12 locations of AICRP centers and cooperating centers. Superior entries were selected for utilization by respective breeders. Phenotypic data was generated for marker assisted breeding trial carrying QTL for downy mildew and drought tolerance.

## **CRP biofortification (Pearl millet) parental line trial**

A trial comprising 20 entries including two checks (ICMB 98222 and Dhanshakti) having high Fe and Zn contributed by different ICAR-AICRP on Pearl millet centers was conducted at 5 locations viz., Mandor, Jaipur, Hisar, Jamnagar and Dhule. The data were generated for Fe and Zinc content and agronomic performance. Fe content ranged from 94 ppm to 118 ppm while Zn content ranged from 58 ppm to 62 ppm as compared to the best check Dhanshakti (Fe 93ppm & Zn 57 ppm). The dry fodder evaluation for nutrients in the fodder of biofortified pearl millet hybrids/varieties HHB 311, HHB 299, AHB 1200, AHB 1269, RHB 233, RHB 234 and Dhanshakti is also under progress.

## RESOURCE MANAGEMENT

The following five agronomy trials were conducted during kharif & summer seasons of 2018 in different agro climatic zones (Zone A<sub>1</sub>, Zone A and Zone B) (Table 2).

**Table 2: Details of the agronomy experiments along with treatments**

S. N.	Title	Treatment
1	<b>PMAT 1:</b> Response of advance hybrid & population entries to nitrogen levels <b>Kharif Season</b> Zone A <sub>1</sub> (1a) Zone A (1b)	16 (Entries 4, N level 4) 32 (Entries 8, N level 4)
2	<b>PMAT 2:</b> Effect of mulching and hydrogel on the productivity of pearl millet under rainfed conditions	8 (T1: Control (RDF), T2: Crop residue mulch @ 5.0 t/ha, T3: Hydrogel @ 2.5 kg/ha, T4: Hydrogel @ 5.0 kg/ha, T5: Hydrogel @ 7.5 kg/ha, T6: Crop residue mulch @ 5.0 t/ha + Hydrogel @ 2.5 kg/ha, T7: Crop residue mulch @ 5.0 t/ha+ Hydrogel @ 5.0 kg/ha and T8 :Crop residue mulch @ 5.0 t/ha + Hydrogel @ 7.5 kg/ha.)
3	<b>PMAT 3:</b> Performance of different weed management practices on pearl millet productivity	8 (T1: Control (RDF), T2: Crop residue mulch @ 5.0 t/ha, T3: Hydrogel @ 2.5 kg/ha, T4: Hydrogel @ 5.0 kg/ha, T5: Hydrogel @ 7.5 kg/ha, T6: Crop residue mulch @ 5.0 t/ha + Hydrogel @ 2.5 kg/ha, T7: Crop residue mulch @ 5.0 t/ha+ Hydrogel @ 5.0 kg/ha and T8 :Crop residue mulch @ 5.0 t/ha + Hydrogel @ 7.5 kg/ha.)
4	<b>PMAT 4:</b> Nutrient management through organic sources in rainfed pearl millet	T1: RDF, T2: RDN through FYM, T3: 75% RDN through FYM, T4: RDN through Vermi-compost, T5: 75% RDN through vermicompost, T6: T2 + Biomix, T7: T3 + Biomix, T8: T4 + Biomix and T9: T5 + Biomix.
5	<b>PMAT 5:</b> Performance of advance hybrid & populations under different dates of sowing Zone A <sub>1</sub>	12 (Entries 4, Dates of Sowing 3*) 24 (Entries 8, Dates of Sowing 3*) *July 5-10, July 20-25 & August 5-10)

## The salient achievements are as follows

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- Response of advance early hybrid entry (MH 2192) was recorded at four nitrogen levels (0, 20, 40 & 60 kg N/ha) in comparison to three early hybrid checks i.e. MPMH 21, HHB 272 and RHB 177 in Zone A<sub>1</sub>. The performance of the test entry was found better in terms of grain (10.27 q/ha) and stover yield (19.69 q/ha) than the tested checks MPMH 21 (9.69 q/ha;18.79 q/ha), HHB 272 (9.31 q/ha;17.77 q/ha) and RHB 177 (9.21 q/ha;16.83 q/ha) at all the locations in Zone A<sub>1</sub>. Application of 60 kg N/ha increased the grain yield to the tune of 70.8, 23.8 & 4.5 per cent over 0, 20 and 40 kg N/ha whereas, stover yield improved to the tune of 76.2, 23.1 & 6.4 per cent, respectively.
- In Zone A, three advance hybrid entries viz. MH 2267, MH 2224 and MH 2228 and two population entries MP 577 and MP 579 were tested for their response to four N levels (0, 30, 60 and 90 kg N/ha) in comparison with two hybrid and one population checks i.e. MPMH 17, KBH 108 and Pusa 383. The mean data pertaining to the performance of advance hybrid entries revealed that the entry MH 2267 (31.97 q/ha) was found to be highest grain yielder and it produced comparable yield than the higher yielder check KBH 108 (30.89 q/ha). Maximum grain (30.82 q/ha) and stover (79.65 q/ha) yields were recorded with the application of 90 kg N/ha and it produced 5.43 and 1.77 q/ha more grain yield, whereas, stover yield was 9.19 and 4.31 q/ha higher over application of 30 kg and 60 kg N/ha, respectively.
- The field experiment aimed to study the effect of mulching and hydrogel on the productivity, water use efficiency and microbial activity of pearl millet exhibited superior performance of the treatment-Crop residue mulch @ 5.0 t/ha+ Hydrogel @ 7.5 kg/ha by 55.3 and 41.1 %, respectively over RDF alone in Zone A<sub>1</sub> & Zone A whereas, in Zone B, T7 (Crop residue mulch @ 5.0 t/ha+ Hydrogel @ 5.0 kg/ha) was found best and had improved the grain yield by 43.6% in comparison to the RDF. The respective water use efficiency was 70.24, 66.41 and 73.72 kg/ha-cm, respectively in Zone A<sub>1</sub>, A & B. The soil microbial studies revealed that the microbe populations recorded better in the Delhi soils as compared to Mandor Center. The dehydrogenase activity, MBC, alkaline phosphatase, acid phosphatases and urease populations were significantly highest among all the treatments of hydrogel, mulching and their combinations as compared to their population in the RDF treatment.
- This experiment was conducted with an objective to improve/ fine tune the existing recommendations of weed management in pearl millet with eight different treatments of weed control including one new herbicide Tembotrione 42% SC. The treatment Tembotrione 42% SC @ 120 g a.i./ha at 3-4 leaf stage of weed was found to be the best method for weed control in terms of net returns (Rs. 35,428/ha) and it was followed by Pre emergence application of Atrazine @400 g a.i./ha fb 1 HW at 3-4 weeks after sowing (Rs.35,406/ha) in Zone A<sub>1</sub>; Pre emergence application of Atrazine @400 g a.i./ha fb 1 HW at 3-4 weeks after sowing (Rs. 30,531/ha) followed by Tembotrione 42% SC @ 120 g a.i./ha at 3-4 leaf stage of weed (Rs. 29,854/ha) in Zone A recorded higher yield & economics, whereas, in Zone B, application of tembotrione from 90 to 120 g a.i./ha could not produce the grain and stover yield to the tune of weed free and recommended practices of weed control for the pearl millet crop
- To enhance productivity and improve quality of pearl millet through nutrient management this experiment was planned with nine treatments of inorganic and organic sources. The mean data of the Zone A<sub>1</sub> showed that the maximum grain (12.76 q/ha) and stover yield (24.36 q/ha) were obtained by the application of RDF through inorganic sources and it was followed by the organic treatment i.e. RDN through Vermicompost + Biomix with grain (11.69 q/ha) and stover yield (22.51 q/ha).

The mean data of the Zone A showed that the maximum grain yield (20.54 q/ha) and stover yield (53.42 q/ha) were obtained by T1 treatment (RDF) and among the organic sources, the treatment T6 (RDN through FYM+biomix) with grain yield of 20.27 q/ha had maximum yield but stover yield was recorded high in T8 (RDN through vermicompost + biomix) with value of 52.41 q/ha. The protein content was also maximum in T1 (10.4%) and it was followed by T6 and T8 (10.2%) treatments. The OC (%), available N and P status were either maintained or slightly higher in the organic treatments compared to initial and RDF treatment.

Mean data of the Zone B revealed that the grain (25.10 q/ha) as well as stover yield (39.13 q/ha) were recorded highest in the RDF treatment (T1). The best organic combination comparable to the T1 was found to be T8 treatment (RDN through vermicompost + biomix) with grain and stover yields of 23.74 and 37.93 q/ha, respectively.

- The performance of new advance entries were evaluated under different sowing dates. In Zone A<sub>1</sub>, the grain yield in D1(July 05-10) and D2(July 20-25) were at par and the decrease in D3 (August 5-10) sowing was 52.5 and 52.0% as compared to respective dates. In Zone A, the mean data of the four locations revealed a decrease of 18.3 and 76.4% in grain yield in D2 and D3 sowing dates compared to D1. In Zone B, the mean data of four locations revealed that the grain yield was decreased from 29.41 q/ha in D1 to 26.86 q/ha in D2 and 21.84 q/ha in D3 and this decrease was 9.5 and 34.7%, respectively. The interaction effect between dates of sowing and advance entries was found significant at some locations in Zone A & B, thereby, indicating differential behavior of the pearl millet entries with delayed sowing.

## FRONT LINE DEMONSTRATIONS

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- During kharif and summer 2018 crop seasons, various Front Line Demonstrations (FLD's) on different production aspects [Improved hybrid/variety, Improved production practices, weed management, use of micronutrient ZnSO<sub>4</sub> and biofertilizer (Azospirillum + PSB), recommended doses of Nitrogen, Phosphorus and moisture conservation practices, Integrated nutrient management in pearl millet, Integrated weed management were conducted on 320 ha area against the target plan of 350 ha in the states of Rajasthan, Haryana, Gujarat, Madhya Pradesh, Punjab, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. The ARS, Fatehpur (SKNAU Jobner), KVK Banasthali & SDAU SK Nagar did not conduct the allotted FLD's. Adoption of improved production technologies recorded 16.0 to 61.2% higher grain yield compared to the yield recorded with the farmer's practice in Zone A<sub>1</sub>, 6.3 to 29.8% in Zone A and the increase was 14.5 to 118.8% in Zone B. During Summer, an average grain yield of 4589 kg/ha was obtained by adoption of improved hybrids as compared to the local varieties (4338 kg/ha). The average improvement in the grain yield to the tune of 5.8% than the local varieties was also reported.

## PLANT PHYSIOLOGY

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Six physiological trials were conducted at Mandor, Jaipur and Jamnagar during summer and kharif 2018.

- During the screening of advanced summer hybrids against terminal stress, low moisture and high temperature conditions, MSH 346 was found significantly superior, which reflects its better tolerance capacity towards terminal stress condition.

- Characterization for drought tolerance in Pearl millet genotypes, the B-lines (JMSB-20172 and, JMSB-9904) and inbred lines (J-2290) at Jamnagar and inbred line J-2340 at Mandor were high yielders under low moisture and high temperature conditions.
- In varietal characterization experiment on the basis of root and shoot traits, the genotype RHB 173 exhibited maximum shoot length, root length, shoot fresh weight, shoot dry weight and root dry weight whereas, GHB 558 exhibited maximum shoot fresh weight at par with RBH 177 experiment under field condition.
- In physiological mechanism of drought tolerance in pearl millet at early seedling stage, the drought tolerant parameters decreased significantly with application of 5% and 10% PEG by inducing water stress in all the hybrids while root length and catalase activity increased significantly under water stress. Hybrids MH 2228, MH 2224 and MH 2359 performed better both under non stress and water stress conditions owing to higher relative water content, membrane stability index, chlorophyll content and catalase activity at 15 days after sowing.
- Manipulation of source sink relationship in pearl millet through growth retardants - application of cycocel and mepiquet chloride (500 & 750 ppm) showed significant variations on physiological growth and yield attributing characters in pearl millet that might be on account of maintaining higher RWC, chlorophyll content and specific leaf weight by CCC and mepiquet chloride
- Identification of heat stress tolerance in genotypes at seedling stage in pearl millet – the parameters viz., shoot length, seedling dry weight, seedling vigor index, RWC, MSI, chlorophyll content decreased significantly while Proline, SOD (Superoxide dismutase), CAT (Catalase) and MDA (Malondialdehyde) content increased under heat stress condition. The genotypes PPMI 1263, PPMI 1239, HTP 94/54 and J-2588 performed better having high shoot length, seedling dry weight, SVI and high root shoot ratio.

## PLANT PATHOLOGY

### Screening for diseases

During kharif and summer 2018, six trials were conducted on various aspects of pathology at Mandor, Jaipur, Hisar, Gwalior, Jamnagar, New Delhi and Anand in zone A<sub>1</sub> & A and at Mysore, Aurangabad, Dhule, Coimbatore and Patancheru in zone B. Total of 310 entries were screened against downy mildew, blast, rust, smut and ergot diseases. Out of these, 154 entries were found resistant against downy mildew at 60 DAS, 106 entries against blast, 136 entries against rust, 134 entries against smut and 186 entries against ergot were found resistant.

- In addition, surveys were conducted to observe disease scenario during the crop season. The mean downy mildew incidence 5.41% in Zone A<sub>1</sub>, 3.80% in Zone A and 3.62% in Zone B was observed at 60 DAS in initial trial whereas in advanced trial, 4.70% downy mildew incidence in Zone A<sub>1</sub>, 3.62% in Zone A and 3.68% in Zone B was observed at 60 DAS. It was observed that rust and blast continued to be the main diseases of pearl millet. The range of downy mildew in the farmer's field varied from 0 to 15% according to the cultivars/varieties. It was observed that blast and rust were becoming more severe (90%) in the states of Rajasthan and Karnataka. Blast was recorded 5-90% in all the fields of Rajasthan while high rust incidence (15%) was observed in Maharashtra. However, smut and ergot incidence was very low in the most of the surveyed states.

**Table 3: Details of pathology trials on Pearl millet conducted during 2018**

Trial	Total number of entries	Highly resistant entries (No.)				
		Downy Mildew	Blast	Rust	Smut	Ergot
PMPT I	109	89	69	83	96	109
PMPT II	24	19	09	14	23	24
PMPT III	41	26	21	27	35	41
PMPT IVa	60	08	-	-	-	-
PMPT VII	12	12	10	12	12	12
PMPT IVc	64	-	27	-	-	-

## ENTOMOLOGY

Seven trials in Kharif and one in summer (total 8) were allotted to entomology discipline. All the experiments were conducted successfully.

**Table 4: Details of entomology trials conducted in 2018**

Trial	No. of entries/ treatments	Major insect-pests	Reaction/ comments
PMET- 1A (Jamnagar & Jaipur)	24 Advanced entries	Shoot fly	Vegetative stage- none was resistant. Earhead stage two were resistant
		Stem borer	1 entry resistant, 14 entries tolerant
		<i>Helicoverpa armigera</i>	3 entries recorded lowest larval population 2.0 larvae/5 ear heads.
		Leaf roller	one entry was found free
PMET- 1B (Jamnagar & Jaipur)	109 Initial trial entries	Shoot fly	57 tolerant at ear head stage
		Stem borer	3 entries free from borer and 63 entries tolerant
		<i>Helicoverpa armigera</i>	5 entries recorded lowest larval population 0.5 larvae/5 ear heads.
		Leaf roller	6 entries were found free
PMET- 2	Monitoring on Research Farm	Jamnagar	Incidence of shoot fly was high (av. 13.18%), while stem borer incidence was very high (av. 20.00%).
		Anand	The incidence of stem borer was higher (av.10.60%) as compared to shoot fly (av.8.33%).

Trial	No. of entries/ treatments	Major insect-pests	Reaction/ comments
		Jaipur	The major insect-pests were shoot fly, stem borer, white grub, termite and root bug
PMET-3	Survey on farmers field	Jamnagar	Shoot fly, stem borer, grass hopper, blister beetle, grey weevil, ear head worm ( <i>Helicoverpa</i> & <i>Eublema</i> ) and leaf binder was observed in low to medium intensity in pearl millet at farmer's fields.
		Jaipur	The major insect-pests were shoot fly, stem borer, white grub, termite and root bug. Grey weevil which was a regular pest for past many years was not observed during 2018.
PMET- 4	Testing of efficacy of different insecticides against shoot fly and stem borer in pearl millet	Shoot fly stem borer	Seed treatment of clothianidin 50 WDG @ 7.5 g/kg seed followed by spray of fipronil 5 SC 0.01% (20 ml/10 lit.) at 35 DAG was found effective
		stem borer	Seed treatment of clothianidin 50 WDG @ 7.5 g/kg seed followed by spray of cloranthraniprole 20 SC @ 0.006% (3 ml/10 lit.) at 35 DAG at 35 DAG was found effective
PMET- 5	Testing of efficacy of different insecticides against shoot fly and stem borer in pearl millet	Shoot fly, stem borer and <i>Helicoverpa armigera</i> , white grub and termite	Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg, removal of shoot fly dead hearts, fish meal trap @ 10/ha, spraying dimethoate 30 EC 0.03 % , at 35 DAG recorded lowest shoot fly, stem borer, termite & white grub incidence in pearl millet along with higher grain and fodder yield. Net return and ICBR was also the highest in this module
PMET- 6	Evaluation of different insecticides as a soil drenching for management of soil pests in pearl millet	white grub and termite	Soil drenching of imidacloprid 17.8 SL @ 60 g a.i. /ha recorded lowest white grub & termite % infestation at harvest, highest grain yield (2592 kg/ha), fodder yield (5642 kg/ha) and also recorded highest ICBR (1:12.46)
PMET- 7	Survey of insect-pests of summer bajra on farmers' field.	Summer pearl millet areas of Gujarat state	Shoot fly, stem borer, <i>Helicoverpa</i> , <i>Eublemasilicula</i> larvae and grey weevil was observed. At some places red cotton bug, jassids, mites were observed in pearl millet fields from low to medium intensity
PMET- 8	Relative susceptibility of pearl millet advanced entries to storage insect pests,	Experiment in progress	



हर कदम, हर डगर  
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*Agr<sup>o</sup>search with a human touch*



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