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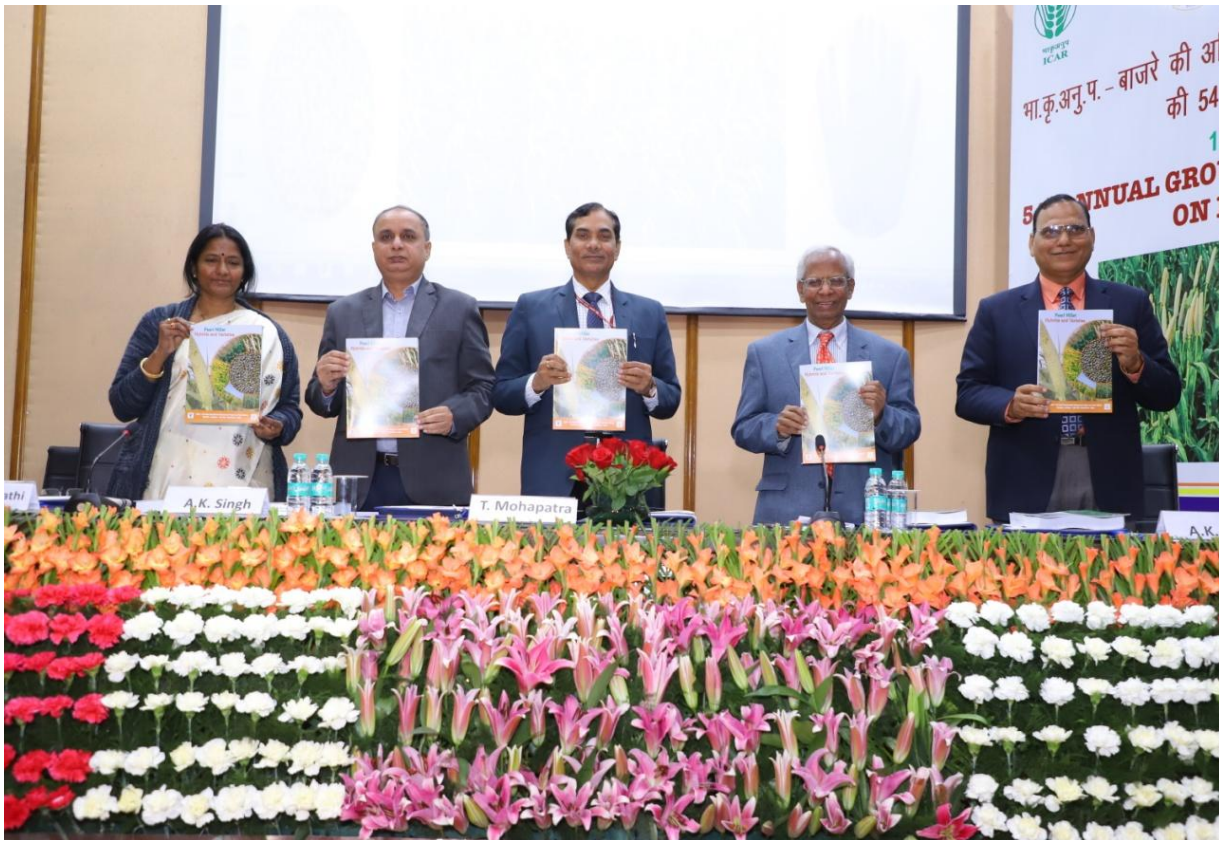
Proceedings of the 54th Annual Group Meeting of ICAR - All India Coordinated Research Project on Pearl Millet

Held at

ICAR – Indian Agricultural Research Institute
Pusa Campus, New Delhi

15th - 17th March, 2019



ICAR-All India Coordinated Research Project on Pearl Millet
Mandor, Jodhpur 342 304
www.aicpmip.res.in

54th Annual Group Meeting of ICAR-All India Coordinated Research Project on Pearl Millet

Date: 15-17 March, 2019 **Venue: B.P. Pal Auditorium ICAR-IARI, New Delhi**

AGENDA

Day 1: March 15, 2019 (Friday)

08:30 – 09:15	:	**Registration**	
09:30 – 10:30	:	**Session – I: Inaugural Session**	
		Chief Guest	Dr. T. Mohapatra Secretary, DARE & DG, ICAR
		Welcome	Dr. A.K. Singh, Director, ICAR-IARI & DDG (Extension), ICAR
		Highlights of Research in Pearl millet 2018-19	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
		Remarks by Guest of Honour	Prof. R.B. Singh, Chancellor, CAU, Imphal & Former President, NAAS
		Release of Publications	By dignitaries
		Inaugural address by Chief Guest	Dr. T. Mohapatra Director General, ICAR & Secretary, DARE
		Vote of thanks	Dr. A.K. Singh, Joint Director (Research), ICAR-IARI, New Delhi

10:30 – 11:00		Tea break

11:00 – 13:00		**Session – II: Brain Storming Session on "Enhancing Genetic Gains in Pearl millet for Nutritional Security and Economic Prosperity"**
		Under the Chairmanship of Dr. T. Mohapatra, Secretary DARE & DG, ICAR
		Convenor – Dr. C. Tara Satyavathi
		Panelists – Dr. B. Dayakar, ICAR-IIMR, Hyderabad Dr. Rakesh Srivastava, ICRISAT, Patancheru Dr. Shelly Praveen, ICAR-IARI, New Delhi Dr. R.S. Sohu, PAU, Ludhiana Dr. Anand Pandravada, Corteva Life Science Smt. Vimla Sihag, Progressive Farmer, Pali, Rajasthan Sh. Mohan Ram, Daikada, Rajasthan

13:00 – 14:00	:	Lunch break

14:00 – 17:30	:	**Session – III: Discipline-wise programme planning and finalization of technical programmes**		
14:00 -15:45		Discipline	Co-Chairs	Rapporteur
		Crop Improvement	Dr. O.P. Govila, QRT Member	Dr. Vikas Khandelwal, ICAR-AICRP on Pearl millet

			Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur	Dr. L.D. Sharma, RARI, Durgapura
		Crop Production		Dr. Anil Kumar, CCS HAU Hisar Dr. Meenakshi Grover, ICAR-IARI, New Delhi
			Dr. C. Viswanathan Head, Division of Plant Physiology	Dr. Sunita Gupta, RARI, Durgapura Dr. R.C. Meena, ICAR-AICRP on Pearl millet
		Crop Protection	Dr. Robin Gogoi (Plant Pathology) ICAR- New Delhi	Dr. Chandra Nayak, UOM, Mysore
			Dr. Mukesh Dhillon (Entomology) ICAR- New Delhi	Dr. R.K. Juneja, JAU, Jamnagar.

15:45 – 16:00	:	Tea break

16:00 – 17:30	:	Common Session for finalization of technical programme

18:00 – 19:00	:	**Session IV: Varietal Identification Committee Meeting**	
		Chairman	Dr. A.K. Singh, DDG (Horticulture & Crop Science), ICAR, New Delhi
		Member Secretary	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur

Day 2: March 16, 2019 (Saturday)

09:00 – 12:00	:	**Session V: Review of Research Results of AICRP-PM Centres 2018-19 (Centre-wise presentation of significant results and progress report)** (One consolidated presentation by centre-Incharge as per template provided; each presentation shall not exceed 10 minutes; handouts to be circulated in advance)	
		Co-chairs	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
		Rapporteurs	Dr. Yash Pal Yadav, RRS, Bawal
			Dr. T. Nepolean, ICAR-IIMR, Hyderabad
		Bikaner, Durgapura, Hisar, Gwalior, Jamnagar, Ludhiana & Ananthapuramu	

10:30 – 10:45	:	Tea break

12:00 – 13:00	:	**Session VI: Review of DUS Testing Project, Progress Report 2018-19 and Pearl millet genetic resources**	
		Co-chairs	Dr. Kuldeep Singh, Director, ICAR-NBPGR, New Delhi Dr. T.K. Nagrathana, Registrar, PPV&FRA, New Delhi
		Rapporteurs	Dr. Dev Vart Yadav, CCS HAU, Hisar Dr. Supriya, ICAR-AICRP on Pearl millet, Jodhpur

		Presentation	Progress Report of DUS testing in pearl millet - Dr. Vikas Khandelwal, ICAR-AICRP on Pearl millet, Jodhpur
			Status of pearl millet genetic resources – Dr. Sushil Pandey, ICAR-NBPGR, New Delhi
			Pearl Millet Pedigree Management System (1981-2018) - Dr. M. Elangovan, Principal Scientist, ICAR-IIMR, Hyderabad

13:00 – 14:00	:	Lunch break

14:00 – 17:00		**Session VII: New Initiatives for Pearl millet Research**	
		Chairman	: Padma Bhushan Prof. R.B. Singh, Chancellor, Central Agricultural University, Imphal
		Co-Chairs	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi Dr. Rajeev K. Varshney, Research Program Director, Genetic Gains, ICRISAT, Patancheru Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
		Rapporteurs	Dr. R.K. Kakani, ICAR-CAZRI, Jodhpur
		Genome sequencing of pearl millet: What next?	Dr. Rajeev K. Varshney, Research Program Director, Genetic Gains, ICRISAT, Patancheru
		Breeding Management System in Pearl millet	Dr. Abishek Rathore, ICRISAT, Patancheru
		Improvement of Shelf Life in Pearl millet - Engineering approach	Dr. P.K. Sahoo, ICAR-IARI, New Delhi
		Pearl millet blast	Drs. Aundi Kumar & G. Prakash., Division of Plant Pathology, ICAR-IARI, New Delhi
		Marketing policies for promotion of pearl millet	Dr. Raka Saxena, Principal Scientist, ICAR-National Institute of Agricultural Economics & Policy Research, New Delhi
		Discussion on Breeding material development for A_1 zone	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur

15:30 – 15:45	:	Tea break

Day 3: March 17, 2019 (Sunday)

09:00 – 10:00	:	**Continue Session V: Review of Research Results of AICRP-PM Centres 2018-19 (Centre-wise presentation of significant results and progress report)** (One consolidated presentation by centre-Incharge as per template provided; each presentation shall not exceed 10 minutes; handouts to be circulated in advance)
		Aurangabad, Coimbatore, Dhule, Mysore, Vijaypur

10:00 – 11:00	:	**Session VIII: Review of Research Results, Progress Report of CRP on Biofortification and ICAR-ICRISAT Collaborative Projects 2018-19 and Plan of Work 2019-20**	
		Chairman	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi
		Co-Chairs	Dr. C.N. Neeraja, Principal Scientist, ICAR-IIRR Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
		Rapporteurs	Dr. K.D. Mungra, JAU, Jamnagar Dr. Sanjana Reddy, ICAR-IIMR, Hyderabad
		CRP on Biofortification	Respective Breeder from AICRP centres (Jaipur, Delhi, Jamnagar, Dhule, Hisar & Mandor) (Presentation not more than 5 minutes each- handout to be circulated in advance)
		Progress report of ICAR-ICRISAT Partnership trials 2018-19	Dr. B.R. Beniwal, ICAR-AICRP on Pearl millet, Jodhpur
		Partnership trials for 2019-20 - Breeding - Marker assisted breeding trials	 Dr. S.K. Gupta, Principal Scientist (Pearl millet breeding), ICRISAT, Patancheru Dr. Rakesh Srivastava, Principal Scientist (Pearl millet Molecular breeding), ICRISAT, Patancheru

11:00 – 11:15		Tea break

11:15 – 12:15	:	**Session IX: Review of Frontline Demonstrations for 2018-19 and Action Plant 2019-20, Review of BSP 2018-19 and Action Plan 2019-20**	
		Co-Chairs	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi Dr. D.K. Yadava, ADG (Seed), ICAR, New Delhi
		Rapporteurs	Dr. P.S. Shekhawat, SKRAU, Bikaner Dr. Arun Kumar MB, ICAR-IARI, New Delhi
		Progress reports on FLDs	Sh. Manoj Kumar, ICAR-AICRP on Pearl millet, Jodhpur
		Breeder Seed Production	Dr. Vikas Khandelwal, Sr. Scientist (GPB), ICAR-AICRP on Pearl Millet, Jodhpur

12:15 – 13:15		**Session X: Review of Research Results and Progress report 2018-19 (PI Presentation)** **Each presentation shall not exceed 10 minutes: Handouts to be circulated in advance**	
		Co-chairs	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
		Rapporteurs	Dr. P.S. Shekhawat, SKRAU, Bikaner
		Plant Breeding	Dr. Vikas Khandelwal, ICAR-AICRP on Pearl millet, Jodhpur
		Agronomy	Dr. Anil Kumar, CCS HAU, Hisar
		Plant Pathology	Dr. Chandra Nayak, UOM, Mysore
		Entomology	Dr. R.K. Juneja, JAU, Jamnagar
		Plant Physiology	Dr. R.C. Meena, ICAR-AICRP on Pearl millet, Jodhpur

13:00 – 14:00	:	Lunch break

14:00 – 16:00		**Plenary Session/ Session-wise Presentation and Recommendations**	
		Chairman	Padma Bhushan Prof. R.B. Singh, Chancellor, Central Agricultural University, Imphal
		Co-chairs	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi Dr. A.K. Singh, Jt. Director (Research), ICAR-IARI, New Delhi
		Remarks by PC	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
		Remarks by ADG (FFC)	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi
		Remarks by JD(R)	Dr. A.K. Singh, Jt. Director (Research), ICAR-IARI, New Delhi
		Rapporteurs	Dr. M. Elangovan, Principal Scientist, ICAR-IIMR-Hyderabad Dr. I. Johnson, Asstt. Professor, TNAU-Coimbatore
		Technical Session III	
		Crop Improvement	Dr. Vikas Khandelwal, ICAR-AICRP on Pearl millet, Jodhpur Dr. L.D. Sharma, RARI, Durgapura
		Crop Production	Dr. Anil Kumar, CCS HAU Hisar Dr. Meenakshi Grover, ICAR-IARI, New Delhi
			Dr. Sunita Gupta, RARI, Durgapura Dr. R.C. Meena, ICAR-AICRP on Pearl millet
		Crop Protection	Dr. Chandra Nayak, UOM, Mysore Dr. R.K. Juneja, JAU, Jamnagar
		Technical Session IV	Dr. Vikas Khandelwal, ICAR-AICRP on Pearl millet, Jodhpur
		Technical Session V	Dr. T. Nepolean, ICAR-IIMR, Hyderabad
		Technical Session VI	Dr. Dev Vart Yadav, CCS HAU, Hisar Dr. Supriya, ICAR-AICRP on Pearl millet, Jodhpur
		Technical Session VII	Dr. R.K. Kakani, ICAR-CAZRI, Jodhpur
		Technical Session VIII	Dr. K.D. Mungra, JAU, Jamnagar Dr. Sanjana Reddy, ICAR-IIMR, Hyderabad
		Technical Session IX	Dr. P.S. Shekhawat, SKRAU, Bikaner Dr. Arun Kumar MB, ICAR-IARI, New Delhi
		Technical Session X	Dr. P.S. Shekhawat, SKRAU, Bikaner
		Technical Session XI	Dr. M. Elangovan, Principal Scientist, ICAR-IIMR-Hyderabad Dr. I. Johnson, Asstt. Professor, TNAU-Coimbatore
		Felicitation	Retiring employee – Dr. Yash Pal Yadav
		Vote of thanks	Dr. A.K. Singh, Jt. Director (Research), ICAR-IARI, New Delhi
16:00 – 16:15		Tea	

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SESSION – I

INAUGURAL SESSION OF 54th ANNUAL GROUP MEETING OF ICAR-AICRP ON PEARL MILLET

Chief Guest	Dr. T. Mohapatra, Secretary, DARE&Director General, ICAR
Guests of Honour	Padma Bhushan Prof. R. B. Singh, Chancellor, CAU, Imphal & Former President, NAAS
Welcome Address	Dr. A.K. Singh, Director, ICAR-IARI & DDG (Extension), ICAR
Research Highlights 2018-19	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl Millet, Jodhpur
Remarks by Guest of Honour	Padma Bhushan Prof. R. B. Singh, Chancellor, CAU, Imphal & Former President, NAAS
Inaugural address by Chief Guest	Dr. T. Mohapatra, Secretary, DARE&Director General, ICAR
Vote of Thanks	Dr. A.K. Singh, Joint Director Research, ICAR- IARI

In the Inaugural session of 54th Annual Group Meeting of ICAR-AICRP on Pearl millet held at Dr. B.P. Pal Auditorium, ICAR- IARI, Padma Bhushan Prof. R. B. Singh, Chancellor, CAU, Imphal & Former President, NAAS was the Guest of Honour and Dr. T. Mohapatra, Secretary, DARE & Director General, ICAR was the Chief Guest. The inaugural session started with floral welcome and address by Dr. A. K. Singh, Director, ICAR- IARI and DDG (Extension), ICAR. Dr C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on pearl millet, Jodhpur presented research highlights of work done in pearl millet during 2018-19. Important points emerged from her presentation are given below:

- The pearl millet productivity was 1237 Kg/ha during 2017-18.
- During 2018-19, a total of 111 new experimental cultivars were evaluated in 13 trials conducted during kharif and summer 2018 at 55 test locations in the country. The hybrids evaluated during 2018-19 were based on 73 A lines and 93 R lines.
- During 2018-19, breeder seed production of 32 parental lines (A,B&R) of hybrids and 10 OPVs was undertaken.
- 40 candidate varieties were tested for DUS characterization.
- In ICAR-ICRISAT partnership trials a total of 93 R lines and 84 B lines were assessed by breeders in 5 trials at 12 locations. CRP biofortification parental line trial was also conducted.
- Five agronomy, 6 pathology, 7 entomology and 6 physiology trials were conducted during kharif and summer 2018.

A number of publications were also released on this occasion viz. Summary of Experiments 2018-19, Pearl millet News Letter, Pearl millet Hybrids & Varieties, Pedigree database on Pearl

millet elite breeding stocks: ICAR – AICRP on Pearl millet 1981-2018 and POSHAN (Pearl millet Oriented Staple Healthy All Inclusive Nutrition).

Padma Bhushan Prof. R. B. Singh, Chancellor, CAU, Imphal & Former President, NAAS congratulated Project Coordinator and whole pearl millet group on various achievements made during 2018-19. He mentioned that Pearl millet is the real Pearl of nutrition and has a major role in addressing the nutritional security of the country.

Dr. T. Mohapatra, Secretary, DARE & Director General, ICAR, congratulated Project Coordinator and whole pearl millet group on various achievements made during 2018-19. He emphasized the importance of research in the AICRP centres along with evaluation. He also suggested that new frontier area research should be taken up. He reiterated that disruptive technologies should be thought of to improve and address the various researchable issues like development of material for A_1 zone and improving shelf life of pearl millet flour.

The session ended with vote of thanks by Dr. A.K. Singh, Joint Director (Research), ICAR-IARI, New Delhi.

SESSION – II

BRAINSTORMING SESSION ON "ENHANCING GENETIC GAINS IN PEARL MILLET FOR NUTRITIONAL SECURITY AND ECONOMIC PROSPERITY"

Chairman	Dr. T. Mohapatra, Secretary, DARE & Director General, ICAR	**Convenor**	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet

Panelists

Dr. B. Dayakar, ICAR-IIMR, Hyderabad
Dr. Rakesh Srivastava, ICRISAT, Patancheru
Dr. Shelly Praveen, ICAR-IARI, New Delhi
Dr. R.S. Sohu, Forage breeder, PAU, Ludhiana
Dr. Anand Pandravada, Research Lead (India), Corteva Life Sciences
Smt. VimlaSihag, Progressive Farmer, Pali, Rajasthan
Sh. Mohan Ram, Daikada, Rajasthan

Date : March 15, 2019 **Time** : 11.00 AM

The Brainstorming session on **"Enhancing Genetic Gains in Pearl millet for Nutritional Security and Economic Prosperity"** was initiated and the topic was introduced by the convenor - Dr. C. Tara Satyavathi, Project Coordinator, ICAR- AICRP on Pearl millet. She presented the status of pearl millet research in India along with area, production and productivity scenario. She also presented the areas in which research efforts are to be directed.

Dr. Dayakar Rao, Principal Scientist from IIMR, Hyderabad stressed upon the need for popularization of pearl millet products and marketing through FPOs, small scale entrepreneurs and MNC's.Dr. Rakesh Srivastava, Principal Scientist, Pearl millet molecular breeding from ICRISAT, Patancheru emphasized on the need for marker assisted research in Pearl millet. He also mentioned that Pearl millet was the first crop to have a marker assisted product (HHB 67 Improved) developed among all the crops. He also reiterated the importance of pearl millet genome sequencing, mapping panel development and genomic selection in pearl millet improvement. Dr. Shelly Praveen, Head, Division of Biochemistry, ICAR-IARI, New Delhi stressed upon the need for nutritional quality improvement along with yield in Pearl millet. Also updated the group about the various activities taken up by the division in Pearl millet flour keeping quality improvement.

Dr. R.S. Sohu, Forage breeder, PAU, Ludhiana elaborated the possibility of breeding for forage pearl millet in Punjab. Dr. Anand Pandravada, Research Lead (India), Corteva Life Sciences has explained the possibility of use of marker technology, high throughput phenotyping and genotyping, speed breeding and also genome editing to address the issues on product/hybrid development, seed production and Pearl millet flour rancidity. Pioneer Ltd before merging into

Corteva life sciences was the major private player in developing a large number of pearl millet hybrids in India.

Smt. Vimla Sihag, Progressive woman Farmer, Jodhpur, Rajasthan brought the home made cake of pearl millet and served it to all the dignitaries on and off the dias. She stressed on the need of bajra like that of bajri quality (local land races). She also gave the account of spread of MPMH 17 hybrid and how the farmers have adopted it due to its high yield even during the drought year in 2018 and bristles on the spikes which did not attract birds. Sh. Mohan Ram, Progressive Farmer, Daikada, Rajasthan who took up the cultivation and seed production of MPMH 17 in Rajasthan said that the state needs varieties and hybrids like MPMH 17. He praised the efforts made by PC unit, ICAR-AICRP on Pearl millet and Agriculture University, Jodhpur in popularization of the pearl millet hybrid MPMH 17. Also presented the possibility of taking up seed production in summer in Jodhpur, Rajasthan.

After the panelists view points were presented, the chairman Dr. T. Mohapatra gave the final remarks.

- He stressed that pearl millet is a major nutricereal. The research should be done and taken up by all the AICRP centres. The centres should not restrict themselves only for testing.
- He also emphasized that of the total pearl millet area cultivated in the country, nearly 4.5 m. ha is under low rainfall area. i.e.A_1 zone. Research efforts should be diverted for developing varieties/ genotypes and technologies for this area.
- He also stressed upon the need for directing the research efforts for improving the shelf life of pearl millet flour for enhancing its consumption.
- He also mentioned that the genetic gains are higher in pearl millet and it should be recorded and documented
- Along with yield, breeding for nutritional quality should also be included in the respective breeding programmes.
- Efforts should be made to popularize the nutritional quality of pearl millet and mainstream its consumption as a staple food crop.
- He also stressed upon the multidisciplinary research to be carried out by the centres.

After the chairman's remarks, mementos were presented to all the panelists. The session ended with vote of thanks to the chair and panelists.

SESSION – III

PLAN OF WORK 2019-20

A. CROP IMPROVEMENT (PLANT BREEDING)

Chairman : Dr. O. P. Govila, Former Project Coordinator& QRT Member

Co-Chairman : Dr. C. Tara Satyavathi, Project Coordinator

Rapporteur : Dr. L. D. Sharma, Professor (GPB), RARI, Durgapura

Dr. Vikas Khandelwal, Sr. Scientist (GPB), PC Unit, ICAR-AICRP on Pearl millet, Jodhpur

Date : 15-03-2019 **Time** : 2.00 pm

FORMULATION OF TECHNICAL PROGRAMME FOR 2019-20
PLANT BREEDING

Organization of trials

Criteria for promotion of entries

- Grain yield = higher than best check or 10% higher over relevant check in early and Medium group and 5% over relevant check in Late group.
- Downy mildew (60 DAS) under sick plot equal to or less than 5% in hybrids and populations across all Zones.
- Blast (Score) equal to or less than 3 (by using 0-9 scale) in hybrids and populations across all Zones.
- Ergot (% severity) under artificial inoculation conditions equal or less than 20% across all zones in hybrids and populations.
- Smut (% severity) under artificial inoculation conditions equal or less than 20% across all zones in hybrids and populations.
- Rust (% leaf area) equal to or less than 20% in hybrids and populations across all zones.
- Days to 50% flowering in IHT (Early) and AHPT (Early) equal to or less than 45 Days, in IHT (Medium) and AHT (Medium) equal to or less than 50 Days.
- A grace of one day in days to 50% flowering may be given to hybrids yielding grains 15% higher over HHB 67 Improved in early group hybrids and yielding grains 15% higher over relevant check in medium group hybrids.
- The total promoted entries should not be more than 33% of total test entries in medium and late maturity hybrid trials.
- Iron content ≥42 ppm and Zinc content ≥32 ppm in all the trials.

Promotion Criteria for Summer Hybrid Trial: (From 2019 onward)

- Grain yield = higher than best check or 5% higher over relevant check.
- Downy mildew (60 DAS) under sick plot equal to or less than 5% in hybrids.
- Blast (Score) equal to or less than 3 (by using 0-9 scale) in hybrids.
- Ergot (% severity) under artificial inoculation conditions equal or less than 20% in hybrids.
- Smut (% severity) under artificial inoculation conditions equal or less than 20% in hybrids.
- Rust (% leaf area) equal to or less than 20% in hybrids.
- The total promoted entries should not be more than 33% of total test entries.
- Iron content ≥42 ppm and Zinc content ≥32 ppm.

The following entries were promoted to next higher stage in various trials on the basis of performance in trials during Kharif 2018 for various characters:

Hybrid and Population Trials

Entries promoted to next higher stage of testing in kharif/summer 2019 Zone A_1 and A

S. No.	**Advanced Hybrid & Population Trial (E) Zone** A_1	**S. No.**	**Advanced Hybrid Trial (L) Zone A [AHT(L) A]**
	IHT (E) to AHPT I (E)		**IHT (L) A to AHT I (L) A**
1	MH 2382	1	MH 2439
2	MH 2381	2	MH 2423
3	MH 2385		
			AHT I (L) A to AHT II (L) A
	PT A to AHPT I (E)		Nil
	Nil		**Checks**
		3	86M86
	AHPT I (E) to AHPT II (E)	4	KBH 108
	Nil	5	MP-7792
	Checks		
4	HHB 67 (Imp.)		**EDV Trial**
5	RHB 177		New entries
6	HHB 272		+ Relevant Checks
7	MPMH 21		
S. No.	**Advanced Hybrid Trial (M) Zone A [AHT (M) A]**	**S. No.**	**Population Trial Zone A (PT A)**
	IHT (M) A to AHT I (M) A		**PT A to PT I A**
	Nil	1	MP 590
	AHT I (M)A to AHT II (M) A		**PT I A to PT II A**
	Nil		Nil
	Checks		**+ New entries of PT**
1	MPMH 17		**Checks**
2	GHB 905	2	Raj 171
3	86M01	3	Pusa Comp. 383
4	PB 1705	4	JBV 2
		5	Pusa Comp. 701
		6	Dhanshakti
		7	ICMV 221

Entries promoted to next higher stage of testing in kharif/summer 2019 Zone B

S. No.	Advanced Hybrid Trial (M) Zone B [AHT (M) B]	S. No.	Advanced Hybrid Trial (L) Zone B [AHT (L) B]
	IHT (M) B to AHT I (M) B		**IHT (L) B to AHT I (L) B**
	Nil	1	MH 2441
		2	MH 2439
	AHT I (M) B to AHT II (M) B		
	Nil		**AHT I (L) B to AHT II (L) B**
	Checks		Nil
1	Pratap		**Checks**
2	NBH 5767	3	86M86
3	86M01	4	Kaveri Super Boss
		5	NBH 5061
		6	NBH 4903
S. No.	**Summer Hybrid Trial (SHT)**	**S. No.**	**Population Trial Zone B (PT B)**
	SHT to SHT I		**PT B to I PT B**
1	MSH 353		Nil
2	MSH 354		
			PT I B to PT II B
	SHT I to SHT II		Nil
3	MSH 339		**+ New entries of PT**
4	MSH 346		**Checks**
	+ New entries	1	Raj 171
	Checks	2	ICMV 221
5	86M64	3	Dhanshakti
6	Proagro 9444	4	ICMV 155
7	Nandi 72*	5	Pusa Comp. 612
8	Nandi 75	6	ABV 04

* Nandi 72 had poor germination, so the entries which were completed 3rd year of testing will be compared with 86M64, Proagro 9444 & Nandi 72 for 2017 & 2018 and for 2019 the entries will be compared with 86M64, Proagro 9444 & Nandi 75 as the company has failed to provide the seed of Nandi 72 and it is not considered for three year data comparison (As the approval has been taken in the house).

Table I.1 Details of Centres and Trials Conducted During Kharif 2019/Summer 2020 in Zone A_1 and A

LOCATIONS	IHT (E)	IHT (M)	IHT (L)	AHPT (E)	EDV	AHT (M)	AHT (L)	PT	RHVT	SHT
ZONE A1										
RAJASTHAN										
Mandor (ICAR-AICRP)	*	*		*	*					*
Mandor (ARS, AU Jodhpur)								*	*	
Jodhpur (ICAR-CAZRI)	*			*						
Bikaner (SKRAU)	*	*		*	*			*	*	
Fathehpur Shekhawati (SKNAU)	*			*		**No**				
Samdari (AUJ)	*			*		**Entry**				
ARS, Jalore (AUJ)	*			*						
Chandan (ICAR-CAZRI)	*			*						
Nagaur (AU, Jodhpur)	*			*						
GUJARAT										
Kothara (SDAU)	*	*		*	*					
HARYANA										
Bawal (CCSHAU)	*	*		*	*					
Total Trials Zone A1	**10**	**4**	**0**	**10**	**4**	**0**	**0**	**2**	**2**	**1**
ZONE A										
RAJASTHAN										
Jaipur (SKNAU)		*	*		*		*	*	*	
Tabiji (SKNAU)		*								
Alwar (Pioneer)			*				*			
Alwar (Seed works International)		*								
Behrod (Bayer)		*	*							
Dausa (Rasi Seeds)		*	*							
GUJARAT										
Talaja (JAU)		*								
Anand (AAU)		*	*				*			*
Jamnagar (JAU)		*	*		*		*	*	*	*
S.K.Nagar (SDAU)	*	*		*						*
Ahmedabad (Nandi)		*	*							*
Dhanera (J K Seed)		*	*			**No**	*			
Dehgam (Metahelix)		*				**Entry**	*			*
Dehgam (Kaveri Seeds)			*							
Deodar (Bayer)										*
Kheda (Shaktivardhak)										*
Deesa (J K Seeds)										*
UTTAR PRADESH										
Jhansi (RLBCAU)		*						*	*	
Eglas (Bioseeds)			*							
Aligarh (Hytech)		*	*							
Hathras (Ganga Kaveri)			*							
Agra (Kartik Bio Seeds)		*	*							*
HARYANA										
Hisar (CCS,HAU)		*	*				*	*	*	
Shikohpur (ICAR-IARI-KVK)										
Gurugram (Tierraagrotech)		*	*					*		
MADHYA PRADESH										
Gwalior (RVSKVV)		*	*		*		*	*	*	
Morena (RVSKVV)								*		
PUNJAB										
Ludhiana (PAU)		*	*				*	*		*
DELHI										
New Delhi (ICAR-IARI)		*			*			*		
JHARKHAND										
Ranchi (BAU)									*	
Total Trials Zone A	**1**	**20**	**17**	**1**	**4**	**0**	**9**	**9**	**6**	**10**

Table I.1 Details of Centres and Trials Conducted During Kharif 2019/Summer 2020 in Zone B

LOCATIONS	IHT (M)	IHT (L)	AHT (M)	AHT (L)	PT	RHVT	SHT
MAHARASHTRA							
Auarangabad (NARP)	*	*		*	*	*	*
Auarangabad (Ajeet Seed)				*			
Niphad (MPKV)				*	*		
Dhule (MPKV)	*	*		*	*	*	*
Jalna (Mahyco)				*			*
Jalna (Krishidhan Ghanewadi)		*					
Pachora (Nirmal Seed)	*	*					*
Buldana (Dr. PDKV)		*		*			
Malkapur (Ankur Seed)		*					
KARNATAKA							
Vijayapur (UAS Dharwad)	*	*		*	*	*	
Malnoor (UAS, Raichur)	*		**No**		*	*	
Dharwad (KSSC Ltd)	*		**Entry**				
ANDHRA PRADESH							
Ananthapuram (ANGRAU)	*	*		*	*	*	
Perumallapalle (ANGRAU)	*				*		
Vizianagaram (ANGRAU)					*	*	
TELANGANA							
Palem (PJTSAU)	*				*	*	*
Hyderabad (Nuziveedu)		*					
Medchal (Ganga Kaveri)		*		*			
Manoharabad (Crystal Crop Protection)		*					
TAMIL NADU							
Coimbatore	*	*		*	*	*	*
ODISHA							
Koraput (OUAT)	*				*	*	
Total Trials Zone B	**11**	**12**	**0**	**10**	**11**	**9**	**6**

Observations to be recorded in initial and advanced trials:

1. Days to 50% Flowering –Rounded to 0 decimal
2. Plant Height (cm) –Rounded to 0 decimal
3. No. of productive tillers/plant -Rounded to one decimal
4. Panicle length (cm) -Rounded to one decimal
5. Panicle Diameter (cm) - Rounded to one decimal
6. Seed set under bagging (In hybrid trials only) –Rounded to 0 decimal
7. Grain yield (kg/plot) -Rounded to three decimals
8. Fodder yield (kg/plot)- Rounded to three decimals
9. Days to maturity- Rounded to 0 decimal
10. Plant population at harvest (No./Plot)
11. 1000-seed wt (g)
12. Diseases and pest incidence (Under natural conditions)

New entries for testing in initial trial kharif 2019/Summer 2020

S. No.	Organization/Institution	Name of Entries				
		IHT (E)	IHT (M)	IHT (L)	PT	Summer
1	AICPMIP, Jodhpur	MPMH 34	MPMH 37			
		MPMH 35	MPMH 38			
		MPMH 36	MPMH 39			
2	AICPMIP, Jaipur	RHB-262	RHB-265	RHB-267	RCB-31	
		RHB-263	RHB-266	RHB-268		
		RHB-264				
3	AICPMIP, Dhule		DHBH 1758	DHBH 1811		DHBH 1756
			DHBH 1772			
			DHBH 1774			
4	AICPMIP, SKRAU, Bikaner	BHB-1901	BHB 1906			
		BHB-1902	BHB 1907			
		BHB-1903				
		BHB-1904				
		BHB-1905				
5	PMRS, JAU, Jamnagar	GHB 1265	GHB 1280	GHB 1240		GHB 1231
		GHB 1270	GHB 1281	GHB 1282		GHB 1245
		GHB 1277		GHB 1283		GHB 1260
		GHB 1279		GHB 1278		GHB 1268
6	AICPMIP, CCS HAU, Hisar	HHB 339	HHB 341	HHB 344	HBC 53	
		HHB 340	HHB 342			
			HHB 343			
7	IARI New Delhi		Pusa 1901		Pusa Composite 720	
			Pusa 1902		Pusa Composite 721	
			Pusa 1903		Pusa Composite 722	
8	CAZRI, Jodhpur	CZH 252	CZH 256			
		CZH 253	CZH 257			
		CZH 254	CZH 258			
		CZH 255				
9	AICPMIP, TNAU, Coimbatore		TNBH 16229			TNBH 1447
			TNBH 1447			
10	PAU Ludhiana			PHB 3507	GBL 2	
					GBL 5	
11	RARS, Palem, Telangana (PJTSAU)		PBH-1806	PBH-1832		
12	SDAU, S. K. Nagar		GDHB-1			GDHB-11
			GDHB-11			
13	NARP, Aurangabad		AHB-1529	AHB-1522		
			AHB-1552	AHB-1523		
				AHB-1524		
14	ARS, Malnoor (UAS, Raichur)				MBP-102	
15	RARS, Vijayapur (UAS, Dharwad)		VPMH-10		VPMV-10	
16	ICAR-Indian Institute of Millets Research	IIMR PH 1				
		IIMR PH 2				
17	Eco Agri Seeds Pvt. Ltd, Hyderabad		ECO-10	ECO-22		ECO-1182
18	Nuziveedu Seed Pvt. Ltd.,Secunderabad		NBH 5966	NBH 5900		
				NBH 5977		
19	Kaveri Seed Com. Ltd.			KPH 6266		
				KPH 6277		
20	Nu Genes Pvt. Ltd., Hyderabad			NU-427		NU-430
				NU-437		
21	Bayer Bio Science Pvt. Ltd., Hyderabad		PB 1889	PB 1873		PB 1921
			YMT 1858	YMT 1797		
22	Dupont Pioneer (CORTEVA)		86M94	86M94		86M21
				86M95		86M22

S. No.	Organization/Institution	Name of Entries				
		IHT (E)	IHT (M)	IHT (L)	PT	Summer
23	Nirmal Seeds Pvt. Ltd ., Pachora (MS)			NPH-5844		NPH-5423
24	Bisco Bio Sciences Pvt. Ltd. Hyderabad		BLPMH 110			BLPMH 111
25	HytechSeed India Pvt. Ltd., Hyderabad			HBH 170073		HBH 180315
				HBH 170727		
26	Ankur Seeds Pvt. Ltd., Nagpur			ARBH-17171		
27	Maharashtra state seeds corp. Ltd, Akola			Mahabeej-1009		
28	JK Agri Genetics Ltd, Hyderabad		JKBH 1783	JKBH 1535		
				JKBH 1782		
29	Rasi Seeds (P) Ltd.		RASI 1845	RASI 1863		RBX003
				RASI 1854		
30	Crystal Crop Protection Ltd., Hyderabad		DB80405	DB80198		DB80305
31	Hi Yield Agri Genetics Pvt. Ltd., Hyderabad			HYMH 4054		
				HYMH 4055		
32	Maharashtra Hybrid Seeds Company Pvt. Ltd.					MRB2222
						MRB2225
33	Shakti Vardhak Hybrid Seeds Pvt. Ltd.		SVPMH-108	SHAGUN		SVPMH-111
34	Trimurti Plant Sciences Pvt. Ltd.			TMBH 633		
35	Krishidhan Seeds, Jalna			17KM1228		
36	Mahodaya Seeds, Jalna			Mahodaya-356		
		23	**39**	**40**	**9**	**20**

Experimental details:

Initial Trials: No. of rows – 3 (net) Row length – 4m(net) Spacing- 60 cm x 15 cm (Zone A_1) 50 cm x 15 cm (Zone A & B) Plot size – 4m x 1.8 m (net) (Zone A_1) 4 m x 1.5 m (net) (Zone A & B) Fertilizer – As per recommendations	**Advanced Trials:** No. of rows – 6 (net) Row length – 4m (net) Spacing- 60 cm x 15 cm (Zone A_1) 50 cm x 15 cm (Zone A & B) Plot size – 4m x 3.6 m (net) (Zone A_1) 4m x 3.0 m (net) (Zone A & B) Fertilizer – As per recommendations
Population Trials: No. of rows – 6 (net) Spacing- 60 cm x 15 cm (Zone A_1) 50 cm x 15 cm (Zone A & B) Plot size – 4m x 3.6 m (net) (Zone A_1) 4m x 3.0 m (net) (Zone A & B) Fertilizer – As per recommendations	**EDV Trial:** No. of rows – 6 (net) Row length – 4m (net) Spacing- 60 cm x 15 cm Plot size – 4m x 3.6 m (net) Fertilizer – As per recommendations

Proposed entries for initial trials

IHT (E) A_1: 23	PT A & B Zone : 9
IHT (M) A & B Zone : 39	Summer 2019: 20
IHT (L) A & B Zone : 40	

Seed Requirement (per entry)

IHT (E) A_1 Zone : 1.5 Kg	AHT (M) A : 2.0 Kg	AHT (L) A: 2.0 Kg
IHT (M) A & B Zone : 2.0 Kg	AHT (M) B : 2.0 Kg	AHT (L) B: 2.0 Kg
IHT (L) A & B Zone : 2.250 Kg	RHVT A : 1.250 Kg	EDV Trials : 1.5 Kg
Initial Population Trial A & B Zone: 2.0 Kg	RHVT B : 1.250 Kg	
Population Trial A Zone : 1.5 Kg	Summer Hybrid Trial : 2.0 Kg	
Population Trial B Zone: 1.5 Kg		
AHPT (E) A_1 Zone: 1.5 Kg		

Additional seed requirement for entries of IIIrd year testing for agronomical trials (Separate pack)

	AHT Zone A: 3.500 Kg		AHT Zone B : 3.500 Kg
	PT Zone A: 2.500 Kg		AHPT Zone A_1: 2.500 Kg
	PT Zone B: 2.500 Kg		Summer Hybrid Trial : 2.0 Kg

Seed requirement of checks:

86M86: 10.0 Kg	Kaveri Super Boss: 6 Kg	GHB 905: 5.0 Kg	JBV 2: 4.0 Kg
ICMH 356: 3.0 Kg	RHB 173: 8.0 Kg	86M01: 6.0 Kg	Raj 171: 7.0 Kg
86M64: 4.0 Kg	MP-7792: 6.0 Kg	HHB 272: 5.0 Kg	Pusa Comp. 383: 5.0 Kg
GHB 558: 6.0 Kg	NBH 5061: 8.0 Kg	NBH 5767: 8.0 Kg	Pusa Comp. 701: 2.0 Kg
HHB 67 Imp.: 8.0 Kg	HHB 223: 2.0 Kg	PB 1705: 4.0 Kg	Dhanshakti: 7.0 Kg
RHB 177: 7.0 Kg	Pratap: 6.0 Kg	NBH 4903: 4.0 Kg	Nandi 72 : 2.0 Kg
GHB 538: 3.0 Kg	MPMH 17: 8.0 Kg	ICMV 155: 3.0 Kg	Proagro 9444: 2.0 kg
KBH 108: 8.0 Kg	MPMH 21: 5.0 Kg	ICMV 221: 6.0 Kg	ABV 04: 4.0 Kg

Seed requirement of Released Hybrids/varieties: 1.5 Kg seed of all national released hybrids/ varieties since 2005 should be sent for RHVT Trial positively (Separate pack).

The required quantity of seed material **(untreated)** of entries along with pedigree selected for organizing the trials as above with new entries should reach to the office of the Project Coordinator (Pearl Millet), ICAR-AICRP on Pearl Millet, ARS, Mandor, Jodhpur 342304 (Rajasthan) **latest by 25th May 2019 for kharif and by 15th January 2020 for summer trials** along with required testing fee of Rs. 60,000 /entry (Private Sector) in form of DD/cheque at par in favour of Project Coordinator (Pearl Millet), Mandor, payable at Jodhpur. **If the testing fee is increased by the council, upon the receipt of information from council, increased testing fee will be charged from this season**. **Entries without fee and pedigree of hybrids/varieties will not be accepted.** Seed of each entry should be packed in cloth bag separately for each zone and also for agronomic trials**.**

Session ended with vote of thanks to the chair.

PLAN OF WORK 2019-20 FOR CROP PRODUCTION (AGRONOMY AND PLANT PHYSIOLOGY)

Chairman : Dr. C. Vishawnath, Head, Division of Plant Physiology, ICAR-IARI, New Delhi

Co-chairman : Dr. P.S. Shekhawat, Zonal Director Research, ARS, Bikaner (SKRAU, Bikaner)

Rapporteur :
1. Dr. Anil Kumar, Principal Scientist (Agro.), Bajra Section, CCS HAU, Hisar
2. Dr. Minakshi Grover, Principal Scientist (Microbiology), ICAR-IARI, New Delhi
3. Dr. Sunita Gupta, Professor (Plant Physiology), RARI, Durgapura (Jaipur)
4. Dr. R.C. Meena, Asstt. Prof. (Pl.Physiology), ICAR-AICRP on Pearl millet, Jodhpur

Date : March 15, 2019 **Time** : 02.30 PM

AGRONOMY

At the outset, Dr. R.S. Bana, Scientist (Agronomy), IARI welcomed the Chairman, Co- chairman & Rapporteurs of the Session. Dr. Anil Kumar briefly presented the results of the all the agronomical trials and apprised the chairman about different agronomical trials being conducted on the aspects of Nitrogen management in advance hybrid & population entries, Effect of mulching and hydrogel on the productivity of rainfed pearl millet, Weed management, Nutrition through organic resources and to see the Effect of dates of sowing in the advance hybrid & population entries.. At the outset, the chairman welcomed the participants in the workshop. The chairman initiated the discussion by describing the importance of bajra as food and feed crop besides as nutricereal in the national scenario. He emphasized that before execution of the new experiment, proper planning is of utmost importance. He also shared his experience on the physiological aspects of the pearl millet crop. The IARI scientists demanded that financial support for conducting the trials should be increased. A total of 41 trials were allotted to different centers and experiments of 39 trials were successfully conducted. The Chairman suggested that -

1. A short workshop/ training on phenotyping may be conducted by ICRISAT for concerned scientists working in Plant Physiology with AICRP on Pearl Millet.
2. Low cost rain out shelters to impose drought stress in all the centre should be provided to conduct drought experiments.

Trials to be continued during 2019-20 of Agronomy

- **PMAT 1 :** Response of pearl millet advance hybrids and/or populations to different levels of nitrogen.
- **PMAT 2 :** Effect of mulching and hydrogel on the productivity of pearl millet under rainfed conditions.
- **PMAT 3 :** Performance of different weed management practices on pearl millet productivity
- **PMAT 4 :** Nutrient management through organic sources in rainfed pearl millet

Recommendation of Plant Physiology (PMPHY 6)

It is recommended that the Foliar spray at tillering (20-25 DAS) & anthesis (35-40 DAS) stage of Chloromequet chloride and Mepiquet chloride showed significant variations on growth, yield and yield attributing characters in pearl millet. Economics of different treatment at three centre suggest that the maximum grain yield (2269 kg/ha), net return (Rs. 27526/ ha and BC ratio 2.73 was reported with Chloromequet chloride -500 ppm

Trials to be continued during 2019 -20 of Plant Physiology

PMPHY 1 : Screening of advance summer hybrids against terminal stress
PMPHY 2 : Characterization for terminal drought stress tolerance in pearl millet genotypes
PMPHY 4 : Varietal characterizations in pearl millet on the basis of root shoot traits
PMPHY 5 : Physiological mechanism of drought tolerance in pearl millet at early seedling stage
PMPHY 7 : Identification of heat stress tolerance in pearl millet genotype at seedling stage in pearl millet

New trial of Plant Physiology
PMPHY 3: To study the photosynthesis partitioning & remobilization in pearl Millet

AGRONOMY - TECHNICAL PROGRAMME FOR 2019-20

PMAT 1 : Response of pearl millet advance hybrids and/or populations to different levels of nitrogen

Objective : To study the response of advance hybrid and population entries to nitrogen application.

d) Performance of advance summer hybrids to nitrogen levels

Nitrogen levels (4) : 0, 60, 90 & 120 kg N/ha
Hybrids (2+2 check) : MSH 339, MSH 349, Nandi 72 (c) & Proagro9444 (c)
Design : Split plot (Nitrogen in main plot and entries in sub-plots)
Replication : Three
Plot size
Gross : 5.00 m x 4.00 m
Net : 4.00 m x 3.60 m
Locations : S. K. Nagar, Jamnagar, Aurangabad and Dhule

Observations to be recorded

1. Plant population (final) in thousands/ha
2. Plant height (cm)
3. Days to 50% flowering

4. Total number of tillers/plant
5. Effective number of tillers/plant
6. Test weight (g)
7. Grain yield (q/ha)
8. Dry Fodder yield (q/ha)

Note: The following soil properties of the field will be recorded before layout of the experiment: Soil texture, pH, EC, available nitrogen, available phosphorus and available potash.

PMAT 2 : Effect of mulching and hydrogel on the productivity of pearl millet under rainfed conditions

Objective : To find out the effect of mulching and hydrogel on the productivity and water use efficiency of pearl millet

*To find out the effect of different treatments on microbial activity in the soil (at Mandor and New Delhi)

Year of Start : 2017

Treatment
T_1 : Control
T_2 : Crop residue mulch @ 5.0 t/ha
T_3 : Hydrogel @ 2.5 kg/ha
T_4 : Hydrogel @ 5.0 kg/ha
T_5 : Hydrogel @ 7.5 kg/ha
T_6 : T_2 + Hydrogel @ 2.5 kg/ha
T_7 : T_2 + Hydrogel @ 5.0 kg/ha
T_8 : T_2 + Hydrogel @ 7.5 kg/ha

Locations : Bikaner and Mandor (Zone A_1)
Jaipur, Hisar, Jamnagar, and New Delhi (Zone A)
Aurangabad, Dhule, Vijayapur & Coimbatore (Zone B)

Entries : MPMH 17 (A_1), RHB 173 (A) and GHB 558 (B)

Design : RBD

Replication : Three

Treatment : 8

Plot size

Gross : 5.00 m x 4.00 m

Net : 4.00 m x 3.60 m

Observations to be recorded

1. Plant population (final) in thousands/ha
2. Plant height (cm)
3. Total number of tillers/plant
4. Effective number of tillers/plant
5. Test weight (g)

6. Grain yield (q/ha)
7. Dry Fodder yield (q/ha)
8. Water use efficiency (kg/ha-cm)
9. Economics
10. *Soil Microbial biomass C
11. *Soil enzymes (Urease, Dehydrogenase, Acid Phosphatase and Alkaline Phosphatase)
12. *Fungal, Bacterial and Actinomycetes counts
13. Economics

* (at Mandor and New Delhi only)

PMAT 3 : Performance of different weed management practices on pearl millet productivity

Objective : To find the optimum dose of Tembotrione (Post emergence herbicide) on yield, weed flora and their economics

Year of Start : 2018

Treatment

T_1 : Weedy check
T_2 : Weed free
T_3 : Two hand weeding 3 and 5 weeks after sowing
T_4 : Pre emergence application of Atrazine @ 400g. a.i./ha. followed by one weeding at 3-4 weeks after sowing
T_5 : Tembotrione 42% SC @ 90g. a.i./ha at 3-4 leaf stage of weeds
T_6 : Tembotrione 42% SC @ 100g. a.i./ha at 3-4 leaf stage of weeds
T_7 : Tembotrione 42% SC @ 110g. a.i./ha at 3-4 leaf stage of weeds
T_8 : Tembotrione 42% SC @ 120g. a.i./ha at 3-4 leaf stage of weeds

Locations : Bikaner and Mandor (Zone A_1)
Jaipur, Hisar, Jamnagar and New Delhi (Zone A)
Aurangabad, Dhule, Vijayapur & Coimbatore (Zone B)

Entries : MPMH 17 (A_1), RHB 173 (A) and GHB 558 (B)
Design : RBD
Replication : Three
Treatment : Eight
Plot size :
Gross : 5.00 m x 4.00 m
Net : 4.00 m x 3.60 m

Observations to be recorded

1. Plant population (final) in thousands/ha
2. Plant height (cm)
3. Total number of tillers/plant
4. Effective number of tillers/plant

5. Test weight (g)
6. Grain yield (q/ha)
7. Dry Fodder yield (q/ha)
8. Weed intensity at 30 DAS and at harvest
9. Weed dry matter at 30 DAS and at harvest
10. Weed control efficiency at 30 DAS and at harvest
11. Economics of the treatments

Note: Initial physico-chemical properties of the soil (pH, EC, organic carbon and available NPK)

PMAT 4 : Nutrient management through organic sources in rainfed pearl millet

Objective : To develop the appropriate technology to realize maximum production

Year of Start : 2018

Treatment
T_1 : Recommended dose of fertilizer
T_2 : Recommended dose of Nitrogen (RDN) through FYM
T_3 : 75 % RDN through FYM
T_4 : Recommended dose of Nitrogen (RDN) through Vermicompost
T_5 : 75 % RDN through Vermicompost
T_6 : T_2 + Biomix (*Azospirillum* + PSB + Mycorrhizae)
T_7 : T_3 + Biomix (*Azospirillum* + PSB + Mycorrhizae)
T_8 : T_4 + Biomix (*Azospirillum* + PSB + Mycorrhizae)
T_9 : T_5 + Biomix (*Azospirillum* + PSB + Mycorrhizae)
RDF : (40 kg N/ha + 20 Kg P_2O_5) for Zone A1 & A
(60 kg N/ha + 30 Kg P_2O_5) for Zone B

Locations : Bikaner and Mandor (Zone A_1)
Jaipur, Hisar, Jamnagar and New Delhi (Zone A)
Aurangabad, Dhule, Vijayapur & Coimbatore (Zone B)

Note: The experiment has to be conducted on the same site for at least 3-4 years

Entries : Zone A_1: MPMH 17, Zone A: RHB 173 and Zone B: GHB 558
Design : RBD
Replication : Three
Treatment : Eight
Plot size :
Gross : 4.00 m x 3.60 m
Net : 4.00 m x 2.70 m

Observations to be recorded
1. Plant population (final) in thousands/ha
2. Plant height (cm)
3. Total number of tillers/plant

4. Effective number of tillers/plant
5. Ear head length (cm)
6. Ear head girth (mm)
7. Test weight (g)
8. Grain yield (q/ha)
9. Dry Fodder yield (q/ha)
10. Protein content (%) in grain

Note: Initial analysis of soil for physico-chemical properties of the soil (pH, EC, organic carbon and available NPK).

PLANT PHYSIOLOGY - TECHNICAL PROGRAMME 2018-19

PMPHY 1 : Screening of advance summer hybrids against terminal drought stress

Objectives : Screening of advance summer hybrids to terminal drought stress

Year of Commencement : 2014
Modified in 2019 during 54th AGM by Dr. C. Viswanathan, HoD, Division of Plant Physiology, ICAR-IARI, New Delhi

Location : Jamnagar and Mandor
Season : Summer
Treatment : 1. Main plot treatments
   a. Irrigated control
   b. Terminal drought stress (Flowering to maturity)-imposed at boot leaf stage
   2. Sub-plot treatment: Entries 24 hybrids
Design : RBD
Replication : Three
Spacing : 50 X 10 cm
Plot size : 2 Rows of 4 M length
Fertilizer : **As per PoP**

Observations:

1. Chlorophyll content at 10 days after imposition of drought stress
2. Relative water content (RWC) at 10 days after imposition of drought stress
3. Seed setting %
4. Days to 50% flowering
5. Grain yield (kg/ha)
6. Productive tillers/plant
7. Test weight (g) (1000 grains)
8. Threshing percentage (Panicle harvest Index)
9. Fodder yield (q/ha)
10. Harvest index (%)
11. Days to Maturity
12. Ear head weight (kg/ha)
13. Drought Susceptibility Index

PMPHY 2 : Characterization for terminal drought stress tolerance in pearl millet genotypes

Objectives : To identify drought tolerant donor parents for crossing programme

Year of Commencement : 2014
Modified in 2019 during 54th AGM by Dr. C. Viswanathan, HoD, Division of Plant Physiology, ICAR-IARI, New Delhi

Location : Jamnagar and Mandor (summer)
Treatment : 20 inbred (R lines and B lines)
Design : RBD
Replication : Three
Spacing : 50 cm X 10 cm
Plot size : 2 Rows of 4 M length
Fertilizer : **As per PoP**

Observations:

1. Chlorophyll content at 10 days after imposition of drought stress
2. Relative water content (RWC) at 10 days after imposition of drought stress
3. Seed setting %
4. Days to 50% flowering
5. Grain yield (kg/ha)
6. Productive tillers/plant
7. Test weight (g) (1000 grains)
8. Threshing percentage (Panicle harvest Index)
9. Fodder yield (q/ha)
10. Harvest index (%)
11. Days to Maturity
12. Ear head weight (kg/ha)
13. Drought Susceptibility Index

New trial

PMPHY 3 : To study the photosynthate partitioning & remobilization in pearl millet under rain-fed condition

Year of Commencement : 2019

Location : Jaipur, Jamnagar and Mandor
Season : Kharif
Treatment : Six genotypes, released hybrids and varieties (Pusa composite 443, MPMH 17, MPMH 21, RHB 177, AHB 1200 & Pusa composite 612)
Design : RBD
Replication : Three
Spacing : 60 X 10-15 cm

Plot size : 2 Rows of 5 M length
Fertilizer : **AS per PoP**

Methodology

Tag ten similar plants, Biomass sampling at anthesis (Record height of the plant; Record dry weight of stem, leaf & panicle separately of whole plant. 10 samples per treatment), Biomass sampling at physiological maturity (Record height of the plant; Record dry weight of stem, leaf, panicle, grains separately; HI use only main shoot, 10 samples per treatment)

Observations:
At Anthesis

1. Plant height
2. Dry weight of stem
3. Leaf dry wt
4. Ear head weight

At Physiological maturity

1. Plant height (Main stem)
2. Dry weight of stem
3. Leaf dry weight
4. Ear head weight
5. Grain yield
6. PNHI, HI

PMPHY 4: Characterization in pearl millet hybrids on the basis of root shoot traits

Year of Commencement : 2014
Modified in 2019 during 54th AGM by Dr. C. Viswanathan, HoD, Division of Plant Physiology, ICAR-IARI, New Delhi

Location : Mandor, Jaipur and Jamnagar
Season : Laboratory trial (*Kharif*)
Replication : Four
Design : CRD
Treatments : Soil moisture 2 (Irrigated Control; Drought stress ~ 40% FC)

Genotypes: HHB 67 Improved, RHB 177, RHB 173, GHB 558, GHB 538 and MPMH 17 (Released hybrids of A and A_1 zone of India)

Methodology:
Five selected genotypes will be grown in PVC tubes (approx 4 inch diameter and 1.0 m Height), each containing one plant. PVC tubes will be filled up with soil; Calculate soil dry weight and water required for FC soil moisture; Install 2 cm diameter pipe inside the 4 inch diameter pipe in such a way that the bottom end is at 50cm depth and top end is slight above the rim of the larger PVC pipe (This pipe will be used to irrigate the drought stress plants to maintain a low soil moisture). Use base caps for closing the PVC pipes at the bottom; Sown the seeds at FC;

Maintain the soil moisture at about 80-90 % of FC; 20 days after germination, impose drought stress treatment; Terminate the experiment at 45 days after germination i.e. 25 days after initiation of drought stress treatment; Each tube will be kept out and cut longitudinally to expose the soil without disturbing the plant. Soil mixture will be removed from root surface by flow of water till all intact roots will appear. Photographs will be taken for each genotype before taking observations.

From the day of drought imposition, the experiment will be protected from rains (Temporaty poly huts to avoid the rain water on the plants/pipes)

Observations:

1. Shoot length (cm)
2. Root length (cm)
3. Shoot fresh Weight (g)
4. Root fresh Weight (g)
5. Shoot dry matter (g)
6. Root dry matter (g)
7. Root - shoot Ratio
8. Fraction of Biomass partitioned to root under control and drought stress

Field trial Observation

Treatment : 1. Main plot treatments
   a. Irrigated control
   b. Rainfed (imposed from sowing)

2. Sub-plot treatment: **Genotypes:** HHB 67 Improved, RHB 177, RHB 173, GHB 558 and GHB 538 (Released hybrids of A and A_1 zone of India)

Design : Split Plot design

Replication : Three

Spacing : 60 X 10 cm

Plot size : 2 Rows of 4 M length

Fertilizer : AS per PoP

Observations:

1. Days to 50% flowering
2. Grain yield (kg/ha)
3. Productive tillers/plant (no)
4. Test weight (g) (1000 grains)
5. Fodder yield (q/ha)
6. Harvest index (%)
7. Days to Maturity

PMPHY 5 : Physiological mechanism of drought tolerance in pearl millet at early seedling stage

Objectives : To identify drought tolerant genotype of pearl millet at seedling stage

Year of Commencement : 2014
Modified in 2019 during 54th AGM by Dr. C. Viswanathan, HoD, Division of Plant Physiology, ICAR-IARI, New Delhi

Location : Jaipur, Mandor and Jamnagar
Season : Laboratory trial (*Kharif*)
Replication : Three
Design : CRD
Genotypes : Advance hybrids of A and A_1 zone of India
Treatment : Control, PEG 5% and PEG 10%
Observation time : 15 days after sowing

Observations:

1. Root length (cm)
2. Shoot length (cm)
3. Seedling dry weight (g)
4. Membrane stability index (%)
5. Relative water content (%)
6. Chlorophyll content (mg/g f.wt.)
7. Germination percentage 15 DAS
8. Seedling vigour

PMPHY 7 : Identification of heat stress tolerance in pearl millet genotype at seedling stage in pearl millet

Objectives :
i. To identify heat stress tolerance mechanism in pearl millet at seedling stage.
ii. To identify physiological parameters for identification of heat stress tolerance mechanism in pearl millet

Year of Commencement : 2017
Modified in 2019 during 54th AGM by Dr. C. Viswanathan, HoD, Division of Plant Physiology, ICAR-IARI, New Delhi

Location : Jaipur and Mandor
Season : Laboratory trial (*Kharif*)
Entries : Study material : Parental line(A and B lines) of pearl millet (15-20)
Replication : Four
Design : CRD
Temperature : 20 DAS

Observations:

Growth parameters – 22 DAS

1. Seedling length,
2. Seedling dry weight
3. Root length;
4. Root dry weight
5. Root -shoot ratio,
6. seedling vigour index

Physiological parameters –

1. RWC
2. Membrane stability index
3. Pigment content (chlorophyll content), chlorophyll stability index

The following scientists attended the meeting and actively participated in the discussions:

1. Dr. C. Vishawnath, Head, Division of Plant Physiology, ICAR-IARI, New Delhi
2. Dr. P.S. Shekhawat, ZDR & Professor (Agronomy), ARS, SKRAU, Bikaner
3. Dr. Anil Kumar, Principal Scientist (Agronomy), Bajra Section, CCS HAU, Hisar
4. Dr. Minakshi Grover, Principal Scientist (Microbiology),ICAR-IARI, New Delhi
5. Dr. R.S. Bana, Scientist (Agronomy), IARI, New Delhi
6. Dr. Babar Sadhana Ramchandra, Scientist (Agronomy), RARS, Bijapur, UAS, Dharwad
7. Dr. M. Senthivelu, Assistant Professor (Agronomy), TNAU, Coimbatore
8. Dr. Sunita Choudhary, Scientist, ISD-SACSA, ISRISAT, Patancheru
9. Dr. S.B. Pawar, Associate Director Research, NARP, Aurangabad
10. Dr. Dinesh M. Lomte, Agronomist, NARP, Aurangabad
11. Dr. H.M. Bhuva, Assoc. Res. Scientist, Pearl Millet Research Station, JAU, Jamnagar
12. Dr. G.M. Parmar, Assoc. Res. Scientist, Pearl Millet Research Station, JAU, Jamnagar
13. Dr. N.S. Ugale, Assistant Professor, Agronomy, BRS, Dhule
14. Dr. R.C. Meena, Asstt. Prof. (Plant Physiology), AICRP-PM, Mandor, Jodhpur
15. Mr. Manoj Kumar, Assistant Professor (Agronomy), ICAR-AICRP on Pearl Millet, Agriculture University, Jodhpur
16. Dr. Sunita Gupta, Professor (Plant Physiology), RARI (SKNAU), Jaipur (Raj.)
17. Dr. Seema Sharma, Associate Professor (Agronomy), RARI (SKNAU), Jaipur (Raj.)
18. Dr. Shankar Lala Jat, Scientist, ICAR-IIMR, Ludhiana, Delhi Unit, New Delhi

The session ended with vote of thanks to the Chairman and Co-chairman.

PLAN OF WORK 2019-20 FOR CROP PROTECTION

Chairman	: **Dr. Robin Gogoi** Principal Scientist Division of Plant Pathology ICAR-IARI, New Delhi	**Co-Chairman**	: **Dr. Mukesh Dhillon** Principal Scientist Division of Entomology ICAR-IARI, New Delhi

Rapporteur : Dr. Chandra Nayaka, University of Mysore, Mysuru

Date : March 15, 2019 **Time** : 2.15 PM

At the outset Dr. Chandra Nayaka welcomed the Chairman Dr. Robin Gogoi, Principal Scientist, Division of Plant Pathology, ICAR-IARI, New Delhi and Co-Chairman Dr. Mukesh Dhillon, Principal Scientist, Division of Entomology, ICAR-IARI, New Delhi. The Chairman discussed various technical aspects on pathological and entomological trials and emphasized to create the facilities for artificial screening of diseases at each locations.

Recommendation:

On the basis of 4 years experiment conducted on efficacy of different fungicides against blast in pearl millet revealed that, spray application of Trifloxystrobin + Tebuconazole-75WG @ 0.05% first at initiation of disease and 2nd spray at 15 days interval significantly reduced the blast incidence in grain and fodder pearl millet.

PATHOLOGY - TECHNICAL PROGRAMME FOR KHARIF / SUMMER – 2019-2020

The group discussed regarding the acceptability of new genotypes for diseases, the following criteria finalized during 54th group meeting were discussed and slightly modified for the year 2019-20.

Downy mildew: **Up to 5%** downy mildew incidence under sick plot condition must be considered for varietal promotion.

Smut: **Up to 20%** smut severity under artificial inoculation must be considered for varietal promotion.

Ergot: **Up to 20%** ergot severity under artificial inoculation must be considered for varietal promotion.

Blast: It was opined by the group to submit the data using 0-9 scale. **Up to the Score 3** for blast be considered for promotion of genotypes: Considered for varietal promotion under the category of resistance in case of natural infection.

Rust: The group concluded to have the observations of rust disease during hard dough stage and genotypes having rust **up to 20%** must be considered for promotion.

Disease Screening Trials

Following procedures should be adopted to conduct the disease screening trials

I. Downy Mildew: Downy mildew sick plot using infector rows system
II. Smut and Ergot: to be inoculated artificially
III. Rust and Blast: Natural disease incidence.

PMPT I: Disease screening trial of Initial Pearl Millet Hybrids and Varieties.

PMPT II: Disease screening trial of Advanced Pearl Millet Hybrids and Varieties.

PMPT III: Monitoring disease resistance stability of released popular hybrid/varieties.

Downy Mildew :

Location **Zone A & A_1**
Mandor, Jaipur, Hisar, Gwalior, Jamnagar and Anand
Zone B
Mysore, Aurangabad, Dhule, Coimbatore and Patancheru (PMPT-II)

Smut

Location **:** **Zone A & A_1**
Jaipur, Jamnagar, Hisar and Gwalior
Zone B
Dhule

Blast

Location **:** **Zone A & A_1**
Jaipur, Jamnagar, Gwalior, Hisar and New Delhi (PMPT-II)
: **Zone B**
Dhule, Aurangabad and Mysore

Rust

Location **:** **Zone A & A_1**
Jaipur, Jamnagar, Hisar and Gwalior
Zone B
Aurangabad, Dhule and Coimbatore

Ergot

Location **:** **Zone A & A_1**
Jaipur
Zone B
Aurangabad, Dhule and Coimbatore

PMPT IV A: Characterization of pathogen diversity in downy mildew of pearl Millet.

1. Pathogenic diversity analysis by virulence nursery

Location : **Zone A & A_1**
Mandor, Jaipur, Hisar, Gwalior, Jamnagar and Anand
: **Zone B**
Mysore, Aurangabad,Dhule, Coimbatore and Patancheru

PMPT IV B: Basic research: Molecular characterization of R and AVR gene in Pearl Millet Downy Mildew and blast system and develop markers for utilization in breeding for DM resistance.

Location **:** Mysore

PMPT IV C: Characterization of pathogenic variability in Pearl Millet blast pathogen

Location **:** **Zone A & A_1**
Gwalior, Anand, Mandor, Jamnagar, Hisar**,** New Delhi, and Jaipur
Zone B
Dhule, Aurangabad, Mysore, Patancheru and **Vijayanagaram**

New Volunteer Centre:
Zone B: Vijayanagaram: Dr. Patro TSSK, Principal Scientist & Head, Agricultural Research station, ANGRAU, Andhra Pradesh

PMPT V: Management of downy mildew by using organic practices

Treatments:

1. *Trichoderma harzianum* formulation (JAU @ 8g/kg) (Jamnagar Centre will supply)
2. PSB formulation (PSB @8g/kg) (Mysore Centre will supply)
3. Neem oil (3%) (Mandor Centre will supply)
4. Metalaxyl 35SD (6g/Kg) (Mandor Centre will supply)
5. Control

Replication: 4 (4 rows in 4 meter length)

Observation to be recorded:

a) Seedling emergence
b) Per cent Downy Mildew Incidence at 30 and 60 DAS
c) Grain and Fodder Yield

Location **:** **Zone A & A_1**
Mandor, Jaipur, Hisar, Gwalior, Jamnagar
Zone B
Aurangabad, Dhule, Coimbatore, Mysore and Patancheru

PMPT V: Management of blast disease by using chemicals and bioagents

Treatments:

1. Seed treatment with Chitosan @3.75g/kg seed + 2 sprays of *Pseudomonas fluorescens* @10g/lt after 20 DAS and 35 DAS (Mysore Centre will supply)
2. Seed treatment with Chitosan @3.75g/kg seed + 2 sprays of *Bacillus subtilis* @10g/lt after 20 DAS and 35 DAS (Mysore Centre will supply)
3. Spray treatment with *Pseudomonas fluorescens* @10g/lt 20 DAS and Trifloxystrobin + Tebuconazole @ 0.04% after 35 DAS (Mysore Centre will supply)
4. Spray treatment with Trifloxystrobin + Tebuconazole @ 0.04% 20 DAS and *Bacillus subtilis* @10g/lt after 35 DAS (Mysore Centre will supply)

5. Trifloxystrobin + Tebuconazole @ 0.04% 2 sprays after 20 DAS and 35 DAS (Mandor Centre will supply)
6. Control – Moderately susceptible cultivar (Mandor Centre will supply)

Note:

1. Cultivar 95444 should be used as a indicator after each treatment

2. Observation of Blast and Downy mildew should be recorded in each treatment. For blast disease severity should be recorded -0-9 scale and PDI should be calculated

Replication: 4 (4 rows in 4 meter length)

Observation to be recorded:

a) Seedling emergence
b) Per cent blast disease severity at 60 DAS
c) Grain and Fodder Yield

Location **:** **Zone A & A_1**
Mandor, Jaipur, Hisar, Gwalior, Jamnagar
Zone B
Aurangabad, Dhule, Mysore and Patancheru

PMPT VI: Monitoring of Pearl Millet diseases at Farmer's field Locations: All AICRP on Pearl millet centres in their respective zones

Method: Record survey information by preparing chart listing field number, location, cultivar/area, crop stage (F and SDS), disease incidence and Collect the infected leaves samples of highly susceptible cultivars of downy mildew and blast samples for pathogen characterization.

PMPT VII: Disease screening trial of pearl millet hybrids in summer Locations: Anand, Jamnagar, **Dhule** and Coimbatore

PMET 4: Recommendation:

On the basis of 4 years experiment conducted at Jamnagar & Jaipur, on the testing of efficacy of different insecticides against shoot fly and stem borer in pearl millet revealed that, seed treatment of clothianidin 50 WDG @ 7.5 g/kg seed followed by spray of fipronil 5 SC @ 0.01%, at 35 days after germination of crop, recorded lowest shoot fly incidence, highest grain & fodder yield. This treatment also registered highest ICBR. Moreover, the grains were estimated for residues revealed that they were Below Detectable Limit (BDL). Since, only the grains were analysed the insecticide is recommended only for the grain purpose pearl millet.

N.B.: This experiment is concluded in the light of recommendation and should be dropped from the technical programme of 2019-20

Technical Programme for *Kharif*-2019-20

PMET-1A: Screening of pearl millet lines against major insect pest (Initial lines/populations)

Objective: To find out resistant promising pearl millet material against major insect pests.

Location: Jamnagar & Jaipur

Experimental details: Design: RBD, **No of replications:** 2, **No. of rows:** One

Row length: 4.0 m and **Spacing:** 50 x 15 cm. **No. of entries: Initial & populations lines to be provided by PC Unit.**

Observations to be recorded:

a. **Shoot fly** – Per cent infestation at 28 DAG (Vegetative stage) and ear head stage.
b. **Stem borer** – Per cent plant damage at 28 DAG (Vegetative stage) and at ear head stage.
c. ***Helicoverpa*** larvae – Number of larvae/ 5 ear heads.
d. **Grey weevil** – Damage score (0-10) and number of grey weevil adults/ 5 plants.
e. **Leaf roller** – Damage score (0-10) and number of larvae/ 5 plants.
f. **Chafer beetle** – Damage score (0-10) and number of beetles/ 5 ear heads

2. PMET-1B: Screening of pearl millet lines against major insect pest (Advance lines)

Objective: To find out resistant promising pearl millet material against major insect pests.

Location: Jamnagar and Jaipur

Experimental details: Design: RBD, **No of replications:** 2**, No. of rows:** Two

Row length: 4.0 m and **Spacing:** 50 x 15 cm. **No. of entries:** Advance Promising lines to be provided by PC Unit.

Observations to be recorded:

a. **Shoot fly** – Per cent infestation at 28 DAG (Vegetative stage) and ear head stage.

b. Stem borer – Per cent plant damage at 28 DAG (Vegetative stage) and at ear head stage.
c. *Helicoverpa* larvae – Number of larvae/ 5 ear heads.
d. Grey weevil – Damage score (0-10) and number of grey weevil adults/ 5 plants.
e. Leaf roller – Damage score (0-10) and number of larvae/ 5 plants.
f. Chafer beetle – Damage score (0-10) and number of beetles/ 5 ear heads

3. PMET-2: Monitoring of major insect pests of pearl millet

Location: Jamnagar, Anand, Jaipur, Aurangabad, Bijapur

Objectives:

1. To study the population fluctuation of key pests of pearl millet.
2. To record the incidence of fall army worm (*Spodoptera furgiperda*)

Experimental details:

Design: Nil (Observation plot)

Replications: Nil

Spacing: 50 x 15 cm.

Variety: Any released pearl millet hybrid of that zone

Methodology:

Sowing of released pearl millet variety will be done over an area of 200 m^2 which will be kept free from insecticidal application during crop season.

Incidence (%) and population of various insect pests observed during the crop period will be recorded at weekly interval from 20 randomly selected plants 7 days after germination (DAG) of the crop.

N.B.:

a) In context to the climate change, correlation of major pests with weather parameters for at least 4-5 years to get clear role of abiotic factors will be worked out.
b) As per the havoc of fall army worm in other crops, the larval counts will be recorded in pearl millet crop critically.
c) Looking to the grass hopper increasing trend it will be take care

4. PMET-3: Survey of insect- pests of the pearl millet crop on farmers' field.

Location: Jamnagar, Anand, Jaipur and Aurangabad

Objective: To examine pest status in pearl millet of the region.

Observations to be recorded:

Survey of insect pests will be carried (minimum 25-50 fields) out at vegetative and ear head stage of bajra crop during *Kharif* season at different locations. Incidence of various insect pests infesting pearl millet will be recorded. The pest status (major and minor) and magnitude of damage will be worked out. The presence of bio-agents will also be recorded.

N.B.:

a) As per the havoc of fall army worm in other crops, the larval counts will be recorded in pearl millet crop critically at the time of survey.
b) Looking to the grass hopper increasing trend it will be take care.

5. PMET-5: Testing of IPM modules with farmers practice against pest complex of pearl millet (Modified from 2019-20)

Objective: To test the effectiveness of IPM modules against major insect pest **(shoot fly, stem borer, *Helicoverpa*, grass hopper, grey weevil, white grub and termite)** of pearl millet.

Location: Jamnagar and Jaipur

Experimental details: Design: RBD, **No. of Replications:** 4

Gross plot size: 4.0 x 3.6 m, **Net plot size:** 3.0 x 2.4 m and **Spacing:** 50 x 15 cm.

Treatment details: 6

1. IPM module-I (Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha impregnated with DDVP.
2. IPM module-II (Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha impregnated with DDVP + Spray Dimethoate 30 EC 0.03 % (10 ml/10 litres of water) at 30 DAG + Azadirachtin @ 1500 ppm (40 ml/10 lit water) at ear head stage.
3. IPM module-III (Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha impregnated with DDVP + Spray Novaluron 10 EC 0.01% (10 ml/10 litres of water) at 30 DAG + Azadirachtin @ 1500 ppm (40 ml/10 lit water) at ear head stage.
4. IPM module-IV (Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha impregnated with DDVP + Spray Dimethoate 30 EC 0.03 % (10 ml/10 litres of water) at 30 DAG + Fipronil 5 SC @ 150 g a.i. /ha (broadcast after mixing in sand) at 30 DAG + Azadirachtin @ 1500 ppm (40 ml/10 lit water) at ear head stage.
5. IPM module-V (Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha impregnated with DDVP + Spray Novaluron 10 EC 0.01% (10 ml/10 litres of water) at 30 DAG + Fipronil 5 SC @ 150 g a.i./ha (broadcast after mixing in sand) at 30 DAG + Azadirachtin @ 1500 ppm (40 ml/10 lit water) at ear head stage.
6. Untreated-Control (This plot will be kept 30 m far from this experiment to avoid the effect of fish meal trap)

Methodology and observation to be recorded

a. Per cent infestations of shoot fly at 28 DAG (vegetative stage) and at ear head stage.
b. Per cent infestation of stem borer at 28 DAG (vegetative stage) and at ear head stage.
c. Per cent infestation of grey weevil, grass hopper termite and white grub at 28 DAG (vegetative stage) and at ear head stage.
d. Larval population of *Helicoverpa* to be recorded on 5 ear heads in each replication.
e. Yield and economics of the treatments.

6. PMET-6: Evaluation of different insecticides as a soil drenching for the management of soil pests (white grub and termite) in pearl millet,

Location: Jaipur only.

Objective: To manage the white grub & termite in standing crop at mid to later stage of the crop**.**

Methodology: The below indicated treatments will be given by drenching in the soil 21 days after germination of the crop**.**

Design: RBD**, Replications:** 3, **Treatment:** 9

Gross plot size: 4.0 x 3.6 m, **Net plot size:** 3.0 x 2.4 m and **Spacing:** 50 x 15 cm.

***Treatment details:**

1. Imidacloprid 17.8 SL, 60 g a.i./ha.
2. Thaimethoxam 70 WS, 150 g a.i./ha.
3. Fipronil 5 SC, 150 g a.i./h.a
4. Clothianidin 50 WDG, 150 g a.i./ha.
5. Imidacloprid 600 FS, 750 g a.i./ha.
6. Acephate 50% + Imidacloprid 1.8% SP, 1.25 kg/ha.
7. Fipronil 40% + Imidacloprid 40% WG 300 g a.i./ha.
8. Chlorantrainiprole 18.5 SC @ 60 g a.i./ha
9. Untreated- control.

Note: The drenching will be carried out at 21 DAG.

Observations to be recorded: -

- Per cent termite and white grub damage at harvest.
- Yield and economics of the treatments.

7. PMET 7: Survey of insect- pests of summer pearl millet on farmers' field.

Location: Jamnagar (Gujarat)

Objective: To examine pest status in summer pearl millet of the region.

Observations to be recorded:

At least 25-50 fields will be observed in bajra growing area of Gujarat twice *i.e.* vegetative stage & ear head stage. From each field 20 plants will be observed for insect-pests and per cent incidence of shoot fly & stem borer will be worked out. Whereas, for other insects, population per 5 plants will be recorded.

N.B.: as per the havoc of fall army worm in other crops, it will be take care off in pearl millet crop too critically at the time of survey.

8. PMET-8: Relative susceptibility of pearl millet advanced entries to storage insect pests

Objective: To find out the resistant/tolerant/ susceptible line against storage insect pests.

Design: CRD**, Replications: 2**, **Treatment/entries:** Approximately 20-30 (Advanced entries)

Methodology & Observations to be recorded:

Two hundred fifty gram seeds of each entry of pearl millet will be taken in plastic container (500 g capacity). Five pairs of adults of ***Tribolium castaneum*** **Herbst (At Jamnagar)** and ***Rhizopertha dominica*** **Fab. (At Jaipur)** will be released in each treatment/entry for egg laying, replicated twice. The plastic container will be covered with muslin cloth and will be fastened with rubber bands. The insects will be removed after 10 days of exposure. The set of experiment will be kept as such for recording the observations at the interval of 3 months and total up to 6 months. Observations on average number of adults emerged, average percentage of seeds damaged, percent weight loss and germination at the end of experiment will be recorded. The data recorded will be subjected to statistical analysis.

Note: The pearl millet seeds will be used from experiment number of advanced entries trail after harvesting of *kharif* trial.

9. PMET-9: Monitoring of Fall Army worm (Spodoptera fulgiperda) in *Kharif* pearl millet (New experiment).

Location: Jamnagar, Anand and Jaipur

Objective: To know the adult intensity & fluctuation of fall army worm in pearl millet

Design: Non replicated observation plot**, Replications:** Nil , **Treatment:** Pheromone traps of fall army worm

Methodology & Observations to be recorded: The pheromone traps of fall army worm (5 traps) will be installed in the general pearl millet crop field of the station. The catches per trap will be recorded at weekly interval as per standard weather week. The mean catches per week will be worked out to know the population fluctuations.

N.B.: The traps will be supplied by PI (Entomology), Pearl millet Research Station, JAU, Jamnagar to the above locations.

SESSION – IV

VARIETAL IDENTIFICATION COMMITTEE MEETING

Dated : March 15, 2019 Time : 5:00 PM

Proceedings of Varietal Identification Committee Meeting held on 15.03.2019 on 5:00 PM at ICAR-IARI, New Delhi

Varietal Identification Committee Meeting of ICAR-AICRP on Pearl millet was held on 15.03.2019 at 5:00 PM in the Board Room, Directorate Building, ICAR-Indian Agricultural Research Institute, Pusa Campus, New Delhi under the Chairmanship of Dr. A. K. Singh, Deputy Director General (HS & CS) ICAR, New Delhi. The following committee members were present:

1.	Dr. A.K. Singh, Deputy Director General (HS & CS)	-Chairman
2.	Dr. A.K. Singh, JDR & Head, Division of Genetics	-Member
3.	Sh. Kuldeep Singh, National Seed Corporation, Pusa Campus	-Member
4.	Dr. Vishnu Ameta, Crystal Crop Production Ltd., Hyderabad	-Member
5.	Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur	-Member Secretary
Principal Investigator		
6.	Dr. Vikas Khandelwal, Sr. Scientist, ICAR-AICRP on Pearl Millet, Jodhpur	-Facilitator
7.	Dr. Anil Kumar Yadav, Prof. (Agronomy), CCS HAU, Hisar	-Facilitator
8.	Dr. Chandra Nayak, Professor (Patho.), UOM, Mysore	-Facilitator

The proposals of 4 hybrids/varieties as per detail given below were discussed:

S. No.	Hybrid/ Variety	Identity	Zone/States/Maturity Group
1	MH 2192	BHB 1602	Zone A_1 (Early Maturity)
2	MH 2224	PB 1852	Zone A (Medium Maturity)
3	MH 2228	JKBH 1326	Zone A (Medium Maturity)
4	MH 2267	JKBH 1490	Zone A (Late Maturity)

15/3/19

15/3/19

The Committee took the following decision:

Zone A_1 (Early maturity) (Drier part of Rajasthan, Gujarat and Haryana)

The proposal of hybrid MH 2192 (BHB 1602) was considered for drier parts of Rajasthan, Gujarat and Haryana under early maturity group. Hybrid MH 2192 (BHB 1602) recorded 14 to 28.6 percent higher grain yield and superiority in dry fodder yield over the checks. This hybrid was also found resistant to downy mildew, blast, smut, rust and ergot. Hence the hybrid MH 2192 (BHB 1602) was identified for release for cultivation in drier parts of Rajasthan, Gujarat and Haryana for early maturity group.

Zone A (Medium maturity) (Rajasthan, Gujarat, Haryana, UP, MP, Punjab and Delhi)

The proposals of two hybrids MH 2224 (PB 1852) and MH 2228 (JKBH 1326) were considered for Rajasthan, Gujarat, Haryana, UP, MP, Punjab and Delhi under medium maturity group. Hybrids MH 2224 (PB 1852) and MH 2228 (JKBH 1326) recorded superiority in grain yield and dry fodder yield as compared to all checks and found resistant to downy mildew, blast, rust, smut and ergot. Hence these hybrids MH 2224 (PB 1852) and MH 2228 (JKBH 1326) were identified for release for cultivation in Rajasthan, Gujarat, Haryana, UP, MP, Punjab and Delhi for medium maturity group.

Zone A (Late maturity) (Rajasthan, Gujarat, Haryana, UP, MP, Punjab and Delhi)

The proposal of hybrid MH 2267 (JKBH 1490) was considered by the committee for late maturity group. Hybrid MH 2267 (JKBH 1490) recorded 2.7 to 10.6 percent higher grain yield over the checks. This hybrid was also found resistant to downy mildew, blast, smut, rust and ergot, but has less zinc content. Hence the hybrid MH 2267 (JKBH 1490) was not identified for release for cultivation in Rajasthan, Gujarat, Haryana, MP, UP, Punjab and Delhi for late maturity group.

The list of identified hybrids/varieties is as per detail given below:

1	MH 2192	BHB 1602	Zone A_1 (Early Maturity)
2	MH 2224	PB 1852	Zone A (Medium Maturity)
3	MH 2228	JKBH 1326	Zone A (Medium Maturity)

15/3/19

Dr. A.K. Singh
Chairman

Dr. C. Tara Satyavathi 15/3/19
Member Secretary

SESSION – V

REVIEW OF RESEARCH RESULTS OF AICRP-PM CENTRES 2018-19
(Centre-wise presentation of significant results and progress report)

Chairman	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi	Co-Chairs	Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
Rapporteur	Dr. T. Nepolean, Principal Scientist, ICAR-IIMR, Hyderabad		
Date	March 17, 2019	**Time**	9:00 AM

The purpose of the session was to review the research results of AICRP-PM centres for the year 2018-19. The session was co-chaired by Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi and Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur.

The presentation was separated by the zones and in each zone, respective researchers of the research institute presented the experiments results. The presentation from each station consisting of explaining the varieties/hybrids released from the centre, number trials successfully completed in breeding, pathology, entomology, agronomy and physiology. The researchers also presented the results of the breeding activities including the maintenance and development of restorers, development of new restorers for different cytoplasms, maintenance of segregating populations, development of new male sterile lines, improvement of B lines, development of new experimental hybrids, population development and seed production activities.

The A_1 and A zones have six locations, namely, Bikaner, Durgapura, Hisar, Gwalior, Jamnagar, and Ludhiana. The primary mandate of the A_1 zone is to identification of high yielding hybrids and populations of pearl millet and to develop suitable production technologies for rainfed situations. The productivity of the A_1 zone was very low owing to various issues such as low penetration improved cultivars, non-availability cultivars with drought tolerances at the various stages of crop growth, non-availability of high-yielding early-maturing cultivars and so on. Development of research programme for improvement of high-yielding varieties were discussed. This crop zone was also affected by the incidence of blast and development of resistance varieties were deliberated using molecular approaches.

The B zone has six locations, namely, Ananthapuram, Aurangabad, Coimbatore, Dhule, Mysore and Vijapur. The research results were discussed location-wise, and each location presented their mandates, activities carried-out during the last year, and their achievements. Although productivity has been much better than the A and A_1 zone, since Zone B located in favourable ecologies, the opportunity to improve the yield further has been discussed. Enhancing the genetic variability, enhancing the B line diversity, development of heterotic groups and other activities were deliberated for development of high-yielding hybrids.

SESSION – VI

REVIEW OF DUS TESTING PROJECT, PROGRESS REPORT 2018-19 AND PEARL MILLET GENETIC RESOURCES

Co-chairs Dr. Kuldeep Singh, Director, ICAR-NBPGR, New Delhi
Dr. T.K. Nagrathana, Registrar, PPV&FRA, New Delhi

Rapporteur Dr. Dev Vart Yadav, CCS HAU, Hisar
Dr. Supriya, ICAR-AICRP on Pearl millet, Jodhpur

Date : March 16, 2019 **Time** : 12:00 PM

During this session, a total of three presentations were made:

The first presentation by Dr. Vikas Khandewal, ICAR-AICRP on Pearl millet, Mandor, Jodhpur was on Progress of DUS testing in pearl millet during 2018-19 at Mandor and Rahuri centres. He mentioned that a total of 13 cultivars for first year and 23 for 2nd year were testing along with 14 reference varieties for 26 characters. He also mentioned about one day training programme organized by ICAR-AICRP on Pearl millet at Jodhpur and the inclusion of two new traits viz. stigma pigmentation and bristle appearance as DUS traits.

The second presentation was on Status of pearl millet genetic resources by Dr. Sushil Pandey, ICAR-NBPGR, New Delhi. He gave an overview of pearl millet collections at NBPGR and procedure of germplasm registration at NBPGR. He also mentioned about the existing gaps in the pearl millet collection as compared to ICRISAT genebank collection and that till date only 20 lines of pearl millet have been registered.

The third presentation was delivered by Dr. M. Elangovan, ICAR-IIMR, Hyderabad on the topic of pearl millet pedigree database management and its key features for the period 1981 to 2018. He mentioned that the database can display information from several aspects such as kind of material tested, location, season, year, institution, etc.

The major highlights of the session may be summarized as under:

- Dr. Kuldeep Singh inquired about the criteria/ algorithm followed for distinguishing the varieties under DUS testing. He also emphasized on the need to generate centre-wise database for all the reference varieties.
- Dr. Nagrathna explained that as of date the varieties are distinguished on the basis of comparative differences with respect to each other but there is a need to adopt method based on statistical analysis/ algorithm along with developing suitable database management method.

- Dr. C. Tara Satyavathi, Project Coordinator (Pearl millet) emphasized that greater efforts be made to register more pearl millet germplasm and that correct status of registration be provided by different centres.
- There is a need to focus on utilization pattern of the germplasm and also proper feedback be provided on the germplasm distributed to various stakeholders.
- There is a need to develop mini core collection of pearl millet for enhanced use. For developing breeding material for A_1 zone, especially, the germplasm from Rajasthan at NBPGR, Jodhpur station may be demonstrated in a field day for selection by breeders.
- Strengthening of germplasm information database of wild pearl millet is also needed.
- DNA fingerprinting of lines/ germplasm for varietal notification/ registration to be mandatorily done at NBPGR in the near future.
- Need to develop and streamline the germplasm sharing procedures. The pearl millet germplasm database of NBPGR to be shared with pearl millet scientists through Project Coordinator.
- Need to screen germplasm for specific traits especially nutrition related traits.
- Germplasm availability from NBPGR to various stakeholders has been made more easy and transparent now including private sector organization.

The session ended with vote thanks to the Chair.

SESSION – VII

NEW INITATIVES FOR PEARL MILLET RESEARCH

Chairman	Padma Bhushan Prof. R.B. Singh, Chancellor, Central Agricultural University, Imphal	**Co-Chairs**	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi Dr. Rajeev K Varshney, Program Director (Genetic Gains), ICRISAT, Patancheru Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur

Rapporteur : Dr. R.K. Kakani, ICAR-CAZRI, Jodhpur

Date : March 16, 2019 **Time** : 2:30 PM

In this technical session VIII, Chairman Prof. R.B. Singh, started the session with welcome to the delegates, after opening remarks, lead speakers, were introduced and invited for presentations.

In this session total 7 presentations were made. The first lecture was delivered by Dr. Rajeev K Varshney, Director, Genetic Gain, ICRISAT, Patancheru on the topic translational genomics in pearl millet. He stated that genetic gain is possible only with combination of genetic improvement, seed development and delivery system and agronomic practices. He emphasized that genetic gain over time can be increased only through higher selection intensity, selection accuracy, genetic variance with more favourable alleles and no of year per cycle. He explained how translational genomics can be utilized as a decision support tools for getting climate resilient crops and enhancing yield. He expressed possibilities of use of pearl millet genome to improve rice, maize/ wheat via pearl millet 384 expanded gene families involved in different pathways and future crop breeding is expected to have integration of different biology disciplines, automation, robotics and artificial intelligence.

Dr. Abhishek Rathore, Principal Scientist, ICRISAT, Patancheru delivered lecture on breeding management system in pearl millet. He explained how efficiency can be enhanced using digital data recording using tablets directly in field, use of barcode and also sharing it efficiently and transparently for maximum benefit.

Dr. P.K. Sahoo, ICAR-IARI, New Delhi delivered lecture on engineering interventions for enhanced nutritional security of pearl millet during milling and storage. He emphasized that improving milling system with packages by cutting in oxygen and light can improve shelf life. He suggested that agricultural engineer may be consulted for mechanization which can wonder in agriculture growth as power and productivity have positive linear association.

Dr. Aundi Kumar, Principal Scientist, ICAR-IARI, New Delhi presented the genome sequence of *Magnaporthe grisea*, a pearl millet fungus causing blast disease in diverse cereal crops. He reported that his team has successfully sequenced genome of blast fungus and identified genes of virulence. Subsequently Dr. G. Prakash, Scientist, ICAR-IARI, made a presentation on phenotyping of pearl millet blast under artificial epiphytotic condition and identified primers to facilitate selection for resistance to blast. He reported that pearl millet isolate is genetically distinct from rice isolate and finger millet isolates.

Dr. Raka Saxena, ICAR-NIA&PR presented marketing polices for promotion of pearl millet. She summarized the trends of pearl millet production and consumption in last two decades and emphasized that efficient value chain, nutritional marketing and promoting trade of value added products can be used to increase the demand. She also explained the role of pearl millet in livestock, poverty elevation and its socio-economic impact in stress area.

Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur emphasized the breeding material development for A_1 zone as this zone have maximum area of 4.8 million ha but minimum increase in productivity till date and need more concentrated efforts.

Following recommendation emerged from the technical session:

1. Workplan should be prepared with time frame involving various public private partners including ICRISAT under the leadership of PC, AICRP on Pearl millet for development of hybrid/ OPV for A_1 zone.
2. Pre-breeding programme should be strengthened with selected material suitable for stress resistance/ tolerance for A_1 hyper arid zone (Barmer, Jaisalmer and Bikaner).

The session ended with vote of thanks to the Chairman, Co-chairs and speakers.

SESSION – VIII

REVIEW OF RESEARCH RESULTS, PROGRESS REPORT OF CRP ON BIOFORTIFICATION AND ICAR-ICRISAT COLLABORATIVE PROJECTS 2018-19 AND PLAN OF WORK 2019-20

Chairman	Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi	Co-Chairs	Dr. C.N. Neeraja, Principal Scientist, ICAR-IIRR Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur
Rapporteur	Dr. K.D. Mungra, JAU, Jamnagar Dr. Sanjana Reddy, ICAR-IIMR, Hyderabad		
Date	March 17, 2019	**Time**	9:00 AM

The session was held under the Co-chairmanship of Dr. C.N. Neerja, Principal Scientist, ICAR-IIRR and Co-chairs of Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi.

In the centre-wise presentations, Dr. L.D. Sharma, presented the results and major achievements for 2018-19 and plan of work 2019-20 for Jaipur centre. Similarly, Dr. S.P. Singh presented for Delhi, Dr. H.T. Patil for Dhule, Dr. K.D. Mungra for Jamnagar and Dr. Dev Vrat Yadav for Hisar. Both the results and plan of work for all the centres was accepted by the house. The Jaipur centre has to submit UC/ SOE for fund release, Dhule centre is advised to verify that amount released by PI with the Comptroller office of University. Dr. C. Tara Satyavathi informed the house regarding the progress made under CRP-project by Mandor centre.

The progress made under ICAR-ICRISAT partnership projects during 2018-19 was presented by Dr. B.R. Beniwal. He briefed the house about the seven trials and nurseries that were a part of this project. The ADG (FFC) suggested that there should not be overlapping of activities of CRP-Biofortification, harvestplus project and Biofortificiation trials of ICAR-ICRISAT. It should be streamlined by all the PIs involved in these projects.

Dr. S.K. Gupta gave a broad perspective of the newly formulated ICAR-ICRISAT partnership projects for five year (2019-2023). The work plan for the year 2019-2020 was presented which involved 7 trials of which five trials were finalized that included B line nursery, R line nursery, Drought tolerant R-composite, Drought tolerant test crosses and one Biofortification trial for Kharif season. One forage OPV/ hybrid trial for summer season was also accepted. The genetic gain study trial may be taken up under ICAR-BMGF project from this year onwards. Dr. Rakesh Srivastava presented the plan of work for 2019-20 for MABT in which 250 TCs will be evaluated along with 50 inbreds and it was accepted.

The session ended with vote of thanks.

ICAR – ICRISAT Pearl Millet Nurseries/Trials – 2019-2020

Sr.No.	Name of the Trial/Breeding nursery	No of Entries	Plot Size	Locations
Trials/Nursery Rainy 2019				
1.	Potential B-line nursery	50-60	1 row x 2 reps	1. AICRP, SKRAU, Bikaner 2. RARI, Durgapura 3. MPKV, Dhule 4. CAZRI , Jodhpur 5. RVSKVV, Gwalior 6. JAU, Jamnagar 7. ICAR-IIMR, Hyderabad 8. CCS HAU, Hisar
2.	Potential R-line nursery	50-60	1 row x 2 reps	1. AICRP, SKRAU, Bikaner 2. RARI, Durgapura 3. MPKV, Dhule 4. CAZRI , Jodhpur 5. RVSKVV, Gwalior 6. JAU, Jamnagar 7. ICAR-IIMR, Hyderabad 8. CCS HAU, Hisar 9. IARI, New Delhi 10. RARS, Vijayapur, Karnataka 11. ARS, Malnoor, UAS, Raichur, Karnataka 12. PC Unit, Mandor, Jodhpur
3.	Drought tolerant nursery	150-200	1 row x 2 reps	1. AICRP, SKRAU, Bikaner 2. RARI Durgapura 3. CAZRI, Jodhpur 4. CCS HAU, Hisar 5. PC Unit, Mandor, Jodhpur
4.	Elite Joint Bio-fortification Trial	40	1 row x 3 reps	1. ARS, Malnoor, UAS, Raichur, Karnataka 2. RARI, Durgapura 3. PAU, Ludhiana 4. AICRP, SKRAU, Bikaner 5. MPKV, Dhule 6. CAZRI 7. JAU, Jamnagar 8. IARI, New Delhi 9. PC Unit, Mandor, Jodhpur
5.	Genomic selection (GS) trial	300	2 rows × 2 replications (30 blocks)	1. AICRP, SKRAU, Bikaner 2. JAU, Jamnagar 3. IARI, New Delhi 4. PC Unit, AICRP, Mandor 5. ICRISAT, Patancheru
Summer 2020				
1.	Promising OPVs/Hybrids for Forage	25-30	4 rows x 2 reps	1. RARS, Vijayapur, Karnataka 2. ARS, Malnoor, UAS, Raichur, Karnataka 3. PAU, Ludhiana 4. Dhasi (Jamnagar) 5. CCS HAU, Hisar

SESSION – IX

REVIEW OF FRONT LINE DEMONSTRATIONS FOR 2018-19 AND ACTION PLAN 2019-20, REVIEW OF BSP 2018-19 AND ACTION PLAN 2019-20

Co-chair : Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi
Dr. D.K. Yadav, ADG (Seed), ICAR

Rapporteur : Dr. P.S. Shekhawat, ZDR & Professor (Agro.), SKRAU, Bikaner
Dr. Arun Kumar M.B., Pr.Scientist, ICAR-IARI, New Delhi

Date : March 17, 2019 **Time** : 12:00 PM

The session started with the welcome of Co-chairs by Dr. C. Tara Satyavathi, Project Coordinator (Pearl millet). There are two speakers in this session.

The progress report of FLD was presented by Sh. Manoj Kumar, Asstt. Professor (Agronomy), PC Unit, Jodhpur. As against the target of 350 ha, FLD's were organized over an area of 320 ha (including 20 ha area under summer) in the States of Gujarat, Haryana, Madhya Pradesh, Rajasthan Maharashtra, Andhra Pradesh, Delhi, Karnataka and Tamil Nadu on five components *i.e.* improved practices, recommended nutrient application, weed management, improved cultivar and moisture conservation. The results revealed that overall yield advantage was in the range of 6.3% at Jamnagar (Gujarat) to 118.8% at Vijyapur among these trials using various technologies. The Vanasthali Vidyapeeth, Fatehpur and SK Nagar did not conduct the kharif FLD which is objectionable. Many of the centres organized the Field Day/ Kisan Mela at Farmer's Field during the season.

For the season 2019-20, total 350 FLDs were proposed to be allotted to different centres. In this, North-east states were added for conducting the 10 FLDs and similarly 20 FLD kept for Summer. Dr. D.K. Yadava, ADG (Seed) suggested that FLD is the best way to disseminate the technology/ cultivar developed by the centres. He also suggested that while preparing the reports be careful that the no centre will mislead the house regarding the data. Dr. R.K. Singh, ADG (FFC) and Dr. C. Tara Satyavathi, Project Coordinator (Pearl millet) suggested that control plot (local check) should be defined properly. They also suggested that biofortified material may be used at farmers' field to eliminate mal-nutrition.

The progress report of Breeder Seed Production programme was presented by Dr. Vikas Khandelwal, Sr.Scientist (GPB), PC Unit, Jodhpur. The DAC indent received during 2018-19 was 5.41 qtls whereas actual production was 39.52 qtls. Out of this, only 5.41 qlts was lifted and 34.11 qtls is in surplus. Out of 10 varieties except MP 403 from Gwalior lacking with 50 kg otherwise, all entries were in higher side. As regards to the parental lines 21 parents line were produced except 4 parental lines from the Hisar has less production due to drought. Otherwise, all parental lines of 21 hybrids are above the level. Dr. D.K. Yadava raise two points for varietal mismatch and non-lifting the seed. He also suggested that NSC/SSC should also invite in this workshop at least from the nearby bajra growing states. .
The meeting ended with thanks to the chair.

Programme of production of Breeder Seed of Pearl millet varieties and parental lines (BSP 1)

Crop: Pearl millet Year of Production: 2019 Year of supply: February 2020

S.No.	Name of Producing center/state	Name of parental line/ variety	DAC indent (q)	Actual allocation as per BSP-I Target (q)
A	**Varieties**			
1	ICRISAT, Patancheru	Dhanshakti (ICTP 8203 Fe 10-2)	3.00	3.00
2	NARP, Aurangabad	ABPC4-3 (MP 484)	0.04	0.04
3	SKNAU, Jaipur	RAJ 171	0.10	0.10
4	ANGRAU, Ananthapuram	ABV-04 (MP 552)	0.35	0.35
5	IARI, New Delhi	Pusa Composite-701 (MP- 535)	0.80	0.80
	Total	**Total (A)**	**4.29**	**4.29**
B.	**Parental lines and Hybrid**			
1	NARP, Aurangabad	AUBI 1105 (R Line AHB 1269)	0.012	0.012
2	NARP, Aurangabad	AUBI 1101 (R Line AHB 1200)	0.01	0.01
3	MPKV, Dhule	DHLBI 1201 (R Line PhuleMahashakti)	0.027	0.027
4	ICRISAT, Patancheru	ICMA 93333 (A line MPMH 21 & RHB 173)	0.15	0.15
5	ICRISAT, Patancheru	ICMB 93333 (B line MPMH 21 & RHB 173)	0.07	0.07
6	ICRISAT, Patancheru	ICMA 04999 (A line GHB 905 & MPMH 17)	0.35	0.35
7	ICRISAT, Patancheru	ICMB 04999 (B line GHB 905 & MPMH 17)	0.17	0.17
8	ICRISAT, Patancheru	ICMA 843-22 (A line RHB 177 & HHB 67 Imp)	0.25	0.25
9	ICRISAT, Patancheru	ICMB 843-22 (B line RHB 177& HHB 67 Imp)	0.10	0.10
10	ICRISAT, Patancheru	ICMA 99222 A1(A Line PhuleMahashakti)	0.054	0.054
11	ICRISAT, Patancheru	ICMB 99222 (B Line PhuleMahashakti)	0.027	0.027
12	ICRISAT, Patancheru	ICMA 98222 (A Line AHB 1269 & AHB 1200)	0.065	0.065
13	ICRISAT, Patancheru	ICMB 98222 (B Line AHB 1269 & AHB 1200)	0.022	0.022
14	ICRISAT, Patancheru	ICMA 04888 (A Line HHB 299)	0.05	0.05
15	ICRISAT, Patancheru	ICMB 04888 (B Line HHB 299)	0.02	0.02
16	HAU, Hisar	HMS 47A (A line HHB 272)	0.04	0.04
17	HAU, Hisar	HMS 47B (B line HHB 272)	0.02	0.02
18	HAU, Hisar	AC 04/13 (R line HHB 272)	0.02	0.02
19	HAU, Hisar	H 77/833-2-202 (R Line HHB 67 Imp)	0.05	0.05
20	HAU, Hisar	H 13/0001 (R Line HHB 299)	0.02	0.02
21	JAU, Jamnagar	J-2454 (R line GHB 905)	0.05	0.05
22	SKNAU, Jaipur	RIB 192 S/99 (R line RHB 173)	0.05	0.05
23	SKNAU, Jaipur	RIB 494 (R Line RHB 177)	0.05	0.05
24	AU, Jodhpur	MIR 524 (R Line MPMH 21)	0.02	0.02
25	AU, Jodhpur	MIR 525-2 (R Line MPMH 17)	0.12	0.12
		Total (B)	**1.817**	**1.817**
		Total (A)+(B)	**6.107**	**6.107**

SESSION X

REVIEW OF RESEARCH RESULTS AND PROGRESS REPORT OF AICRP ON PEARL MILLET (2018-19) – PI PRESENTATIONS

Co-chairs : Dr. R.K. Singh, ADG (FFC), ICAR, New Delhi
Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur

Rapporteur : Dr. P.S. Shekhawat, Zonal Director Research, ARS, Bikaner (SKRAU, Bikaner)

Date : 17th March, 2019 **Time** : 12:15PM

Plant Breeding (Presented by: Dr. Vikas Khandelwal)

This session was Co - chaired by Dr. Dr. R.K. Singh, ADG (FFC), ICAR and Dr. C. Tara Satyavathi, Project Coordinator (Pearl millet) .

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 were evaluated in 13trials 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

During *Kharif* 2018, in total 154trials were allotted in A_1, A and B zones. Out of these, 139 trials were conducted with success rate of 90%.

Agronomy (Presented by: Dr. Anil Kumar)

In Agronomy, five different kinds of trials were conducted in zone A_1, A & B in respect of nutrient management (macro & micro nutrient), soil moisture conservation and irrigation management during summer and to evaluate the performance of different advance hybrid entries under staggered sowing. Three major recommendations were generated:

- 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_1. 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. 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 the 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_1& Zone A whereas, in Zone B, T_7 (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, &73.72 kg/ha-cm, respectively in Zone A_1, A & B.

- 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_1; 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 this experiment was planned with nine treatments of inorganic & organic sources. The mean data of the Zone A_1 showed that the maximum grain (12.76 kg/ha) and stover yield (24.36 q/ha) were obtained by the application of RDF through inorganic and it was followed by the organic treatment i.e. RDN through Vermicompost + Biomix with grain (11.69 Kg/ha) and stover yield (22.51 q/ha).

- The performance of new advance entries were evaluated under different sowing dates. In Zone A_1, the grain yield in D_1(July 05-10) and D_2(July 20-25) were at par and the decrease in D_3 (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 D_2 and D_3 sowing dates compared to D_1. In Zone B, the mean data of four locations revealed that the grain yield was decreased from 29.41 q/ha in D_1 to 26.86 q/ha in D_2 and 21.84 q/ha in D_3 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.

Plant Pathology (Presented by: Dr. Chandra Nayaka)

During *kharif* and *summer* 2018, six trials were conducted on various aspects of pathologyat Mandor, Jaipur, Hisar, Gwalior, Jamnagar, New Delhi and Anand in zone A_1& A and at Mysore, Aurangabad, Dhule, Coimbatore and Patancheru in zone B. Total of 310entries 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_1, 3.80% in Zone A and 3.62% in Zone B was observed at 60 DAS in initial trial whereas in advancedtrial,4.70% downy mildew incidence in Zone A_1, 3.62% in ZoneA 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 ofRajasthan 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.

Entomology (Presented by: Dr. R.K. Juneja)

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

Plant Physiology (Presented by: Dr. R.C. Meena)

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 genotype, 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.

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.

The session ended with vote of thanks to the co-chairs.

PLAN OF WORK 2019-20 FOR BIOTECHNOLOGY

Chairman:	Dr. R.K. Singh, ADG, (FFC), ICAR- New Delhi	**Co-Chairman**	: Dr. C. Tara Satyavathi, PC, ICAR-AICRP ON Pearl Millet, Mandor Jodhpur Dr. C. N. Neeraja, Principal Scientist, ICAR-IIRR
Rapporteurs :	Dr. K.D. Mungra, JAU, Jamnagar Dr. Sanjana Reddy, ICAR-IIMR, Hyderabad		
Date	March 17, 2019	**Time**	1:00 PM

Experiment 1: Genetic Diversity analysis and molecular characterization studies in pearl millet

Objective: Molecular characterization and diversity analysis of released hybrids and varieties of pearl millet.

Plant material: Young leaf samples of 2-3 leaf stage of released hybrids/varieties.

Methodology

- DNA isolation will be done using CTAB method.
- Molecular characterization using SSR markers.
- Construction of dendrogram using NTSys software and diversity analysis.

PLENARY SESSION

Chairman	:	Padma Bhushan Professor RB Singh, Chancellor,CAU, Imphal	**Co-Chairman**	:	Dr RK Singh, ADG (FFC), ICAR, New Delhi
			Rapporteur	:	Dr M Elangovan, Principal Scientist, ICAR-IIMR-Hyderabad Dr I Johnson, Assistant Professor, TNAU-Coimbatore
Date	:	17th March 2019	**Time**	:	2:10 PM

Plenary session of the 54th Annual Group Meeting of AICRP on Pearl Millet was held under the Chairmanship of Padma Bhushan Professor RB Singh, Chancellor, CAU, Imphal. Dr RK Singh, ADG (FFC), ICAR, New Delhi was the Co-Chairman of the session. Other dignitaries present on the dais were Dr AK Singh, Joint Director (Research), ICAR-IARI & DDG (Extension), ICAR and Dr C Tara Satyavathi, Project Coordinator (AICRP on Pearl millet).

Dr C Tara Satyavathi, Project Coordinator (AICRP on Pearl millet) welcomed the dignitaries on the dais and briefed the proceedings of the AGM2019. She highlighted the active participation of representatives from public sector, private sector, ICRISAT and progressive farmers from Rajasthan during the Brainstorming session and about the technical session on new initiatives in pearl millet research.

The technical programmes formulated for the year 2019-20 were presented by the Principal Investigators of the different disciplines of AICRP on Pearl Millet.

The highlights of the Technical Session III were presented by Dr Vikas Khandelwal, (PI – Plant Breeding). He presented the criteria for promotion of entries in coordinated trials and summer hybrid trial, also about the entries promoted for next level of testing.

The proceedings of Varietal Identification Committee was presented by Project Coordinator, ICAR-AICRP on Pearl millet.

Dr Anil Kumar (PI – Agronomy) presented the highlights. In the Physiology experiment, Phenotyping may be conducted at ICRISAT. PMAT 1 – 2 entries are promoted and three experiments on weed management, nutrient management will be conducted. Irrigation management during the summer was discussed and drafted the experiments. In physiology one recommendation was made. One new experiment on photosynthesis accumulation has been formulated.

Dr Chandra Nayaka (PI – Plant Protection) highlighted the discussion, pathological and entomological traisl should be conducted in artificial infestation. New genotypes were identified for different pest and disease resistances. Characterization of pathogen variability will be

conducted. Management of Downy Mildew will be continued. Management of blast disease as new experiment was formulated.
Dr Rajkumar Juneja (PI – Entomology) presented the highlight of entomology experiments and technical programme , seed treatment of …… has been recommended.

Technical Session VII – Dr Supriya presented the highlight. In DUS testing two new traits were added. Dr Sushil Pandey presented the status of pearl millet germplasm. Dr M Elangovan presented the 37 years database on pearl millet pedigree. Dr Kuldeep wanted centre wise database on all varieties available. Dr Tara mentioned that centres will be encouraged to register more genetic stocks. Need to develop minicore germplasm especially a trial to be organized at Rajasthan with all local germplasm collected at ICAR-NBPGR, Regional Station in Jodhpur. Need to screen the germplasm specific trait.

Technical Session VIII - New initiatives – Dr Kakani highlighted the Technical Session VIII, Seven presentations were made during the session. The recommendation was to prepare a workplan for public-private partnership for development for pearl millet hybrid for A_1 zone.

Technical Session IX – Dr KD Mungra highlighted the discussion, ADG (FFC) suggested that there should not be any overlapping of ICAR-ICRISAT partnership project and AICRP-PM project, Genetic gain project may be taken up during 2019-2023. Project Coordinator suggested that Genetic Gain experiment will be taken under ICAR-BMGF project.

Technical Session X – Dr PS Shekhawat – two presentations were made, 350 ha area of FLD was conducted. Yield advance of 6.3 % higher yield was achieved. Many centres organized farmers day, field day. During 2019-20, Northern-Eastern States also included for FLD. Data on yield and local landraces should be perfect and not to mislead. 31.11 q is the surplus breeders seed production. MSSC and NSC should be invited for the AGMs.

Remarks by Dr RK Singh, ADG (FFC), ICAR

- Appreciated the work done by the researchers and centre of ICAR-AICRP on Pearl millet in the AGM.
- This AGM is unique as it had presentations on the new initiatives in pearl millet research.
- Cutting edge researches were presented including marketing.
- Appreciation award for including nutritional para meters in promotion criteria.

Remarks by Dr AK Singh, Joint Director, IARI

- Nutritional aspects of pearl millet should be brought into consideration before deciding the MSP.
- Genetic gain – excellent presentation is made; 0.6-0.8% in general; the gain can be compared for decades or overall years. When the checks are same in the last 5-7 years then we may not get the genetic gain.
- The information of the Genomics resources development by ICRISAT group may be used by the National researchers.

- Competition with the private sector which has social responsibility to spend 3-5% in the A_1 zone
- Populations are important in the zone A_1.
- Some of the technologies are matured and the recommendations must be released in the AGMs like varieties considered in the workshops

Remarks by Padma Bhushan Professor RB Singh, Chancellor, CAU, Imphal

- Dr Tara has made very hard work to organize the workshop. Congratulated her and team pearl millet for the Harvest Plus Award
- The recommendations of the technologies will be faithfully implemented. These recommendations should be reported
- Hunger due to mal-nutrition is very alarming
- Nation should take high priority on pearl millet for its nutritional profile and at least take one health care programme based on pearl millet. Pearl millet stand very tall in this nutritional endeavour
- The criteria for the promotion is necessary and taken up based on the proper analysis. There is a statistical procedure to exclude or include the data from the locations. Why so much of locational effects? The G x E interactions should also informed and genetic gain measurement
- The points on A_1 zone is essential and priority to be given in this zone. It is our science-social responsibility of the public and private sectors for the country to work in the A_1 zone with 4.5 to 5.0 m.ha.
- There is difference between characterization and evaluation, we need to formulate evaluation programme at A_1 Zone with the available germplasm, population of that area
- India will lead the International Year of Millets in 2023 through FAO.
- India may declare the Year of Pearl millet in 2023 based on the work take up in the next four years

The session ended with vote of thanks by Dr AK Singh, JD, ICAR-IARI and the National Anthem.