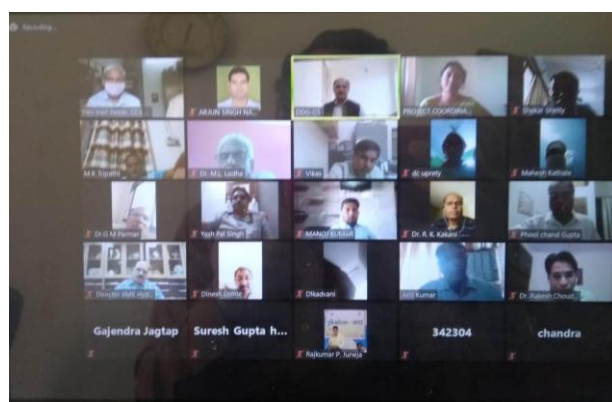
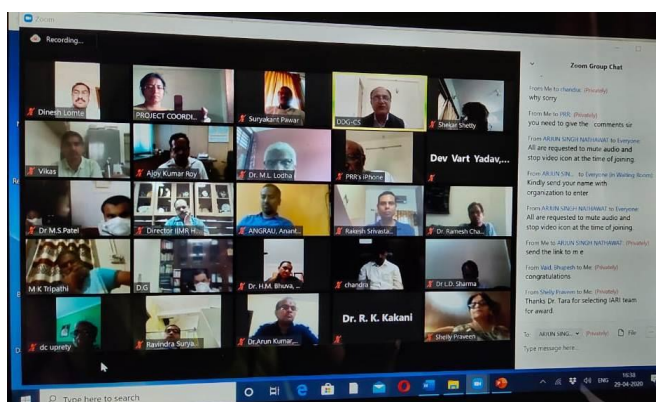


**Proceedings of 55th Online Annual Group Meeting
of
ICAR-All India Coordinated Research Project on Pearl Millet
(April - May, 2020)**



ICAR-All India Coordinated Research Project on Pearl Millet
Mandor, Jodhpur 342 304
<https://aicrp.icar.gov.in/pearl/>
www.aicpmip.res.in





55th Online Annual Group Meeting

ICAR-All India Coordinated Research Project on Pearl Millet



(April - May, 2020)

Venue: Skype/ Zoom

AGENDA

15th April, 2020

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|---------------|---|
| 10:00 – 13:00 | Principal Investigators meeting (Plant Breeding, Agronomy, Plant Pathology, Entomology, Plant Physiology & Plant Biotechnology) |
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17th April, 2020

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| 10:00 – 13:00 | Plant Physiology - Review of research results of 2019-20 and plan of work for 2020-21 |
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20th April, 2020

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| 10:00 – 13:00 | Plant Pathology - Review of research results of 2019-20 and plan of work for 2020-21 |
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21st April, 2020

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| 10:00 – 13:00 | Entomology - Review of research results of 2019-20 and plan of work for 2020-21 |
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22nd April, 2020

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| 10:00 – 17:00 | Plant Breeding - Review of research results of 2019-20 and plan of work for 2020-21 |
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23rd April, 2020

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| 10:00 – 13:00 | Agronomy - Review of research results of 2019-20 and plan of work for 2020-21 |
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29th April, 2020 - One day 55th Online Annual Group Meeting

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| 10:00 – 11:00 | Session I: Inaugural Session | |
| 10:00 – 10:10 | Welcome | Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur |
| 10:10 – 10:20 | Introductory Remarks | Dr. Vilas Tonapi, Director, IIMR, Hyderabad |
| 10:20 – 10:30 | Remarks by Guest of Honour | Dr. Yashpal Singh, ADG (FFC), ICAR, N. Delhi |
| 10:30 – 10:55 | Inaugural address | Dr. T.R. Sharma, DDG (CS), ICAR, N. Delhi |
| 10:55 – 11:00 | Vote of thanks | Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur |
| | Rapporteurs | Dr. Sanjana Reddy & Dr. Supriya |

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| 11:00 – 14:00 | Session II: Review of Research Results and Progress report 2019-20 and Technical programme for 2020-21 (Principal Investigator Presentation) | |
| | Chairman | Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi |
| | Co-chairs | Dr. Yashpal Singh, ADG (FFC), ICAR, N. Delhi Dr. Vilas A Tonapi, Director, ICAR-IIMR, Hyderabad |
| | Facilitator | Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur |
| | Rapporteur | Dr. P.S. Shekhawat & Dr. S. P. Singh |
| 11:10 – 11:35 | Plant Breeding | Dr. Vikas Khandelwal, ICAR-AICRP on Pearl millet, Jodhpur |
| 11:40 – 12:00 | Agronomy | Dr. Anil Kumar, CCS HAU, Hisar |
| 12:05 – 12:25 | Plant Pathology | Dr. Chandra Nayak, UoM, Mysore |
| 12:30 – 12:55 | Entomology | Dr. R.K. Juneja, JAU, Jamnagar |
| 13:00 – 13:25 | Plant Physiology | Dr. R.C. Meena, ICAR-AICRP on Pearl millet, Jodhpur |
| 13:30 – 13:40 | Plant Biotechnology | Dr. Supriya, ICAR-AICRP on Pearl millet, Jodhpur |
| 13:40 – 13:55 | ICAR- ICRISAT Partnership trials | Dr. S. K. Gupta/ Dr. Rakesh Srivastava, ICRISAT |
| 14:55 – 14:15 | Discussion and remarks by DDG (CS) | |

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| 14:15 – 15:00 | Lunch break |
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| 15:15 – 17:30 | Session III: Plenary Session | |
| | Chief Guest | Dr. T. Mohapatra, Secretary DARE & DG, ICAR |
| | Chairman | Dr. TR Sharma, DDG (CS), ICAR, N. Delhi |
| | Co-Chairs | Dr. Yashpal Singh, ADG (FFC), ICAR, N. Delhi Dr. Vilas A Tonapi, Director, ICAR-IIMR, Hyderabad |
| | Rapporteurs | Dr. R.K. Kakani & Dr. R.K. Solanki |

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| 15:15 – 15:45 | Review of Pearl millet activities during 2019-20 and significant technical recommendations of the workshop | Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur |
| 15:45 – 15:50 | Remarks by Co-chairman | Dr. Yashpal Singh, ADG (FFC), ICAR, N. Delhi |
| 15:50– 16:00 | | Dr. Vilas A Tonapi, Director, ICAR-IIMR, Hyderabad |
| 16:00– 16:10 | Reading out citation of retiring scientists & Award winners | Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl millet, Jodhpur |
| 16:10 – 16:25 | Remarks by Chairman | Dr. T. R. Sharma, DDG (CS), ICAR, N. Delhi |
| 16:25 – 17:00 | Plenary Address by Chief Guest | Dr. T. Mohapatra, Secretary DARE & DG, ICAR |
| 17:00 – 17:05 | Vote of Thanks | Dr. Vikas Khandelwal, Senior Scientist, ICAR-AICRP on Pearl millet, Jodhpur |

Review of centre wise activities taken up during 2019-20

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| 10:30 - 13:30 | 5 th May, 2020 | Durgapura, Bikaner, Jodhpur, Gwalior |
| | 6 th May, 2020 | Hisar, Ludhiana, Jamnagar, Aurangabad |
| | 7 th May, 2020 | Dhule, Ananthapuramu, Coimbatore, Vijayapur and Mysore |

15th May, 2020 - Committee meeting for deciding SoP for data recording of Pathology trials

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| 10:30 - 13:30 | Online committee meeting to decide SoP for data recording of Pathology trials |
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23rd May, 2020 - Varietal Identification Committee meeting

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| 17:00 - 18:45 | VIC meeting |
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SESSION – I**INAUGURAL SESSION OF 55th ONLINE ANNUAL GROUP MEETING OF
ICAR-AICRP ON PEARL MILLET**

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| Chief Guest | Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi |
| Guest of Honour | Dr. Yashpal Singh, ADG (FFC), ICAR, New Delhi |
| Welcome | Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl Millet, Jodhpur |
| Introductory Remarks | Dr. Vilas Tonapi, Director, IIMR, Hyderabad |
| Programme Advisory and Monitoring Committee (PAMC) | <ol style="list-style-type: none">1. Dr. P. Raghava Reddy, Ex-VC, ANGRAU - Chairman2. Dr. H. Shekhar Shetty, Ex-Professor, Downy Mildew Research Lab., UOM, Mysore - Member3. Dr. M.L. Lodha, Division of Bio-Chemistry, IARI, New Delhi - Member4. Dr. U.C. Uprety, Ex-Principal Scientist, Division of Plant Physiology, IARI - Member5. Dr. R.K. Pannu, Ex-Dean, CCS HAU, Hisar - Member |
| Rapporteurs | Dr. Sanjana Reddy & Dr. Supriya |

The 55th Annual Group Meeting of ICAR-AICRP on Pearl millet was held online via Zoom on 29th April, 2020 due to COVID-19 pandemic and lockdown across the country. During the inaugural session, Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi was the Chief Guest and Dr. Y.P. Singh, ADG (FFC), ICAR, New Delhi was the Guest of Honour. Around 99 participants including PAMC Chairman, Dr. P. Raghava Reddy and members Dr. M.L. Lodha (Biochemistry), Dr. R.K. Pannu (Agronomy), Prof. H. Shekhar Shetty (Plant Pathology) and Dr. D.C. Uprety (Plant Physiology), Directors from various ICAR institutes and scientists from public sector, private sector and ICRISAT attended this online meeting. Dr C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur welcomed all the guests and participants.

Dr. Vilas Tonapi, Director, IIMR, Hyderabad in his introductory remarks appreciated the efforts of ICAR-AICRP on Pearl millet and informed that area under pearl millet is stable while area under summer pearl millet is growing. He further added that summer pearl millet can be exploited for enhancing the income of the farmers. He emphasized on strengthening parental line development in pearl millet. He also suggested that integrated programs involving IIMR and AICRP should be initiated and also assured that IIMR, Hyderabad will provide full support to strengthen basic/ strategic research component related to pearl millet.

Guest of Honour, Dr. Y.P. Singh, ADG (FFC), ICAR, N. Delhi in his remarks highlighted the importance of the crop in the country and mentioned that pearl millet is 4th important crop after rice, wheat and maize. He further informed that pearl millet is grown as rainfed crop and is important as feed and the crop's potential as feed and fodder should be exploited.

Chief Guest, Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi welcomed Directors of ICAR institutes present in the meeting and the members of the expert committee (PAMC). He said that ICAR is able to organize meetings through video conferencing despite COVID-19. We need to use the technology and continue to make progress. In his inaugural address, he highlighted the significance of AICRP on Pearl millet and historical aspects adding that this program is 55 years old and is going to stay as an important crop in the coming future as it is grown for both food and fodder. Pearl millet has the advantage of the big genome size, cross-pollination, C_4 photosynthetic pathway. He mentioned that as the genome has been decoded, the available genomic information must be utilized and further improvement in this crop is required using advanced technologies. He also suggested that all disciplines should join hands together and work in a network mode to get desired output. He also added that pearl millet gene pool is rich in diversity and it should be exploited in breeding programmes. He also suggested that homology searches can be done and available database of rice and Arabidopsis may be used to further improve the crop against various biotic/abiotic stresses. He urged that scientists must devote more time for research programs and try to seek competitive grants from different funding agencies. They should record data in a scientific manner and proper interpretation should be done and quality publications must be brought out of the work. He mentioned about the role of apomixis in fixing heterosis in this crop and suggested that collaborative programs should be designed between IGfRI, IIMR and AICRP on Pearl millet. He suggested that seed value chain and seed village concept is already successful in pulses and should be replicated in pearl millet. He reiterated that the AICRP on Pearl millet has very few to nil basic and strategic research programs and more focus should be given to these. He suggested to emphasize more efforts on food processing, value addition, shelf life and rancidity and study various metabolic pathways using advanced tools and techniques such as genome editing etc. He appreciated the efforts of all participants to join the online meeting and wished that with new deliverables we shall be successfully celebrating 'Year 2021' as "International Year of Millets". He concluded his remarks wishing a fruitful workshop.

The session ended with vote of thanks by Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl Millet, Jodhpur.

SESSION- II

Review of Research Results and Progress Report 2019-20 and Technical Programme for 2020-21 (PI Presentations)

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|--------------------|---|
| Chairman | Dr. T.R. Sharma, DDG(CS), ICAR, New Delhi |
| Co-chairs | Dr. Yashpal Singh, ADG (FFC), ICAR, N. Delhi Dr. Vilas A Tonapi, Director, IIMR, Hyderabad |
| Facilitator | Dr. C. Tara Satyavathi, PC, AICRP on Pearl millet, Jodhpur |
| Rapporteur | Dr. P.S. Shekhawat and Dr. S.P. Singh |

A PAMC was constituted as per Council's order No. F.24-8/2018-CS-FFC dated 04.03.2020 constituting the following as experts to evaluate the work done during 2019-20:

1. Dr. P. Raghava Reddy, Ex-VC, ANGRAU - Chairman
2. Dr. H. Shekhar Shetty, Ex-Professor, Downy Mildew Research Lab., UOM, Mysore - Member
3. Dr. M.L. Lodha, Ex-Principal Scientist, Division of Biochemistry, IARI, New Delhi - Member
4. Dr. U.C. Uprety, Ex-Principal Scientist, Division of Plant Physiology, IARI, New Delhi - Member
5. Dr. R.K. Pannu, Ex-Dean, CCS HAU, Hisar - Member

In this session, presentations were made by PI's of different disciplines and progress report of 2019-20 along with technical program for 2020-21 of different disciplines was presented as mentioned below:

Plant Breeding: The presentation was done by PI, Plant Breeding, Dr. Vikas Khandelwal, ICAR-AICRP on Pearl Millet, Jodhpur. He stated that 166 trials were allotted to different centers. Out of which, 151 trials were successfully conducted by different centres in all zones. Only 4 entries were promoted, rest all entries failed to show their superiority. DDG, Dr. T.R. Sharma showed the concern and inquired about the possible reasons of rejection of most of the entries for the next stage. Dr. C. Tara Satyavathi, PC, ICAR-AICRP on Pearl Millet, Jodhpur responded to the query and informed that due to severity of DM & Blast many of the entries got rejected. Further, DDG suggested that blast of rice and wheat are similar to millets. Hence, similarities may be looked into and use similar approaches to develop resistant varieties in pearl millet also. He also suggested that a strong programme on resistance breeding should be chalked out in the new EFC. He stressed that development of breeding material is very important and as now genome sequence of pearl millet is available, it should be used in breeding programs and genomic studies and molecular breeding techniques should be incorporated for pearl millet improvement.

Agronomy: PI, Agronomy, Dr. Anil Kumar, CCSHAU, Hisar presented the progress report of Agronomy discipline. He informed that 32 trials were conducted during 2019-20. One

recommendation was also reported from PMAT-2 trial - based on the studies of effect of mulching and hydrogel on the productivity, water use efficiency and microbial activity of pearl millet exhibited 49.8, 40.2 and 52.2 % improvement in the grain yield by the treatment with Recommended Dose of Fertilizer (RDF) + crop residue mulch @ 5.0 t/ha+ hydrogel @ 7.5 kg/ha over RDF alone in Zone A₁, Zone A and Zone B, respectively. The water use efficiency was recorded 70.24, 78.78, & 79.98 kg/ha-cm in the best treatment as compared to 36.60, 52.85 & 52.72 kg/ha-cm in RDF in Zones A₁, A & B, respectively. The soil microbial activities viz. the dehydrogenase activity, MBC, alkaline phosphatase, acid phosphatases and urease populations were recorded significantly higher among all the treatments of hydrogel, mulching and their combinations as compared to their population in the inorganic RDF treatment.

Pathology: PI, Pathology, Dr. Chandra Nayak, UoM, Mysore presented the report on trials taken up during kharif 2019 and plan for kharif 2020. He informed that downy mildew is a major disease in Rajasthan and Maharashtra and caused 10- 40% losses. A₁ zone has higher DM as compared to A & B zones. Blast is another important disease which was reported to be higher in Maharashtra. DDG suggested that that extent of yield losses due to different diseases must be recorded and estimated properly and screening methods must be used efficiently for evaluation of the material. Blast disease of pearl millet is found in rice as well where lot of information is available and should be utilized for pearl millet improvement also.

Entomology: PI, Entomology, Dr. R.K. Juneja, JAU, Jamnagar presented the progress report. He reported that three important insects are there for pearl millet and IPM modules are being used to control these insects. DDG suggested that NCIPM should be consulted and modules developed by them must also be incorporated in pearl millet programme. He further suggested that pearl millet is a resource poor crop and hence, focus should be laid on development of resistant genotypes, entomological and pathological trials must be focused in an effective manner especially for A₁ zone. Dr. H. Shekhar Shetty, Member, PAMC for ICAR-AICRP on Pearl millet suggested that broad spectrum storage pest management is required.

Plant Physiology: The presentation was done by PI, Plant Physiology, Dr. R.C. Meena, ICAR- AICRP on Pearl Millet, Jodhpur. DDG suggested that the physiological work should be done in collaboration with breeders and new entries must be included for testing for drought and heat stress. He also suggested that soil moisture studies must be added in the physiological experiments and the trials must be reformulated in consultation with expert Dr. Uprety, Member of PAMC for ICAR-ICRISAT on Pearl millet.

Plant Biotechnology: The presentation was done by Dr. Supriya, PI, Plant Biotechnology, ICAR- AICRP on Pearl Millet, Jodhpur. She presented the work done on Plant Biotechnology at PC unit during 2019-20 and future plan of 2020-21. She informed that a common facility lab has been established at PC Unit and work on genetic diversity analysis of pearl millet hybrids/varieties was initiated last year and it was successfully accomplished using SSR markers. DDG suggested that scientists must be trained and new tools and techniques must be also utilized for crop improvement. Dr. Lodha, QRT, Member

appreciated the initiative and suggested that markers for phytic acid and other traits must also be developed and used in future.

ICAR-ICRISAT partnership trials: Dr. SK Gupta and Dr. R.K. Srivastava, ICRISAT presented the progress report on ICAR-ICRISAT partnership trials and discussed the future plan. DDG suggested that efforts be made to broaden the genetic base of the crop and ICRISAT should develop material and share with NARS system.

Suggestions and Recommendations from Dr P Raghava Reddy, Chairman (PAMC):

All the results of the experiments pertaining to pearl millet programme (2019-20) were well presented by the Project Coordinator in the virtual meeting. The results of different experiments and the progress made in different disciplines were thoroughly reviewed by the Hon'ble DG, DDG(CS), ADG, Directors, Project Coordinator, Principal Scientists of both ICAR/agriculture universities/ICRISAT and private research organizations. Based on the deliberations and proceedings of the virtual meeting, the following observations and suggestions are offered for favour of perusal.

Crop Improvement:

- i. Large number of experimental hybrids nominated by the public and private research institutions were evaluated at different locations. The data indicated that the nominations proposed by different centres exhibited high yielding ability as well as tolerance to both biotic and abiotic stresses. Based on the criteria for promotion of entries to next stage for further evaluation, only a few entries could be promoted, out of large number tested. On perusal of the data, it is opined that the project scientists should take up this challenge and intensify their research efforts in developing elite germplasm with desirable traits and develop superior experimental hybrids in close collaboration with the public and private institutions utilizing innovative technologies (genome sequencing/editing, molecular markers) effectively.
- ii. Though there is significant improvement in overall productivity of bajra in the country from 1007.6 Kg per ha (2007–12) to 12 19.2 (2012–17) the actual yield level especially in low rainfall areas of Rajasthan is significantly less. There is an urgent need to address this issue on top priority and develop superior hybrids with the target yield and associated production /protection technologies for A₁ zone.
- iii. Basic and strategic research programmes in respect of crop improvement, physiology, biochemistry, post-harvest technology and value addition including rancidity problem should be addressed after thorough discussion at apex level (PC with national and international institutions including SAU's and private research organizations).

Resistance Breeding:

- i. The biotic and abiotic stresses prevailed in each of the agro climatic zones should be thoroughly analyzed and suitable bajra ideotype for that niche area has to be

developed with the targetted yield. The physiologists should suggest necessary growth parametres to the breeder to develop such superior ideotypes.

Seed Production:

- i. Seed production programme should be strengthened further and quality seed to be distributed to enhance the Seed Replacement Rate (SRR) resulting in increased productivity .
- ii. Summer seed production areas should also be identified and seed multiplication programmes to be taken up in such niche areas.
- iii. The identified superior cultivars should be popularized through effective seed production programmes and front line demonstrations.

Crop Production/ Protection Technology:

- i. Effective production technology like RDF+5t mulching+ gel, identified from the experimental results should be popularized duly including it in the package of practices.
- ii. Host-Pathogen relationship and trends in pest/ disease incidence needs to be thoroughly researched and appropriate integrated technologies should be developed for effective management of diseases & pests.

PHT and value addition:

- i. Being nutri-cereal crop, the protocols for health and functional foods to be developed and popularized duly addressing the rancidity problem.
- ii. To encourage the growing of Nutri-cereal like Bajra, as economically viable crop; the GOI may be requested to announce additional price for its nutritive value over and above the MSP which will not only enhance image of this nutri-cereal among consumers but also help the resource poor farmers with relatively better income.

Project Coordinating Unit at Jodhpur:

To improve the system and to get back to the vital role played by the PC unit it is submitted to the council to kindly consider these two issues in right perspective:

- i. Post only ICAR Scientists at PC unit with multidisciplinary faculty along with the required laboratory facilities, and budget so that the ICAR scientists will work with dedication and commitment not only for the growth & development of Pearl millet with superior germplasm & hybrids, production/protection technologies but also for their professional growth.
- ii. Review the ICAR-ICRISAT collaboration arrangements and limit the active research collaboration between the ICAR-AICRP on Pearl millet and ICRISAT only and not

directly with different coordinating centres; so that single line of command from PC unit will yield tangible results. Only PC unit shall run the coordinating system duly delinking parallel system by ICRISAT.

Dr. DC Uprety suggested following points for improvement of Plant Physiology experiments:

- i. Several years data on meteorological parameters from different agro ecological zones have been collected and these valuable data need to be correlated with the physiological factors and growth parameters related to the production and productivity of pearl millet. This will give a picture that how climate changes stresses have affected and will affect the yield of pearl millet. This will also help in identifying the physiological constraints and mitigation options.
- ii. Development of early maturing and drought tolerant population involving in-breds and material developed from land races are required. It is also important to develop suitable technology for pearl millet production under climate change stresses.
- iii. Characterization of physiological parameters leading to drought tolerance in pearl millet genotypes must be done in different locations of A, A1 and B zones. Such characterization of physiological attributes affecting pearl millet yield need to be based on field experiments. The pot culture experiments should be avoided.
- iv. The source-sink relationships must be analyzed as per the type/ application of the hybrid specifically i.e. fodder/ grains). Less translocation of photosynthates towards the grains and less towards vegetative organs, for grain purpose.
- v. Soils in pearl millet growing area in general are very poor in their physico-chemical characters with low organic carbon and poor water retention capacity, therefore, soil health card for each centre needs to be prepared with the concerned scientist for nutrient management in pearl millet fields. Nutrient management through organic and inorganic sources for major and trace elements in rain fed pearl millet is the need of hour to combat the climate change stress and to develop climate stress resilience in pearl millet cultivars.
- vi. IARI is having a large group of plant physiologists with immense laboratory and instrument facilities. Physiological characterization of pearl millet cultivars needs to be done in collaboration with the plant physiology group of IARI, New Delhi. This group must concentrate on basic studies to explain variability on pearl millet breeding materials for their productivity, drought and thermo tolerance using plant phenomics facilities.

Dr. M.L. Lodha submitted following observations and suggestions for improvement of ICAR-AICRP on Pearl millet:

- i. **Development of molecular markers** - Good work is being carried out on genetic diversity analysis and molecular characterization of hybrids and varieties of pearl millet by using SSR markers. For future, it has been planned to do validation of markers for high Fe and Zn. Side by side, it would be quite useful if efforts are made to develop molecular markers for low phytic acid, which is an anti-nutritional factor affecting bioavailability of micronutrients.
- ii. **Product development and value addition** - Pearl millet being an important nutriacereal, there is a need to popularize it through the development of Ready-to-Eat and Ready-to-Cook products. Till the time the proposed position in the discipline of "Food science & Technology" is sanctioned/ filled up, it would be better if the AICRP centers wherever they located have such facilities in their Universities/ Institutes, should collaborate with and utilize the available facilities for product development. It should help in value addition to pearl millet and commercialization of its products.
- iii. **Creating laboratory facilities for assay of bioavailable micronutrients** - Pearl millet being a rich source micronutrients, can alleviate the problem of 'Hidden Hunger'. With this view, the hybrids of this Nutri-Cereal are being developed by AICRP-Pearl millet with enhanced levels of Fe and Zn for which benchmarks have been fixed. However, what is more important is bio available Fe and Zn and not so much their total content since their availability is reduced in the presence of phytic acid, polyphenols and fibre. The advantage of having higher content of Fe and Zn may to a large extent be nullified by their low bioavailability; bioavailability being 7.0 - 7.5% for Fe and 25% for Zn. Thus, for the proper assessment of available micronutrients, there is a need to develop laboratory facilities for the assay/ estimation of bioavailable Fe and Zn in pearl millet. Bioassay is the most appropriate method. Of course, this method is cumbersome and needs specialized lab facilities as well as trained personnel. In view of this, it is suggested that it would be better if IARI Biochemistry Division can be designated as the facility for the 'Assay of bioavailable Fe and Zn'. This is because, at present, the Division is extensively working on biochemical/ nutritional/ molecular aspects of pearl millet, and has already initiated some work on bioavailability of Fe and Zn also. Moreover, in India such facilities are available only at a few places and out-sourcing can't be done so easily. This assay method may be applied only to all the released popular hybrids/ varieties and routinely to all the hybrids at the advanced stage of their release.

Suggestions and recommendations from Dr. R.K. Pannu

- i. **Agronomy - nutrient management studies** - Routinely, experiments are being carried out at different locations to find out optimum doses of plant nutrients, especially nitrogen, for newly developed varieties and also with different organic sources of nutrients in combination with RDF. However, there exists a dichotomy - on one side 'Soil Health Cards' have been/ are being issued to the farmers so that there is

maximal utilization of nutrients applied to soil, by the respective crops. But on the other side, neither the RDF is determined nor the nutrient management experiments are based on prior 'soil-test analysis'. In view of this, it is important that all such experiments should be based on 'soil-test analysis'.

At the end, Deputy Director General (Crop Science), Dr T.R. Sharma chaired the session. All the presentations were critically reviewed by DDG (CS) and in his remarks; he thanked the PIs for nice presentations and gave major comments as given below:

- i. He highlighted the importance of pre-breeding approach in developing biotic and abiotic stresses tolerant materials and suggested that in new EFC, one objective should be based on pre-breeding.
- ii. Work on apomixis should be initiated as it has a great role in fixation of heterosis in pearl millet where hybrid development is the main stay.
- iii. He also emphasized on broadening of genetic base of parental lines so that magnitude of heterosis for yield and related traits can be further enhanced.
- iv. Basic and strategic research for blast, drought and other economically important traits should be given priority. The genetics of economically important traits - blast, rancidity etc. should be worked out.
- v. He emphasized that identification/ development of differential hosts should be done in order to study the virulence of different races of blast pathogen which would be the foundation for resistance breeding against blast.
- vi. He highlighted the importance of modern breeding approaches like - Genomic selection, Genome wide association studies and other marker technologies and emphasized on their use in millet improvement program.
- vii. He stressed upon collaborative programme among different institutions like ICAR-AICRP on Pearl millet, ICAR-AICRP on Fodder Crops and ICRISAT especially on fodder related aspects of pearl millet.
- viii. He highlighted the problem of storage and rancidity in pearl millet. He also suggested that low rancid genotypes of pearl millet should be identified. If genetic variability is less in available germplasm, then genome editing approach can be used to address this problem.
- ix. He also suggested that multi-location coordinated trial data, if analyzed and interpreted properly can be utilized for quality publications.
- x. He mentioned that Year 2023 is going to be celebrated as International Year for Millets. During this year several programs should be organized by PC Unit and IIMR to promote and popularize the millets among people.

- xi. DDG (CS) also stressed upon giving more time on planning the experiments. Accordingly efforts should be made to attract external funding in addition to in-house projects.

Dr Vilas A. Tonapi, Director ICAR-IIMR emphasized the importance of shuttle breeding approach for development of blast and drought tolerant materials. PAMC Chairman, Dr. P. Raghava Reddy gave some critical comments and stressed upon reframing the existing system in PC Unit (i.e. university staff to be replaced with ICAR staff for effective and efficient functioning) for improvement of pearl millet. He further added that the trials must be unified and value addition, MSP, productivity are some of the areas which need to be focused. He further added that basic, strategic research should be included in the program and such technologies must be developed which can ultimately benefit the farmers.

The session ended with thanks to the chair, PAMC and all presenters.

SESSION -III

Plenary Session

| | |
|--------------------|---|
| Chief Guest | Dr. T. Mohapatra, Secretary, DARE & DG, ICAR, New Delhi |
| Chairman | Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi |
| Co-Chairs | Dr. Yashpal Singh, ADG (FFC), ICAR, New Delhi Dr. Vilas A Tonapi, Director, ICAR-IIMR, Hyderabad |
| Rapporteurs | Dr R.K. Kakani and Dr. R.K. Solanki, ICAR-CAZRI, Jodhpur |

Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur welcomed the Chief Guest and Chairman of the session. Later, she presented in brief about the activities and experiments conducted during 2019-20 kharif and summer season, along with significant achievements of the AICRP programme including development of hybrids/ varieties and recommendations emerging from different disciplines.

PAMC Chairman, Dr. P. Raghava Reddy appreciated the entire programme, suggested about defining a base line for productivity enhancement in different agro-ecological zones of pearl millet. He further added that issues related to biotic and abiotic stresses should also be considered for identification of potential varieties/hybrids; innovative and modern technologies should be used to develop better breeding lines; FLD's should be taken up intensively for popularization of recommended practices; physiological studies should help plant breeders to take up indirect selection for target traits. Programmes related to expanding area in non- traditional areas should be given emphasis and MSP of pearl millet should also be relooked for defining a policy for betterment of pearl millet growers.

Dr Vilas Tonapi, Director, ICAR-IIMR, Hyderabad in his remarks presented the SWOT analysis, he emphasized to strengthen the breeding programmes for parental line development for diverse hybrids suitable for multiple ecologies, trait specific breeding, defining the heterotic gene pool etc.

Three online publications including Summary of Research Experiments, Pearl millet News, Project Coordinator Review were released by the Chief Guest and Chairman.

Felicitations of the retiring scientist Dr. H.T. Patil, Pearl millet breeder, MPKV, Rahuri was done. Awards were given to the different centres and scientists for their contribution during 2018-2020. Best AICRP centre award was given to RARI (SKNAU), Durgapura centre and AICRP on Pearl millet centre, Ananthapuramu; Corteva Agri Science was awarded for the best private sector organization contributing to pearl millet improvement, multi-disciplinary research award was given to ICAR-IARI, New Delhi for outstanding contribution in diverse fields; National Nutritional Security award was given to AICRP on Pearl millet, Aurangabad centre for the development of AHB 1200 and AHB 1269 biofortified hybrids and large scale

seed production of AHB 1200 for farmers benefit, the Best scientist award was given to Dr Chandra Nayak, Plant Pathology from University of Mysore, Mysore and Dr Vikas Khandelwal, Senior Scientist, PC Unit, AICRP-PM, Jodhpur. Appreciation certificate was also given to Dr. V Khandelwal and Mr Arjun Singh Nathawat, PC Unit, ICAR-AICRP on Pearl millet for developing the Information system on Pearl millet.

Hon'ble Dr. T.R. Sharma, DDG (CS), in his remarks welcomed the Chief Guest, Dr. T. Mohapatra, Secretary DARE & DG, ICAR and other national and international dignitaries including the members of the AICRP-PM team. He appreciated the efforts taken up to conduct the 55th Online Annual Group Meeting under the present situation of COVID19 outbreak and nationwide lockdown. The meeting was cancelled due to COVID19 out break and rearranging the online meeting by video conferencing facility is a remarkable approach. He was happy to share that national experts on pearl millet were part of the online meeting and their valuable suggestions would benefit the programme. He suggested continuing with the online meetings among the teams of AICRP-PM for betterment. He further added that the ICAR- AICRP on Pearl millet is one of the oldest program of the country which has contributed significantly in enhancing national productivity, the available genetic resources which are ample in the crop and genomic information with respect to genome needs integration, marker assisted selection and genome wide markers information offers great opportunity for developing better hybrids. There is need to broaden the genetic base, both biotic and abiotic stress resistance needs to be intensified for generating better parents. Routine evaluation and testing should be redefined, target based evaluation and trait analysis should be done to come up with concrete analysis to deliver best information and product. Biofortification programme should be strengthened by integrating diverse institutes like NIN, Hyderabad for study of nutrient bio-availability, value additions and secondary agriculture are subjects to be looked into. Inter institutional and inter-domain programmes needs to be designed. These programmes can be included in the upcoming EFC document. Target setting is very important to bring out more number of products from the AICRP-PM umbrella, targets should be clear and time bound. He extended his warm wishes to Dr HT Patil on his superannuation and congratulated the PC and team members for their efforts and awards received for outstanding contribution.

The Chief Guest of the Session, Hon'ble Dr T Mohapatra, Secretary, DARE and DG, ICAR New Delhi in his remarks, thanked DDG (CS), ADG (FFC), PC (AICRP-PM), PAMC Members, Directors of ICAR institutes for active participation in the workshop and valuable contribution. He appreciated the efforts placed by AICRP-PM PC for the successful conduct of the online workshop under the national lockdown situation due to COVID 19. Hard stones need to be identified mainly for A₁ zone, it's a challenging ecological condition for breeding durable hybrids, research work on rancidity is a good initiative taken up by the AICRP PM, IPM/IDM/INM issues are important and the centers linked with AICRP should work accordingly. Untiring efforts of the PC were appreciated to strengthen the programme. The role of ICRISAT is very important, germplasm holding with the CGIAR institutes and modern tools available should be utilized and the programme can be immensely improved, special workshop can be organized to target zonal ecologies to break the barriers using

genetic resources and modern tools. Focus should be more on proper screening of hybrids against major diseases, it may happen that there may be less potential entries in the initial cycle but this will increase gradually with targeted programme. He appreciated the contribution of private sector which is also high to bring up the productivity levels in pearl millet, commercialization of public sector hybrids and active participation of private sector with public sector for parental line development. Pathogen interaction studies, hot spot screening can be useful in designing disease resistant hybrids. Climate change with respect to high temperature and response in pearl millet needs attention. The ongoing programme can also be strengthened by adopting speed breeding protocols, experience of other AICRP can also be looked into for improvement. Bioavailability of nutrients needs to be studied. Digital revolution of scientific interaction should be conducted among experts for better output. All the technological recommendations should come up as certificates that can be sent to State Governments for inclusion in the package of practices. In his closing remarks, he congratulated the entire team and encouraged for working sincerely for pearl millet improvement, later he requested all to stay home, stay safe and wished an early solution to the COVID19 outbreak.

The session ended with a formal vote of thanks by Dr Vikas Khandelwal.

CENTRE-WISE PRESENTATIONS

The centre-wise presentations to evaluate the performance of ICAR-AICRP on Pearl millet were taken up during 5-7th May, 2020. During these days, presentations were made by respective centre incharges about the research programme and activities taken up during 2019-20. The session was chaired by Dr. C Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl millet, Jodhpur. The meetings were held online via Zoom platform as mentioned below:

| | | |
|---------------------------------|--|--|
| 5th May, 2020 | Review of centre wise activities taken up during 2019-20 | Durgapura, Bikaner, Jodhpur, Gwalior |
| 6th May, 2020 | Review of centre wise activities taken up during 2019-20 | Hisar, Ludhiana, Jamnagar, Aurangabad |
| 7th May, 2020 | Review of centre wise activities taken up during 2019-20 | Dhule, Ananthapuramu, Coimbatore, Vijayapur and Mysore |

The centre wise observations and suggestions are as follows:

RARI, Durgapura

- Dr. L.D. Sharma presented the progress of the centre and the centre was applauded for their contribution made during last year by the Project Coordinator. However, the following suggestions were given for improvement:
- Few grams of seed of MS lines (A/B pairs) should be spared and sent to the PC Unit, Jodhpur to form a National Repository of pearl millet parental lines.
- The available germplasm from the centre should be characterized and catalogued. The technologies developed must be documented and the publications need to be brought out.
- The physiologist was not there during 2019-20 due to which data was not recorded for physiology experiments. This was viewed very seriously and warned about withdrawal of Physiologist position.
- Emphasis should also be given for basic and strategic research.
- A mapping population should be developed by the centre for downy mildew.

SKRAU, Bikaner

Centre Incharge Dr. P S Shekhawat presented the progress report and following suggestions were given for the centre:

- As Bikaner centre lies in A₁ zone, emphasis was laid on development of material and technologies for A₁ zone for which centre was suggested to start developing seed parental lines (A/B pairs).

- The local landraces and germplasm collected should be characterized. A small set of same should be contributed to PC Unit for maintenance.
- A mapping population should be developed by the centre for drought tolerance.
- The technologies developed must be documented.

RVSKVV, Gwalior

Dr. M.K. Tripathi presented the progress of the centre and the following suggestions were given:

- The performance of the centre was very poor. Not even a single entry was contributed by this centre except mere conducting coordinated trials. The PC was unhappy and advised the centre to improve or else the centre will be removed in next EFC.

PC Unit, Mandor, Jodhpur

- Dr. Vikas Khandelewal presented the progress report and the suggestions given for the centre are as follows:
- The centre was advised to develop mapping population for drought and screening for drought tolerance.
- Being the coordinated unit, the centre was advised to maintain collection of parental lines and germplasm received from different centres and maintain documentation.

CCS HAU, Hisar

Dr. Dev Vrat Yadav presented the progress report and the centre was appreciated for the performance. However, the following suggestions were given by the Project Coordinator for the centre:

- Few grams of seed of MS lines (A/B pairs) should be spared and sent to the PC Unit, Jodhpur to form a National Repository of pearl millet parental lines.
- The available germplasm from the centre should be characterized and catalogued.
- The various technologies developed by the centre must be documented and the information must be sent to PC Unit, Jodhpur.
- A mapping population should be developed for blast.
- Basic Biochemistry research done at the centre should also be presented during the centre wise presentation.
- Information on variation of blast pathogen isolates of Haryana must be recorded and the report should be sent to Dr. Chandra Nayaka, Pathologist, University of Mysore.

PAU, Ludhiana

- Dr. Ruchika Bhardwaj presented the progress report and the following suggestions were given by the Project Coordinator for the centre:
- Seed of MS lines must be collected, documented and few grains of seed should be sent to the PC Unit, Jodhpur for National repository.

- Possibility of fodder quality of advanced entries must be explored with NIN, Hyderabad.
- The available germplasm from the centre should be characterized and catalogued.
- A mapping population should be developed for blast.
- The various technologies developed by the centre must be documented and the information must be sent to PC Unit, Jodhpur.

JAU, Jamnagar

Centre incharge Dr. K.D. Mungra presented the progress report and the Project Coordinator appreciated the team work of the centre and suggested following points for further improvement:

- It was pointed out that the data recorded for physiological experiment was not up to the mark and it should be noted and taken into consideration for future.
- The various technologies developed by the centre must be documented and the information must be sent to PC Unit, Jodhpur.
- Few grams of seed of MS lines (A/B pairs) should be spared and sent to the PC Unit, Jodhpur to form a National Repository of pearl millet parental lines.
- The centre should contact and discuss with NCIPM, New Delhi related to IPM modules to implement and use their well developed modules and methodology in pearl millet program for entomology and pathology research programs.
- A mapping population should be developed for downy mildew.

NARP, Aurangabad

Dr. SB Panwar presented the progress report and the centre was appreciated for the progress and the suggestions given are as follows:

- It was suggested that they should strengthen their own breeding programme and must not depend on ICRISAT's material.
- A regular breeder must be appointed at the centre to perform and take activities of the program at the centre.
- The available germplasm from the centre should be characterized and catalogued.
- Seed of MS lines must be collected, documented and few grains of seed should be sent to the PC Unit, Jodhpur for National repository.
- The various technologies developed by the centre must be documented and the information must be sent to PC Unit, Jodhpur.

MPKV, Dhule

Dr. H T Patil presented the progress report and the centre was appreciated for the progress and following suggestions were given:

- Few grams of seed of MS lines (A/B pairs) should be spared and sent to the PC Unit, Jodhpur to form a National Repository of pearl millet parental lines.

- The available germplasm from the centre should be characterized and catalogued.
- The various technologies developed by the centre must be documented and the information must be sent to PC Unit, Jodhpur.
- A mapping population should be developed for blast.

UOM, Mysore

Dr. Chandra Nayaka presented the progress report and the suggestions given are as follows:

- Various isolates of downy mildew and blast pathogens must be collected from the different centres and characterized.
- The names of infector rows along with disease incidence should be reported in the experiment.

TNAU, Coimbatore

Dr. K Iyanaar presented the progress report and the following suggestions were given for the centre:

- Few grams of seed of MS lines (A/B pairs) should be spared and sent to the PC Unit, Jodhpur to form a National Repository of pearl millet parental lines
- A mapping population should be developed for downy mildew.

ANGRAU, Ananthapuramu

The progress report was presented by Dr. R. Narasimuhulu and the suggestions given are as follows:

- The centre should focus more on breeding trials and must increase the number of entries submitted for coordinated trials.
- A mapping population should be developed for downy mildew.

UAS, Vijayapur

Dr. B.K. Athoni presented the progress report and the following suggestions were given for the centre:

- The available germplasm from the centre should be characterized and catalogued.
- Seed of MS lines must be collected, documented and few grains seed should be sent to the PC Unit, Jodhpur for National repository.
- The various technologies developed by the centre must be documented and the information must be sent to PC Unit, Jodhpur.

Further, the following points were suggested by the Project Coordinator for all the centers:

- All centers must collect the available germplasm and characterize it and submit the material for proper documentation to PC Unit, Jodhpur.

- All the centres were suggested to spare few grams of seed of MS lines (A/B pairs) and sent to the PC Unit, Jodhpur to form a National Repository of pearl millet parental lines. In addition, Bikaner centre was suggested to start developing seed parental lines (A/B pairs) suitable for A₁ zone.
- The various technologies developed by the centers including state releases must be documented and the information must be sent to PC Unit, Jodhpur.
- Data should be recorded in proper way as there were many discrepancies in Pathology report. Hence, a committee has been constituted to discuss and resolve the issue.
- Entomology and Pathology groups can contact and discuss with NCIPM, New Delhi to implement and use their well developed modules and methodology in pearl millet IPM modules.
- **Mapping population development for different centres of ICAR-AICRP on Pearl millet centres as given in table:**

| Name of centre | Mapping population |
|-----------------------|--|
| RARI, Durgapura | Mapping population for downy mildew |
| SKRAU, Bikaner | Mapping population for drought tolerance |
| PC Unit, Jodhpur | Mapping population for drought tolerance |
| CCS HAU, Hisar | Mapping population for blast |
| PAU, Ludhiana | Mapping population for blast |
| JAU, Jamnagar | Mapping population for downy mildew |
| MPKV, Dhule | Mapping population for blast |
| TNAU, Coimbatore | Mapping population for downy mildew |
| ANGRAU, Ananthapuramu | Mapping population for downy mildew |

PROCEEDINGS OF ONLINE PORTAL (ZOOM) MEETING OF THE COMMITTEE CONSTITUTED BY THE PROJECT COORDINATOR- PEARL MILLET TO DISCUSS THE PROTOCOL AND SOP FOR TAKING OBSERVATION AND ANALYSIS OF DATA FOR PEARL MILLET DISEASES FOR KHARIF, 2020

Date: 15-5-2020

Time: 11:30 AM

The meeting under the leadership of Dr. H. Shekar Shetty, Chairman of the committee, was held on May, 15, 2020 through Zoom portal to discuss the protocol and SoP for taking observation and analysis of disease data for downy mildew, blast, rust, smut, and ergot for Kharif, 2020.

The committee with 07 members 1. Dr. H Shekar Shetty 2. Dr. Chandra Nayak, PI, Plant Pathology 3. Dr. I.K. Das, IIMR, Hyderabad, 4. Dr. Rajan Sharma, Cereal Pathologist, ICRISAT 5. Dr. Vikas Khandelwal, PI, Plant Breeding, Mandore 6. Dr. L. D. Sharma, Breeder, SKNAU, Durgapura and 7. Dr. R.K. Solanki, Breeder, CAZRI met on 15th May at 11:30 AM through Zoom meeting and all the members were present.

Dr. Chandra Nayak, Principal Investigator and Convener of the meeting welcomed the members and briefed the mandate for the meeting. Dr. H. Shekar Shetty also briefed on the purpose of meeting as necessitated by certain issues raised by the breeders on the disease data observed for the year 2019. He explained that pathotypes issue in the downy mildew pathogen is already well established and in the present situation the data of the pathological trials is not affected by the occurrence of new pathotypes of the downy mildew pathogen.

Screening system of disease of the breeders test materials such as initial hybrids, advanced hybrids, released hybrids and varieties are already well standardized based on the spreader row or Infector row system and checks. At this stage, there is no need for changing the procedures as there is no scientific evidence based difficulties for pathologists or breeders.

The tolerance level fixed for identification for promotion and also for release found to be working well for the breeders materials and the existing system has prevented the recurrence of downy mildew epidemics or breakdown of resistance in any hybrids or varieties in the recent years. At present important issue is to ensure uniformity of the data between the different pathology centers and to avoid any variation in the test result.

In most of the pathology centre following the screening procedures by following the existing experimental design, which ensures sufficient inoculum pressure in the infector rows, test entries and indicator plants, with the minimum required plant population for data recording and analyses.

Dr. R.K. Solanki, plant breeder presented some of the issues connected with the breeders in assessing their hybrids and varieties to downy mildew reaction. All the points raised by him were discussed in detail. All the other members interacted on the different issues raised by breeders. After the discussion with pathologists, the breeders agreed to that

for recording downy mildew and other disease, follow the existing system of disease scoring for the year 2020.

The pathologists ensured the breeders that uniform experimental procedures will be followed; required number of plant population between 35-40 in each replication will be maintained at 4m length. The monitoring team as constituted by the Project coordinator which includes 02 pathologists with breeders for A, A₁ and B, zone centres. The team will visit the centres and can critically observe for experimental layout, disease reaction and send the report to the project coordinator immediately with the proper format. Each centre breeders are also encouraged to visit and give their expert opinion to the different centre pathologists. Any noticeable discrepancies in the experimental design, statistically analyses, disease scoring/reaction are to be discussed in the workshop and settle the matter where all the stakeholders are present.

Finally the committee resolved that there is no basis for re-validation of the mandore centre pathology data at this stage. There is no evidence to show that mandore centre sick plot is having different pathotype than the rest of the centres.

Data recording to be continued based on the existing system and minimum plant population needs to be 35-40 per replication as practiced all these years.

The criteria for the disease reaction and evaluation for acceptability of new genotypes for promoting are, finalized for the year 2020-2021.

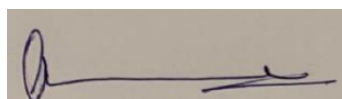
Downy mildew: Up to 5% downy mildew mean disease incidence percentage under sick plot condition with the spreader rows system and ensured minimum 70% downy mildew disease incidence in the spreader row and checks must be considered for varietal promotion.

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

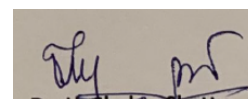
Ergot: Up to 20% ergot severity under artificial inoculation must be considered for varietal promotion.

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 i.e., varietal promotion under the category of blast resistant screening procedure in the field using infector rows and indicator rows system.

Rust: The group recommended to have the observations of rust disease during hard dough stage and genotypes having rust under natural condition **up to 20%** can be considered for promotion.



Dr. Chandra Nayaka
Principal Investigator-Pathology



Dr. H. Shekar Shetty
Chairman of the committee

**PROCEEDINGS OF THE VARIETAL IDENTIFICATION COMMITTEE MEETING
(VIRTUAL) HELD ON 23RD MAY, 2020 HOSTED BY ICAR-INDIAN INSTITUTE OF
MILLETS RESEARCH, HYDERABAD**

The Varietal Identification Committee meeting (virtual) for Sorghum, Small Millets and Pearl Millet was hosted by Indian Institute of Millets Research, Hyderabad on 23rd May, 2020. The following members were present:

| S.No. | Particulars | Proposed Name | Position |
|-------|--|--|-------------------------|
| 1 | Deputy Director General (CS) | Dr. TR Sharma, Deputy Director General (CS) (ddgcs.icar@nic.in) | Chairman |
| 2 | Assistant Director General (F&FC) | Dr. YP Singh, Assistant Director General (FFC) (ypsingh1777@gmail.com) (adgffc.icar@nic.in) | Member |
| 3 | Assistant Director General (Seeds) | Dr. DK Yadav, Assistant Director General (Seeds) (adgseed.icar@gmail.com) | Member |
| 4 | Project Director (IISS, Mau) | Dr. DK Agarwal, Director, IISS (director.seed@icar.gov.in) | Member |
| 5 | Director of Research of host University / SAU | Dr. R Jagdeeshwar, Director of Research, PJTSAU, Hyderabad (dr.pjtsau@gmail.com) | Member |
| 6 | One Representative of seed organization (NSC, SSC) | Dr. Sudhakar, Regional Manager, NSC, Secunderabad (rm.secunderabad@indiaseeds.com) | Member |
| 7 | Representative of crop-based processing / manufacturing industry | Dr. CS Jadhav, CEO, Innerbeing Private Limited, Hyderabad (jadhav@innerbeing.com) | Member |
| 8 | One representative of the private seed agency | Dr. SM Rafiq, General Manager, Nuziveedu Seeds Private Limited, Hyderabad (smrafiq123@gmail.com) | Members |
| 9 | Two eminent scientists | Dr. Prabhakar, Former Project Coordinator (Small Millets) (prabhakar34@rediffmail.com) | |
| | | Dr. Jayaram Gowda, Principal Scientist (smallmillets@gmail.com) | Member |
| | Principal Investigators / Resource persons | SORGHUM | |
| | | Dr. C Aruna | Plant Breeding - Kharif |
| | | Dr. R Madhusudhana | Plant Breeding - Rabi |
| | | Dr. SS Rao | Physiology |
| | | Dr. B Gangaiah | Agronomy |
| | | Dr. G Shyam Prasad | Entomology |
| | | Dr. IK Das | Pathology |
| | | Dr. AV Umakanth | Sweet sorghum |
| | | Dr. B Venkatesh Bhat | Forage sorghum |
| | | SMALL MILLETS | |
| | | Dr. A Nirmala Kumari | Plant Breeding |
| | | Dr. TS Sukanya | Agronomy |
| | | Dr. Palanna | Pathology |
| | | Dr. Prabhu C Ganiger | Entomology |

| S.No. | Particulars | Proposed Name | Position |
|-------|---|-----------------------|------------------|
| | | PEARL MILLET | |
| | | Dr. Vikas Khandelwal | Plant Breeding |
| | | Dr. Anil Kumar Yadav | Agronomy |
| | | Dr. Chandra Nayak | Pathology |
| | | Dr. Raj Kumar Juneja | Entomology |
| 11 | Project Coordinator (Sorghum & Small Millets) | Dr. VA Tonapi | Member Secretary |
| 12 | Project Coordinator (Pearl Millet) | Dr. C Tara Satyawathi | |

A total of 15 proposals were received. A proposal of entry KMV 542 of kodo millet that was not approved by the VIC during 2019 was again not considered since the new data did not indicate any superiority of the entry over check variety. A proposal for entry LMV 523 of little millet was not considered as it was inferior in grain yield to other two proposals LMV 514 and LMV 518 and had 17.46% less fodder yield than the check. The committee critically examined the remaining 13 proposals of Sorghum, Small Millets and Pearl Millet for different zones consisting of the following:

SORGHUM (7): 2 - Kharif sorghum hybrids; 2 - Kharif sorghum varieties; 1 - Single-cut forage sorghum hybrid and 2 - Multi-cut forage sorghum hybrid;

SMALL MILLETS (5): 2 - Finger millet varieties; 2 - Little millet varieties & 1 - Kodo millet variety.

PEARL MILLET (1): 1 - Dual purpose pearl millet hybrid.

The VIC after considerable deliberations made the following recommendations.

SORGHUM

| S. No | Tested Number | Variety description | Centre / Company Proposed | Regions proposed for identification | Recommendations of the committee |
|-------|---------------------|------------------------|---------------------------|---|---|
| 1 | SPH 1883 | Kharif sorghum hybrid | UAS, Dharwad | Karnataka, Andhra Pradesh, Madhya Pradesh & Gujarat | This hybrid has better grain yield (8.3%) and fodder yield on par with the national checks. It is on par with the check for major pest and disease resistance. Because of its shorter height, it may be suitable for mechanical harvesting. The grain and stover quality were on par when compared with national checks. Therefore, this hybrid is identified for release. |
| 2 | SPH 1886 (AKSH 745) | Kharif sorghum hybrid | PDKV, Akola | Maharashtra | This hybrid was proposed for only one state, hence, this hybrid is not identified . Its performance in other states may be checked and the proposal may be submitted again if it is good in more states. |
| 3 | SPV 2504 | Kharif sorghum variety | PDKV, Akola | Maharashtra | This hybrid was proposed for only one state, hence, this hybrid is not identified . Its performance in other states may be checked and the proposal may be submitted again if it is good in more states. |

| S. No | Tested Number | Variety description | Centre / Company Proposed | Regions proposed for identification | Recommendations of the committee |
|-------|-----------------------|------------------------|----------------------------------|-------------------------------------|---|
| 4 | SPV 2510 | Kharif sorghum variety | MPUA&T, Udaipur | All India | This variety is having only marginal superiority for grain yield over checks. There is no superiority for other traits. Hence, this variety is not identified . |
| 5 | SPH 1881 (UTMCH 1319) | Forage sorghum hybrid | GBPUA&T, Pantnagar | All India | This hybrid has better green fodder yield (5.29%) and dry fodder yield (10.82%) over the national checks. This hybrid is based on A2 cytoplasm. It is on par with the checks for major pests and diseases, agronomic practices, protein digestibility and for fodder quality when compared with national checks. Therefore, this hybrid is identified for release. |
| 6 | SPH 1879 (PSC 10) | Forage sorghum hybrid | PAU, Ludhiana | Zone I | This hybrid, though was better than check for dry fodder yield (10.04%) in North Zone, was inferior for green fodder yield (-6.87%) over the check. Therefore, this hybrid is not identified for release. |
| 7 | SPH 1890 (ADV 6681) | Forage sorghum hybrid | UPL Limited (Advanta), Hyderabad | All India | This single-cut hybrid showed superiority for dry fodder yield (5.43%) and green fodder yield (4.77%) over the national checks. It is found to be responding to agronomic practices and on par for major pests and diseases, and for fodder quality, when compared with check. Therefore, this hybrid is identified for release. |

SMALL MILLETS

| S. No | Tested Number | Variety description | Centre / Company Proposed | Regions proposed for identification | Recommendations of the committee |
|-------|--------------------|-----------------------|-----------------------------|--|---|
| 1 | FMV 1116 (VR 1101) | Finger millet variety | ANAGRAU, ARS, Vijayanagaram | Andhra Pradesh, Tamil Nadu, Karnataka, Puducherry & Odisha | This variety has better grain yield (7.39%) and fodder yield (4.0%) when compared with the national checks. It has given good response to crop management and had fewer incidences of banded blight and blast diseases but totally on par for major pests and diseases. Therefore, this variety is identified for release. |
| 2 | WN 559 (FMV 1118) | Finger millet variety | NAU, Navsari | Andhra Pradesh, Chattisgarh, Gujarat, Maharashtra & Odisha | This variety has better grain yield (7.85%) and fodder yield (8.81%) when compared with the national checks. It has given good response to crop management and is on par for major pests and diseases. Therefore, this variety is identified for release. |
| 3 | OLM 217 (Santala) | Little millet variety | Berhampur, Odisha | Odisha, Jharkhand, Madhya | This variety has better grain yield (6.2%) but less fodder yield (-6.22%) when compared with the national checks. It has given good |

| S. No | Tested Number | Variety description | Centre / Company Proposed | Regions proposed for identification | Recommendations of the committee |
|-------|-------------------------|-----------------------|---------------------------|--|---|
| | (IC 573423) | | | Pradesh, Tamil Nadu, Gujarat & Maharashtra | response to crop management and is on par for major pests and diseases. Since, comparable better varieties are available, this variety is not identified for release. |
| 4 | LMV 518 (JAICAR Sama 1) | Little millet variety | IIMR, Hyderabad | Maharashtra, Andhra Pradesh, Telangana, Tamil Nadu & Puducherry | This medium-duration variety has better grain yield (12.40%) and fodder yield (4.30%) when compared with the national checks. It has given good response to crop management and is on par for major pests and diseases. Hence, this variety is identified for release. |
| 5 | KMV 545 | Kodo millet variety | TNAU, Athiyandal | Andhra Pradesh, Chattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Tamil Nadu & Telangana | This variety has better grain yield (16.3%) and fodder yield (17.8%) when compared with the national checks. It has given good response to crop management and is on par for major pests and diseases. Therefore, this hybrid is identified for release. |

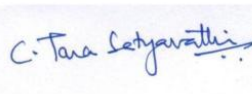
PEARL MILLET

| S. No | Tested Number | Variety description | Centre / Company Proposed | Regions proposed for identification | Recommendations of the committee |
|-------|-------------------|---------------------|---------------------------------|---|---|
| 1 | MSH 346 (MP 7366) | Pearl millet hybrid | Rallis India Limited, Bengaluru | Rajasthan, Gujarat, Uttar Pradesh, Maharashtra & Tamil Nadu | This hybrid has superiority for grain yield (6.4%) over check and on par for fodder yield over the national checks. It is found to be on par for major pests and diseases when compared with national checks. Therefore, this hybrid is identified for release for summer cultivation. |

It was emphasized by the Chairman that in future more attention should be given for developing disease and insect -pest resistant varieties for which breeding strategies have to be designed carefully. Meeting ended with a vote of the thanks to the chair.



(VA Tonapi)
Project Coordinator
(Sorghum & Small Millets)
IIMR, Hyderabad



(C Tara Satyavathi)
Project Coordinator
(Pearl Millet)
AICRP on Pearl Millet, Jodhpur



(TR Sharma)
Deputy Director General
(Crop Science)
ICAR, New Delhi

SESSION-II**PLAN OF WORK-2020-21****CROP IMPROVEMENT (PLANT BREEDING)**

| | | | |
|-----------------|---|--------------------|---|
| Chairman | : Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi | Co-Chairman | : Dr. Yashpal Singh ADG(FFC), ICAR, New Delhi Dr. Vilas A Tonapi, Director, ICAR-IIMR, Hyderabad |
| | | Rapporteur | : Dr. P.S. Shekhawat Director of Research, SKRAU, Bikaner Dr. S. P. Singh Principal Scientist, Division of Genetics, ICAR-IARI, New Delhi |
| Date | : 29. 04.2020 | Time | : 11.10 am to 11.35 am |

**FORMULATION OF TECHNICAL PROGRAMME FOR 2020-2021
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-60 DAS) 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-60 DAS) 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 for the characters:

Hybrid and Population Trials

Entries promoted to next higher stage of testing in kharif/summer 2020 Zone A₁ 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 2474 | 1 | MH 2512 |
| | | 2 | MH 2517 |
| | PT A to AHPT I (E) | 3 | MH 2520 |
| | Nil | 4 | MH 2522 |
| | | | |
| | AHPT I (E) to AHPT II (E) | | AHT I (L) A to AHT II (L) A |
| | Nil | 5 | MH 2423 |
| | Checks | 6 | MH 2439 |
| 2 | HHB 67 (Imp.) | | Checks |
| 3 | RHB 177 | 7 | 86M86 |
| 4 | HHB 272 | 8 | KBH 108 |
| 5 | MPMH 21 | 9 | MP-7792 |
| 6 | RHB 223 | | |
| | | | |
| 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 |
| 1 | MH 2480 | 1 | MP 596 |
| 2 | MH 2481 | | PT I A to PT II A |
| | | | Nil |
| | AHT I (M) A to AHT II (M) A | | + New entries of PT |
| | Nil | | Checks |
| | Checks | 2 | Raj 171 |
| 3 | MPMH 17 | 3 | Pusa Comp. 383 |
| 4 | 86M01 | 4 | JBV 2 |
| 5 | PB 1705 | 5 | Pusa Comp. 701 |
| | | 6 | Dhanshakti |
| | | 7 | ICMV 221 |
| | | | |
| S. No. | Essentially Derived Varietal Trial (EDV) | | |
| | Retesting of EDV entries (MH 2543, MH 2544, MH 2545, MH 2546, MH 2547) | | |
| | Checks | | |
| 1 | HHB 67 (Imp.) | | |
| 2 | RHB 177 | | |

Entries promoted to next higher stage of testing in kharif/summer 2020 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 | | Nil |
| | | | |
| | | | AHT I (L) B to AHT II (L) B |
| | AHT I (M) B to AHT II (M) B | | Nil |
| | Nil | | Checks |
| | Checks | 1 | 86M86 |
| 1 | Pratap | 2 | Kaveri Super Boss |
| 2 | NBH 5767 | 3 | NBH 5061 |
| 3 | 86M01 | 4 | NBH 4903 |
| | | | |
| S. No. | Summer Hybrid Trial (SHT) | S. No. | Population Trial Zone B (PT B) |
| | SHT to SHT I | | PT B to PT I B |
| 1 | MSH 361 | | Nil |
| 2 | MSH 363 | | PT I B to PT II B |
| 3 | MSH 364 | | Nil |
| | SHT I to SHT II | | + New entries of PT |
| 4 | MSH 353 | | Checks |
| | | 1 | Raj 171 |
| | + New entries | 2 | ICMV 221 |
| | Checks | 3 | Dhanshakti |
| 5 | 86M64 | 4 | ICMV 155 |
| 6 | Proagro 9444 | 5 | Pusa Comp. 612 |
| 7 | Nandi 75 | 6 | ABV 04 |
| | | | |

Table I.1 Details of Centres and Trials Conducted During Kharif 2020/Summer 2021 in Zone A₁ and A

| LOCATIONS | IHT (E) | IHT (M) | IHT (L) | AHPT (E) | AHT (M) | AHT (L) | EDV | PT | RHVT | SHT |
|--|------------|------------|------------|-------------|------------|------------|----------|----------|----------|----------|
| ZONE A₁ | | | | | | | | | | |
| RAJASTHAN | | | | | | | | | | |
| Mandor (ICAR-AICRP) | * | * | | * | * | | * | | | * |
| Mandor (ARS, AU Jodhpur) | | | | | | | | * | * | |
| Jodhpur (ICAR-CAZRI) | * | | | * | | | * | | | |
| Bikaner (SKRAU) | * | * | | * | * | | * | * | * | |
| Fathehpur Shekhawati (SKNAU) | * | | | * | | | | | | |
| Samdari (AUJ) | * | | | * | | | * | | | |
| ARS, Jalore (AUJ) | * | | | * | | | * | | | |
| Nagaur (AU, Jodhpur) | * | | | * | | | * | | | |
| GUJARAT | | | | | | | | | | |
| Kothara (SDAU) | * | * | | * | * | | * | | | |
| HARYANA | | | | | | | | | | |
| Bawal (CCSHAU) | * | * | | * | * | | * | | | |
| Total Trials Zone A₁ | 9 | 4 | 0 | 9 | 4 | 0 | 8 | 2 | 2 | 1 |
| ZONE A | | | | | | | | | | |
| RAJASTHAN | | | | | | | | | | |
| Jaipur (SKNAU) | | * | * | | * | * | * | * | * | |
| Jaipur (Seed works International) | | | * | | | | | | | |
| Tabiji (SKNAU) | | * | | | * | | | | | |
| Alwar (Corteve) | | * | * | | * | * | | | | |
| Dausa (Rasi Seeds) | | * | * | | | | | | | |
| GUJARAT | | | | | | | | | | |
| Talaja (JAU) | | * | | | * | | | | | |
| Anand (AAU) | | * | * | | * | * | | | | * |
| Jamnagar (JAU) | | * | * | | * | * | * | * | * | * |
| S.K.Nagar (SDAU) | * | * | | * | * | | | | * | * |
| Ahmedabad (Nandi) | | | * | | | * | | | | * |
| Dhanera (J K Seed) | | * | | | * | | | | | * |
| Dehgam (Metahelix) | | * | | | * | | | | | * |
| Dehgam (Kaveri Seeds) | | | * | | | * | | | | |
| Deesa (J K Seed) | | | | | | | | | | * |
| UTTAR PRADESH | | | | | | | | | | |
| Jhansi (RLBCAU) | | * | | | | | | * | * | |
| Eglas (Bioseeds) | | | * | | | | | | | |
| Aligarh (Hytech) | | | | | | * | | | | |
| Hathras (Ganga Kaveri) | | * | | | | | | | | |
| Agra (Kartik Bio Seeds) | | * | * | | | | | | | * |
| HARYANA | | | | | | | | | | |
| Hisar (CCS,HAU) | | * | * | | * | * | | * | * | |
| Gurugram (Tierra agrotech) | | * | * | | | | | * | | |
| MADHYA PRADESH | | | | | | | | | | |
| Gwalior (RVSKVV) | | * | * | | * | * | * | * | * | |
| Morena (RVSKVV) | | | | | * | | | * | | |
| PUNJAB | | | | | | | | | | |
| Ludhiana (PAU) | | * | * | | * | * | | * | | * |
| DELHI | | | | | | | | | | |
| New Delhi (ICAR-IARI) | | * | | | * | | * | * | | |
| JHARKHAND | | | | | | | | | | |
| Ranchi (BAU) | | | | | | | | | * | |
| JAMMU & KASHMIR | | | | | | | | | | |
| Jammu (SKUAST) | | | | | | | | | * | |
| Total Trials Zone A | 1 | 18 | 14 | 1 | 14 | 10 | 4 | 9 | 8 | 8 |

Table I.1 Details of Centres and Trials Conducted During Kharif 2020/Summer 2021 in Zone B

| LOCATIONS | IHT (M) | IHT (L) | AHT (M) | AHT (L) | PT | RHVT | SHT |
|---------------------------------|-----------|-----------|---------------------|---------------------|-----------|----------|----------|
| MAHARASHTRA | | | No Entry | No Entry | | | |
| Aurangabad (NARP) | * | * | | | * | * | * |
| Aurangabad (Crystal Crop Prot.) | | * | | | | | |
| Aurangabad (Seed Works) | | * | | | | | |
| Niphad (MPKV) | | | | | * | | |
| Dhule (MPKV) | * | * | | | * | * | * |
| Jalna (Mahyco) | | | | | | | * |
| Jalna (KrishidhanGhanewadi) | | * | | | | | |
| Buldana (Dr. PDKV) | | * | | | | | |
| KARNATAKA | | | | | | | |
| Vijayapur (UAS Dharwad) | * | * | | | * | * | |
| Malnoor (UAS, Raichur) | * | | | | * | * | |
| Dharwad (KSSC Ltd) | * | | | | | | |
| ANDHRA PRADESH | | | | | | | |
| Ananthapuram (ANGRAU) | * | * | | | * | * | |
| Perumallapalle (ANGRAU) | * | | | | * | | |
| Vizianagaram (ANGRAU) | | | | | * | * | |
| TELANGANA | | | | | | | |
| Palem (PJ TSAU) | * | | | | * | * | * |
| Hyderabad (Nuziveedu) | | * | | | | | |
| Medchal (Ganga Kaveri) | * | | | | | | |
| TAMIL NADU | | | | | | | |
| Coimbatore (TNAU) | * | * | | | * | * | * |
| ODISHA | | | | | | | |
| Semiliguda (OUAT) | * | | | | * | * | |
| Total Trials Zone B | 11 | 10 | 0 | 0 | 11 | 9 | 5 |

Observations to be recorded in initial and advanced trials:

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

New entries for testing in initial trial Kharif 2020/Summer 2021

| S. No. | Organization/Institution | Name of Entries | | | | |
|--------|--|-----------------|------------|------------|----------------|---------------|
| | | IHT (E) | IHT (M) | IHT (L) | PT | Summer |
| 1. | ICAR-AICRP on PM, JAU, | GHB 1294 | GHB 1286 | | | GHB 1282 |
| | | GHB 1314 | GHB 1315 | | | GHB 1286 |
| | | | | | | GHB 1288 |
| 2. | NARP, Aurangabad | | AHB-1530 | | | |
| | | | AHB-1540 | | | |
| 3. | ICAR-IARI New Delhi | | Pusa 2001 | | Pusa Comp. 723 | |
| | | | Pusa 2002 | | Pusa Comp. 724 | |
| | | | | | Pusa Comp. 725 | |
| 4. | ICAR-AICRP on PM, TNAU, Coimbatore | | TNBH 1619 | | | TNBH 1619 |
| 5. | CCI, SDAU, SK Nagar | | | GDHB 15 | | GDHB 17 |
| 6. | ICAR-AICRP, PC Unit, Mandor | MPMH 42 | | | | |
| 7. | ICAR-AICRP, RARI, SKNAU, Jaipur | RHB-270 | | | | |
| 8. | ICAR-AICRP on PM, RVSKVV, Gwalior | RVBH18-37 | | | | |
| | | RVBH18-39 | | | | |
| 9. | ICAR-AICRP on PM, PAU Ludhiana | | | PHB 3283 | GBL 3 | |
| | | | | | GBL 4 | |
| 10. | RARS, Vijayapur | | | VPMH-14 | VPMV-10 | |
| | | | | | VPMV-11 | |
| 11. | ICAR-IIMR, Hyderabad | IIMR HB3 | IIMR HB4 | | | |
| 12. | ARS, Malnoor | | | | RCB-102 | |
| | | | | | RCB-103 | |
| 13. | Seed Works PVT. LTD. Hyderabad | | | US7711 | | |
| | | | | US7775 | | |
| 14. | Hi-Yield Agrigenetics Pvt. Ltd. | | | HYMH 4046 | | HYMH 4069 |
| 15. | Nuziveedu Seed Pvt. Ltd., Secunderabad | | NBH 5980 | NBH 5930 | | |
| 16. | Kaveri Seed Com. Ltd., Secunderabad | | KPH6155 | KPH6288 | | KPH6310 |
| | | | | | | KPH6320 |
| 17. | Nu Genes Pvt. Ltd., Hyderabad | | | | | NU 435 |
| 18. | Bayer Bio Science Pvt. Ltd., Hyderabad | | | | | PB1907 |
| | | | | | | PB1921 |
| 19. | Corteva Agriscience, Hyderabad | | 86M93 | 86M98 | | 86M23 |
| | | | | 86M93 | | |
| 20. | Ganga Kaveri Seeds Pvt. Ltd | | GK 1225 | | | |
| 21. | Hytech Seed India Pvt. Ltd., Hyderabad | | | HBH 190057 | | |
| | | | | HBH 191294 | | |
| 22. | Maharashtra state seeds corp. Ltd, Akola | | | | | Mahabeej-1005 |
| 23. | JK Agri Genetics Ltd, Hyderabad | | | JKBH1792 | | JKBH1416 |
| 24. | Mahindra Agri Solutions Ltd., Telangana | | | MB 1040 | | |
| 25. | Shakti Vardhak Hybrid Seeds Pvt. Ltd., Hisar | | | | | SVPMH-116 |
| 26. | KSSC, Karnataka | | BRBH-17088 | | | |

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 : 07 | PT A & B Zone : 09 |
| IHT (M) A & B Zone : 13 | Summer 2021: 15 |
| IHT (L) A & B Zone : 14 | EDV (A ₁) : 05 |

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 |
| RHB 223: 5.0 Kg | | | |

*Nandi 72- Not Germinated During Summer-2019

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 2020 for kharif and by 15th January 2021 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.

**REVIEW OF RESEARCH RESULTS, PROGRESS REPORT OF CRP ON
BIOFORTIFICATION AND ICAR-ICRISAT COLLABORATIVE PROJECTS
2019-20 AND PLAN OF WORK 2020-21**

Chairman : Dr. T. R. Sharma,
DDG (CS),
ICAR, New Delhi

Co-Chairman : Dr. Yashpal Singh
ADG (FFC), ICAR, New
Delhi

Dr. Vilas A Tonapi,
Director, ICAR-IIMR,
Hyderabad

Rapporteur : Dr. P.S. Shekhawat
Director of Research,
SKRAU, Bikaner

Dr. S. P. Singh
Principal Scientist,
Division of Genetics,
ICAR-IARI, New Delhi

Date : 29. 04.2020

Time : 11.10 am to 11.35 am

The session was held under the Chairmanship of Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi and Co-chairs by Dr. Y.P. Singh, ADG (FFC) and Dr. Vilas A Tonapi, Director, ICAR-IIMR, Hyderabad.

The progress made under ICAR-ICRISAT partnership projects and CRP-Biofortification Projects during 2019-20 was presented by Dr. Vikas Khandelwal. He briefed the house about the six trials and nurseries that were a part of this project.

Dr. S.K. Gupta was presented the work plan for the year 2020-21 and the following trials were finalized.

| Sl. No. | Name of the Trial/Breeding nursery | No of Entries | Plot Size | Locations |
|----------------------------------|------------------------------------|---------------|----------------|---|
| Trials/Nursery Rainy 2020 | | | | |
| 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, Jodhpur |
| 3. | Drought tolerant Restorer nursery | 40 | 1 rows x 2 reps | 1. AICRP, SKRAU, Bikaner 2. RARI Durgapura 3. CAZRI, Jodhpur 4. CCS HAU, Hisar 5. PC Unit, Jodhpur |
| 4. | Elite Joint Bio-fortification Trial (coordinated by AICRP on Pearl millet) | 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, Jodhpur |
| 5. | Blast resistance trial | 350 | 2 rows x 2 reps | 1. RRS, Bawal 2. RARI, Durgapura 3. PC Unit, Jodhpur 4. MPKV, Dhule |
| 6. | Heat tolerance trial | 350 | 2 rows x 2 reps | 1. PC Unit, Jodhpur 2. SKRAU, Bikaner |

The session ended with vote of thanks.

BREEDER SEED PRODUCTION (ACTION PLAN 2020-21)

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

Crop: Pearl millet

Year of Production: 2020

Year of supply: February 2021

| 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 | ANGRAU, Ananthapuram | ABV-04 (MP 552) | 0.25 | 0.25 |
| 2 | ICAR-IARI, New Delhi | Pusa Composite701 (MP 535) | 0.60 | 0.60 |
| 3 | ICAR-IARI, New Delhi | Pusa Composite612 (MP 480) | 0.25 | 0.25 |
| 4 | NARP, Aurangabad | ABPC4-3 (MP 484) | 0.77 | 0.77 |
| 5 | ICRISAT, Patancheru | Dhanshakti (ICTP 8203 Fe 10-2) | 3.09 | 3.09 |
| | Total | Total (A) | 4.96 | 4.96 |
| B. | Parental lines | | | |
| 1 | NARP, Aurangabad | AUBI 1105 (R line AHB 1269) | 0.01 | 0.01 |
| 2 | NARP, Aurangabad | AUBI 1101 (R line AHB 1200) | 0.03 | 0.03 |
| 3 | MPKV, Dhule | DHLB-8A (A line ADISHAKTI) | 0.03 | 0.03 |
| 4 | MPKV, Dhule | DHLB-8B (B line ADISHAKTI) | 0.02 | 0.02 |
| 5 | MPKV, Dhule | DHLBI-967 (R line ADISHAKTI) | 0.02 | 0.02 |
| 6 | ICRISAT, Patancheru | ICMA 93333 (A line MPMH 21) | 0.30 | 0.30 |
| 7 | ICRISAT, Patancheru | ICMB 93333 (B line MPMH 21) | 0.15 | 0.15 |
| 8 | ICRISAT, Patancheru | ICMA 04999 (A line MPMH 17) | 0.22 | 0.22 |
| 9 | ICRISAT, Patancheru | ICMB 04999 (B line MPMH 17) | 0.11 | 0.11 |
| 10 | ICRISAT, Patancheru | ICMA 843-22 (A line HHB 67 Imp) | 0.25 | 0.25 |
| 11 | ICRISAT, Patancheru | ICMB 843-22 (B line HHB 67 Imp) | 0.10 | 0.10 |
| 12 | ICRISAT, Patancheru | ICMA 02333 (A line RHB234) | 0.02 | 0.02 |
| 13 | ICRISAT, Patancheru | ICMB 02333 (B line RHB 234) | 0.01 | 0.01 |
| 14 | ICRISAT, Patancheru | ICMA 99444 (A line RHB233) | 0.02 | 0.02 |
| 15 | ICRISAT, Patancheru | ICMB 99444 (B line RHB233) | 0.01 | 0.01 |
| 16 | ICRISAT, Patancheru | ICMA 96666 (A line RHB223) | 0.10 | 0.10 |
| 17 | ICRISAT, Patancheru | ICMB 96666 (B line RHB 223) | 0.06 | 0.06 |
| 18 | ICRISAT, Patancheru | ICMA 98222 (A line AHB 1269 & AHB 1200) | 0.09 | 0.09 |
| 19 | ICRISAT, Patancheru | ICMB 98222 (B line AHB 1269 & AHB 1200) | 0.05 | 0.05 |
| 20 | ICRISAT, Patancheru | ICMA 04888 (A line HHB 299) | 0.07 | 0.07 |
| 21 | ICRISAT, Patancheru | ICMB 04888 (B line HHB 299) | 0.04 | 0.04 |
| 22 | ICAR-IARI, New Delhi | MS 411A (A line PUSA 1201) | 0.02 | 0.02 |
| 23 | ICAR-IARI, New Delhi | MS 411B (B line PUSA 1201) | 0.01 | 0.01 |
| 24 | ICAR-IARI, New Delhi | ICMR 07333 (R line PUSA 1201) | 0.01 | 0.01 |
| 25 | CCSHAU, Hisar | H 77/833-2-202 (R line HHB 67 Imp) | 0.05 | 0.05 |
| 26 | CCSHAU, Hisar | H 13/0001 (R line HHB 299) | 0.03 | 0.03 |
| 27 | SKNAU, Jaipur | RIB 3135-18 (R line RHB 223) | 0.04 | 0.04 |
| 28 | SKNAU, Jaipur | RIB 15177 (R line RHB 234) | 0.01 | 0.01 |
| 29 | SKNAU, Jaipur | RIB 15176 (R line RHB 233) | 0.01 | 0.01 |
| 30 | AU, Jodhpur | MIR 524 (R line MPMH 21) | 0.15 | 0.15 |
| 31 | AU, Jodhpur | MIR 525-2 (R line MPMH 17) | 0.11 | 0.11 |
| | | Total (B) | 2.15 | 2.15 |
| | | Total (A)+(B) | 7.11 | 7.11 |

PLAN OF WORK 2020-21 FOR PLANT PHYSIOLOGY

The technical program of plant physiology has been reformed as per suggestions of Dr. D.C. Uprety, Ex. Principal Scientist, Division of Plant Physiology, ICAR-IARI, New Delhi and PAMC Expert. He gave various suggestions for reformation of technical program. Two trials PMPHY 4 and PMPHY 5 should be dropped and a new trial should be formulated. hence, a new trial "PMPHY4 : Identification of physiological traits for drought tolerance in pearl mille" has been formulated instead of old trial PMPHY4-Varietal characterizations in pearl millet on the basis of root shoot traits.

PMPHY 1 : Screening of advance summer hybrids against heat stress

Objectives : Screening of advance summer hybrids to heat stress

Year of Commencement : 2014

Modified as per suggestion of the expert Dr. D.C. Uprety, Ex. Principal Scientist, Division of Plant Physiology, ICAR-IARI, New Delhi during 55th online AGM on 29th April, 2020.

Location : Jamnagar and Mandor

Season : Summer (Irrigated)

Entries : Advance summer hybrids

Design : RBD

Replication : Three

Spacing : 50 X 10 cm

Plot size : 4 Rows of 4 M length

Fertilizer : As per PoP

Observations:

1. Chlorophyll content at anthesis and 65 DAS
2. Relative water content (RWC) at anthesis and 65 DAS
3. Seed setting %
4. Panicle initiation
5. Days to 50% flowering
6. Grain yield (kg/ha)
7. Productive tillers/plant
8. Test weight (g) (1000 grains)
9. Threshing percentage (Panicle harvest Index)
10. Fodder yield (q/ha)
11. Harvest index (%)
12. Days to Maturity
13. Ear head weight (kg/ha)
14. Soil temperature ($^{\circ}\text{C}$)
15. Air Temperature ($^{\circ}\text{C}$)

PMPHY 2 : Characterization for heat stress tolerance in pearl millet genotypes

Objectives : To identify heat tolerant donor parents for hybrid and population development in pearl millet

Year of Commencement : 2014
Modified as per suggestion of the expert Dr. D.C. Uprety, Ex. Principal Scientist, Division of Plant Physiology, ICAR-IARI, New Delhi during 55th online AGM on 29th April, 2020.

Locations : Summer : Jamnagar and Mandor
Kharif : Jamnagar, Jaipur and Mandor

Conditions Summer : Irrigated
Kharif : Rainfed

Treatment : 20 inbred (R lines and B lines)

Design : RBD

Replication : Three

Spacing : 50 cm X 10 cm

Plot size : 4 Rows of 4 M length

Fertilizer : As per PoP

Observations:

1. Chlorophyll content at anthesis and 65 DAS
2. Relative water content (RWC) at anthesis and 65 DAS
3. Seed setting %
4. Panicle initiation
5. Days to 50% flowering
6. Grain yield (kg/ha)
7. Productive tillers/plant
8. Test weight (g) (1000 grains)
9. Threshing percentage (Panicle harvest Index)
10. Fodder yield (q/ha)
11. Harvest index (%)
12. Days to Maturity
13. Ear head weight (kg/ha)
14. Soil temperature (⁰C)
15. Air Temperature (⁰C)

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

Year of Commencement : 2019, As per the QRT, suggestions and Dr. C. Viswanathan, HoD, Division of Plant Physiology, ICAR-IARI, New Delhi during 54th AGM.

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 (cm)
2. Dry weight of stem (g)
3. Leaf dry weight (g)
4. Ear head weight (g)

At Physiological maturity

1. Plant height (Main stem)
2. Dry weight of stem (g)
3. Leaf dry weight (g)
4. Ear head weight (g)
5. Grain yield (g)
6. Panicle harvest index (PNHI)
7. Harvest index (HI)

PMPHY4: Identification of physiological traits for drought tolerance in pearl millet

Objectives : Find out drought tolerant traits in pearl millet

Year of Commencement : 2020

Modified as per suggestion of the expert Dr. D.C. Uprety, Ex. Principal Scientist, Division of Plant Physiology, ICAR-IARI, New Delhi during 55th online AGM on 29th April, 2020.

Location : Mandor, Jaipur and Jamnagar
Season : Field (*Kharif*)
Replication : Three
Design : RBD
Genotypes: (Released hybrids of A and A₁ zone of India)

Methodology:

Tag five similar plants, Biomass sampling at 30 DAS (Record Chlorophyll content, height of the plant, number of leaf, number of tillers, dry weight of stem, leaf & panicle separately of whole plant - five samples per treatment), Biomass sampling 45 DAS (Record Chlorophyll

content, height of the plant, number of leaf, number of tillers, dry weight of stem, leaf & panicle separately of whole plant - five samples per treatment), 60 DAS (Record Chlorophyll content, height of the plant, number of leaf, number of tillers, dry weight of stem, leaf & panicle separately of whole plant - five samples per treatment) and at maturity (Record Chlorophyll content, height of the plant, number of leaf, number of tillers, dry weight of stem, leaf & panicle, Grain yield separately of whole plant - five samples per treatment).

At 30 DAS, 45 DAS and 60 DAS

1. Chlorophyll content (mg/g f.wt)
2. height of the plant cm)
3. Number of leaf
4. Number of tillers
5. Dry weight of stem (g)
6. Dry weight of leaf & panicle
7. Plant height (cm)
8. Dry weight of stem (g)
9. Dry weight Leaf (g)
10. Dry weight of era head (g)

At Physiological maturity

1. Chlorophyll content (mg/g f.wt)
2. Number of leaf
3. Number of tillers
4. Dry weight of stem (g)
5. Dry weight of leaf (g)
6. Dry weight of panicle (g)
7. Plant height (cm)
8. Dry weight of stem (g)
9. Dry weight Leaf (g)
10. Dry weight of era head weight (g)
11. Grain yield (g)
12. Panicle harvest index (PNHI %)
13. Harvest index (HI %)
14. Crop growth rate (CGR per unit land area per unit time)
15. Relative growth rate (RGR $\text{gg}^{-1} \text{day}^{-1}$ or $\text{gg}^{-1} \text{week}$)

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*)
In the Field also (*kharif*) Rain fed

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. Shoot length(cm)
2. Root length(cm)
3. Shoot dry weight(mg)
4. Root dry weight (mg)
5. Root -shoot ratio
6. seedling vigour index

Physiological parameters –

1. RWC
2. Membrane stability index
3. Pigment content (chlorophyll content (mg/g f.wt)), chlorophyll stability index

Field observation at 15 ,22 and 30 DAS

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

PLAN OF WORK 2020-21 FOR BIOTECHNOLOGY

The technical programme for 2020-21 of Biotechnology discipline was finalized in consultation with Dr. Tara Satyavathi, Project Coordinator via telephonic/online discussion held on 20th April, 2020.

PMBT 1: Genetic diversity analysis and molecular characterization of 24 released hybrids and varieties of pearl millet

Background: Database on various morphological parameters for these hybrids/varieties is already available but till now no molecular database is existing. Thus, this experiment will be conducted to screen some SSR markers and initiate genomic studies in pearl millet under ICAR-AICRP on 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.

PMBT 2: DNA fingerprinting of identified/advanced hybrid entries of third year testing

Background: The entries promoted for third year testing will be later identified for release and hence need DNA profile for submission of proposal. Thus, this experiment will be useful for authenticity of identification proposal and can meet the basic requirements of proposal submission.

Objective: DNA profiling of advanced hybrid entries of pearl millet using SSR markers.

Plant material: Young leaf samples of 2-3 leaf stage of identified/advanced hybrid entries.

Methodology

- DNA isolation will be done using CTAB method.
- DNA fingerprinting using SSR markers.

PMBT 3: Molecular characterization of 15 drought/heat tolerant lines suitable for A₁ zone

Background: Development of high yielding, dual purpose disease resistant cultivars for low

rainfall areas i.e. A₁ zone is of utmost priority for increasing pearl millet productivity at national level and some new initiatives were taken last year to screen germplasm for A₁ zone and develop some hybrids for this specific zone. Keeping this in view, this experiment will be useful for screening and developing drought/heat tolerant hybrids for A₁ zone.

Objective: Molecular characterization of drought tolerant lines suitable for A₁ zone using SSR markers

Plant material: Young leaf samples of 2-3 leaf stage of drought/heat tolerant genotypes.

Methodology

- DNA isolation will be done using CTAB method.
- Molecular characterization using SSR markers.

PMBT 4: Validation of already reported high Fe/Zn markers among pearl millet lines rich in Fe and Zn content

Background: Pearl millet is rich in Fe & Zn content and ICAR-AICRP on Pearl Millet has already included minimum standard for micronutrient (Fe = 42 ppm; Zn = 32ppm) in the promotion criteria. Hence, screening of pearl millet lines rich in Fe and Zn content using molecular markers and their validation will be helpful for developing high Fe/Zn pearl millet hybrids.

Objective: Screening and validation of already reported high Fe/Zn markers in Fe/Zn rich lines.

Plant material: Young leaf samples of 2-3 leaf stage of high Fe/Zn genotypes.

Methodology

- DNA isolation will be done using CTAB method.
- Screening and validation of high Fe/Zn markers in Fe/Zn rich lines.

PLAN OF WORK 2020-21 FOR CROP PRODUCTION (AGRONOMY)

Chairman : Dr. C. Tara Satyavathi

Project Coordinator

ICAR-AICRP on Pearl millet, Jodhpur

Rapporteur : 1. Dr. Anil Kumar, Principal Scientist (Agronomy), Bajra Section, CCS HAU, Hisar
2. Manoj Kumar, Assistant Professor (Agronomy), ICAR-AICRP on Pearl millet, Agriculture University, Jodhpur

Date : April 23, 2020

Time : 11:00 AM

AGRONOMY

At the outset, Dr. Anil Kumar, Principal Scientist (Agronomy) welcomed the Chairman of the skype meeting. 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. A total of 32 trials were allotted to different centers and experiments of 32 trials were successfully conducted. The following recommendation was made by the Crop production group;

- The field experiment conducted during 2017-2019 with an objective to study the effect of mulching and hydrogel on the productivity, water use efficiency and microbial activity of pearl millet exhibited 49.8, 40.2 and 52.2 % improvement in the grain yield by the treatment Recommended Dose of Fertilizer (RDF) + Crop residue mulch @ 5.0 t/ha+ Hydrogel @ 7.5 kg/ha over RDF alone in Zone A₁, Zone A and Zone B, respectively. The water use efficiency was recorded 70.24, 78.78, & 79.98 kg/ha-cm in the best treatment as compared to 36.60, 52.85 & 52.72 kg/ha-cm in RDF in Zones A₁, A & B, respectively .
- The soil microbial activities viz. the dehydrogenase activity, MBC, alkaline phosphatase, acid phosphatases and urease populations were recorded significantly higher among all the treatments of hydrogel, mulching and their combinations as compared to their population in the inorganic RDF treatment.

Trials to be continued during 2020-21 of Agronomy

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

AGRONOMY - TECHNICAL PROGRAMME FOR 2020-21

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.

b) Response of advance late hybrid entries to nitrogen levels

Nitrogen levels (4) : 0, 30, 60 & 90 kg N/ha
Hybrids (2+3 checks) : MH 2423, MH 2439, 86M86 (c), KBH 108(c) & MP 7792 (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 : Jaipur, Hisar, Jamnagar and New Delhi (Zone A)

d) Performance of advance summer hybrids to nitrogen levels

Nitrogen levels (4) : 0, 60, 90 & 120 kg N/ha
Hybrids (1+2 check) : MSH 354, 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 : Moisture conservation through polymers and crop residues under rainfed conditions

Objective : To find out the effect of polymers and crop residues on the productivity, water use efficiency and microbial count of pearl millet.

Year of Start : 2020

Treatment T₁ : Control (RDF)
 T₂ : T₁+Crop residue mulch @ 5.0 t/ha after 10-15 DAS
 T₃ : T₁+ Pusa Hydrogel dry application @ 5.0 kg/ha
 T₄ : T₁+ SPG 1118 dry application @ 5.0 kg/ha
 T₅ : T₁+ Pusa Hydrogel slurry application @ 5.0 kg/ha
 T₆ : T₁+ SPG 1118 slurry application @ 5.0 kg/ha
 T₇ : T₃+ Crop residue mulch @ 5.0 t/ha after 10-15 DAS
 T₈ : T₄+ Crop residue mulch @ 5.0 t/ha after 10-15 DAS
 T₉: T₅+ Crop residue mulch @ 5.0 t/ha after 10-15 DAS
 T₁₀: T₆+ Crop residue mulch @ 5.0 t/ha after 10-15 DAS

Locations : Bikaner & Mandor (Zone A₁)
 Jaipur, Hisar, Jamnagar and New Delhi (Zone A)
 Aurangabad, Dhule, Vijayapur & Coimbatore (Zone B)
 Note : Pusa Hydrogel & SPG 1118 will be supplied by IARI, New Delhi

Entries : MPMH 17

Design : RBD

Replication : Three

Treatment : Ten

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. Microbial activities (MBC, Dehydrogenase, Alkaline phosphatase, Urease activities)*
9. Depthwise soil moisture content at different growth stages
10. Consumptive use (cm) & Water use efficiency (kg/ha-mm)
11. Economics of the treatments [Gross Returns (Rs/ha), Net returns (Rs/ha) & B:C ratio]

**At Mandor & New Delhi*

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

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

- T₁ : Weedy check
- T₂ : Weed free
- T₃ : Two hand weeding 3 and 5 weeks after sowing
- T₄ : Pre emergence application of Atrazine @ 400g. a.i./ha. followed by one weeding at 3-4 weeks after sowing
- T₅ : Tembotrione 42% SC @ 90g. a.i./ha at 3-4 leaf stage of weeds
- T₆ : Tembotrione 42% SC @ 100g. a.i./ha at 3-4 leaf stage of weeds
- T₇ : Tembotrione 42% SC @ 110g. a.i./ha at 3-4 leaf stage of weeds
- T₈ : Tembotrione 42% SC @ 120g. a.i./ha at 3-4 leaf stage of weeds

Locations : Bikaner and Mandor (Zone A₁)
Jaipur, Hisar, Jamnagar and New Delhi (Zone A)
Aurangabad, Dhule, Vijayapur & Coimbatore (Zone B)

Entries : MPMH 17 (A₁), 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 explore the possibility of organic cultivation of pearl millet crop under rainfed situation

Year of Start : 2018

Treatment

- T₁ : Recommended dose of fertilizer
- T₂ : Recommended dose of Nitrogen (RDN) through FYM
- T₃ : 75 % RDN through FYM
- T₄ : Recommended dose of Nitrogen (RDN) through Vermicompost
- T₅ : 75 % RDN through Vermicompost
- T₆ : T₂ + Biomix
- T₇ : T₃ + Biomix
- T₈ : T₄ + Biomix
- T₉ : T₅ + Biomix
- RDF : (40 kg N/ha + 20 Kg P₂O₅) for Zone A₁ & A
(60 kg N/ha + 30 Kg P₂O₅) for Zone B

Locations : Bikaner and Mandor (Zone A₁)
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 A₁: MPMH 17, Zone A: RHB 173 and Zone B: GHB 558

Design : RBD

Replication : Three

Treatment : Nine

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: Chemical analysis of the properties of the soil (pH, EC, organic carbon and available NPK) before sowing & after harvesting of the crop.

PMAT 5 : Effect of tillage and nutrient management systems on pearl millet yield and soil properties

Objective : To study the effect of different tillage manipulations and nutrient management practices on the productivity, water use efficiency, physico-chemical and Energy analysis in pearl millet crop.

Year of Start : 2020

Treatment : **A. Main Plot (Tillage practices)**

- a. Conventional tillage (Two harrow + one cultivator and planking + Two Inter culture operations by kasola/wheel hand hoe/power weeder at 15-20 & 30-35 DAS)
- b. Conventional tillage (Two harrow + one cultivator and planking + One Inter culture operations by kasola/wheel hand hoe/power weeder at 21-28 DAS)
- c. Minimum tillage (One harrow + One cultivator and planking + Two Inter culture operations kasola/wheel hand hoe/power weeder at 15-20 & 30-35 DAS)
- d. Minimum tillage (One harrow + One cultivator and planking One Inter culture operations by kasola/wheel hand hoe/power weeder between 21-28 DAS)

B. Sub Plot (Nutrient supply)

- a. 100% RDF of the Zones
- b. 75 % N through RDF + 2.5 t/ha FYM
- c. 50 % N through RDF + 5.0 t/ha through FYM
- d. 100% N through FYM

*RDF : (40 kg N/ha + 20 Kg P₂O₅) for Zone A1 & A
(60 kg N/ha + 30 Kg P₂O₅) for Zone B*

Locations : Bikaner & Mandor (Zone A₁)
Jaipur, Hisar, Jamnagar and New Delhi (Zone A)
Aurangabad, Dhule, Vijayapur & Coimbatore (Zone B)

Entries : MPMH 17/ Latest Recommended Hybrid for the State

Design : SPD

Replication : Three

Treatment : 16

Plot size :

Gross : 5.0 m x 4.5 m

Net : 4.0 m x 3.6 m

Observations to be recorded

1. Plant population (Initial & 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. Depthwise soil moisture content at different growth stages
9. Consumptive use (mm) & Water use efficiency (kg/ha-mm)
10. Energy Input & Output Analysis (MJ/ha)
11. Economics of the treatments [Gross Returns (Rs/ha), Net returns (Rs/ha) & B:C ratio]

Note: *Physico-chemical properties of the soil (Bulk Density, pH, EC, organic carbon and available NPK before and after harvesting of the crop)*

The following scientists attended the Zoom APP & skype meeting and actively participated in the discussions:

1. Dr. C. Tara Satyavathi, Project Coordinator, ICAR-AICRP on Pearl Millet, Jodhpur
2. Dr. P.S. Shekhawat, Director of Research, 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. D.M. Lomte, Agronomist, NARP, Aurangabad
9. Dr. H.M. Bhuva, Assoc. Res. Scientist, Pearl Millet Research Station, JAU, Jamnagar
10. Mr. Manoj Kumar, Assistant Professor (Agronomy), ICAR-AICRP on Pearl Millet, Agriculture University, Jodhpur
11. Dr. Seema Sharma, Associate Professor (Agronomy), RARI (SKNAU), Jaipur (Raj.)
12. Dr. R.T. Suryvawanshi, Assistant Professor (Agronomy), College of Agriculture (MPKV), Dhule

The meeting ended with vote of thanks to the Project Coordinator.

REVIEW OF FRONT LINE DEMONSTRATIONS FOR 2019-20 AND ACTION PLAN 2020-21

The progress report of FLD was presented by Mr. Manoj Kumar, Asstt. Professor (Agronomy), PC Unit, Jodhpur. As against the target of 350 ha, FLD's were organized over an area of 306.4 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 different components *i.e.* improved practices, recommended nutrient application, Biofortified variety/hybrids, improved cultivar and moisture conservation. The results revealed that overall yield advantage was in the range of 20.4% to 39.9% higher grain yield compared to the yield recorded with the farmer's practice in Zone A₁, 5.9% to 38.6% in Zone A and the increase was 16.9% to 132.2% in Zone B. During summer season in Gujarat state, the grain yield of 4739 kg/ha was obtained with improved cultivation practices as against 4494 kg/ha recorded with farmer's practices thereby improving the grain yield by 5.4%. The KVK Jalore, KVK Sirohi and ICAR Nagaland center Dimapur agreed to take up FLD's in Summer 2020 in place of Kharif 2019. In Hisar 13.4 ha area not planted FLD's due to lack of HHB 299 seed. Many of the centres organized the Field Day/ Kisan Mela at Farmer's Field during the season. For the season 2019-20, total 350 FLD's were proposed to be allotted to different centres. In this, North-east states were added for conducting the 10 FLD's and total 30 FLD's kept for Summer.

Proposal of FLD's on pearl millet for the year 2020-21 (*Kharif & Summer*) (Revised)

| Sr. No. | Name of the coordinating centre | (Area in ha) | | | Technology to be demonstrated |
|---------|--|---------------|------------|-----------|--|
| | | <i>Kharif</i> | Summ er | Tot al | |
| 1 | RARI, (SKNAU), Durgapura (Jaipur), Rajasthan | 10 | - | 10 | <ul style="list-style-type: none"> Improved variety (MPMH 17, RHB 173 & RHB 177) V/s Local variety Full Package of practices Weed management |
| 2 | Agricultural Research Station (SKRAU), Bikaner (Rajasthan) | 30 | - | 30 | <ul style="list-style-type: none"> Improved variety (MPMH 17 & RHB 177) V/s Local variety Full package of practices Weed management |
| 3 | Millet Research Station, JAU, Jamnagar (Gujrat) | 10 | - | 10 | <ul style="list-style-type: none"> Improved variety (GHB 558) V/s Local variety in kharif Improved hybrid (GHB 538) v/s Local variety in summer Full package of practices in summer |
| 4 | Bajra Section, CCSHAU, Hisar (Haryana) | 10 | - | 10 | <ul style="list-style-type: none"> Improved hybrids (HHB 299) V/s Local variety Weed management by Atrazine |

| | | | | | |
|----|--|----|---|----|--|
| | | | | | <ul style="list-style-type: none"> • Efficient nutrient management • Use of micro nutrient v/s Farmer's practices |
| 5 | KVK, Shikohpur (IARI, New Delhi), Gurgaon | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrids (HHB 299) V/s Local variety • Improved variety v/s local variety • Full package of practices • Weed management |
| 6 | AICRP-PM, COA (RVSKVV), Gwalior (MP) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrids (RHB 173) v/s local variety • Full package of practices |
| 7 | AICRP on Pearl Millet, NARP, Aurangabad (MH) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrid AHB 1200 v/s Local variety |
| 8 | Department of Millets, CPBG, TNAU, Coimbatore | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrids (TNAU Cumbu hybrid Co9 and Improved variety Co (cu) 10) V/s Farmer's practice • Weed management |
| 9 | AICRP on Pearl Millet, Regional Agricultural Research Station, Vijayapur (Karnataka) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrid/variety AHB 1200 and Dhanshakti v/s Local variety |
| 10 | College of Agriculture, (MPKV, Rahuri), Dhule (MH) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved variety Dhanshakti • Full package of practices |
| 11 | Agricultural Research Station, (ANGRAU), Ananthapuram (AP) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved Hybrid (ABV 04) V/s Local Variety • Full package of practices • Weed management |
| 12 | Directorate of Extension Education, AU, Jodhpur, (Rajasthan) | 30 | - | 30 | <ul style="list-style-type: none"> • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 13 | KVK, CAZRI, Jodhpur (Rajasthan) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrids (MPMH 17 & RHB 177)V/s Local variety • Full package of practices |
| 14 | Incharge Forage & Millet section, Department of Plant Breeding, PAU, Ludhiana (Punjab) | 10 | - | 10 | <ul style="list-style-type: none"> • Improved hybrids V/s Local variety • Full package of practices |
| 15 | Agricultural Research Station, (ANGRAU), Vizianagaram (AP) | 20 | - | 20 | <ul style="list-style-type: none"> • Improved hybrids V/s Local variety • Full package of practices |
| 16 | KVK Phalodi, Jodhpur | 20 | - | 20 | <ul style="list-style-type: none"> • Improved hybrids (MPMH 21, |

| | | | | | |
|--------------|--|------------|-----------|------------|--|
| | (Rajasthan) | | | | MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 17 | KVK Gudamalani, Barmer (Rajasthan) | 20 | - | 20 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 18 | KVK Sirohi (Rajasthan) | - | 10 | 10 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 19 | KVK Athiyasan, Nagaur (Rajasthan) | 10 | - | 10 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 20 | KVK Molasar, Nagaur (Rajasthan) | 10 | - | 10 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 21 | KVK Jalore (Rajasthan) | 10 | 10 | 20 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 22 | KVK Chandgothi, Churu (Rajasthan) | 20 | - | 20 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 23 | JVWU, Jaipur (Rajasthan) | 10 | - | 10 | • Improved hybrids (MPMH 17 & RHB 173) V/s Local variety • Full package of practices |
| 24 | College of Agriculture Sumerpur, AU, Jodhpur (Rajasthan) | 10 | - | 10 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 25 | KVK Jaisalmer (Rajasthan) | 10 | - | 10 | • Improved hybrids (MPMH 21, MPMH 17 & RHB 177) V/s Local variety • Full package of practices |
| 26 | ICAR, Research Complex for NEH Region, Nagaland Centre, Jharnapani, Distt. Dimapur | - | 10 | 10 | • Improved hybrids V/s Local variety • Full package of practices |
| Total | | 320 | 30 | 350 | |

Note: The monitoring team will be constituted after planting of the crop.

PLAN OF WORK OF PLANT PATHOLOGY (2020-21)

The group meeting under the leadership of Dr. C. Tara Satyavathi, Project Coordinator, was held on April, 20, 2020 through SKYPE to discuss about the last year experiments results and formulate the experiments for the year 2020-2021. All the centers, viz., Mysore, Coimbatore, Anand, Jamnagar, Jaipur, Gwalior, Aurangabad, Hisar, and ICRISAT centers participated in the group meeting. Mandor and Dhule centres Scientists, could not attend the meeting due to the poor network issues.

PATHOLOGY - TECHNICAL PROGRAMME FOR KHARIF / SUMMER – 2020-21

The group decided to continue the same experiments under PMPTI, II, III, VI, and PMPT V: Management of downy mildew by using organic practices and Management of blast disease by using chemicals and bioagents for the year 2020-2021.

The group also discussed about developing artificial screening facility under controlled conditions for blast disease at all the centres and requested for the separate contingency grant for the establishment of disease screening facility.

The criteria for the acceptability of new genotypes for diseases, the following criteria finalized for the year 2020-2021.

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 i.e., varietal promotion under the category of blast resistant under natural infection. Data will be taken at 30 DAS, 45 DAS and 60 DAS.

Rust: The group concluded to have the observations of rust disease during hard dough stage and submit the data using 0-6 scale. **Up to the score 3 (upto 20%)** for rust can be considered for promotion under natural condition.

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 (seed should not be treated with fungicide)
- II. Smut and Ergot: to be inoculated artificially
- III. Rust and Blast: Natural disease severity.

****The group decided that all Centres should record natural incidence of DM (in sick plot), blast, rust, ergot, smut disease in PMPT I, II, & III entries during 2020-2021.**

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 & A₁

Mandor, Jaipur, Hisar, Gwalior, Jamnagar and Anand

Zone B

Mysore, Aurangabad, Dhule, Coimbatore and Patancheru (PMPT-II)

Smut

Location : Zone A & A₁

Jaipur, Jamnagar, Hisar and Gwalior

Zone B

Dhule

Blast

Location : Zone A & A₁

Jaipur, Jamnagar, Mandore, Gwalior, Hisar and New Delhi (PMPT-II)

: Zone B

Dhule, Aurangabad and Mysore

Rust

Location : Zone A & A₁

Jaipur, Jamnagar, Hisar and Gwalior

Zone B

Aurangabad, Dhule and Coimbatore

Ergot

Location : Zone A & A₁

Jaipur

Zone B

Aurangabad, Dhule and Coimbatore

PMPT IV A: Pearl millet downy mildew virulence nursery (PMDMVN).

1. Pathogenic diversity analysis by virulence nursery

Location : Zone A & A₁

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.

Location : Mysore

PMPT IV C:

Pearl millet blast variability nursery (PMBVN)

Location : **Zone A & A₁**
Gwalior, Anand, Mandor, Jamnagar, Hisar, New Delhi, and Jaipur

Zone B

Dhule, Aurangabad, Mysore, Patancheru and Vijayanagaram

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 - Should be calculated per hectare

Location : **Zone A & A₁**

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

6. Control – Moderately susceptible cultivar (Mandor Centre will supply- Dhanashakti)

Replication: 4 (4 rows in 4 meter length)

Observation to be recorded:

- a) Seedling emergence
- b) Per cent blast disease severity at 30, 45 & 60 DAS
- c) Grain and Fodder Yield –Should be calculated per hectare

Location : **Zone A & A₁**
Mandor, Jaipur, Hisar, Gwalior, Jamnagar

Zone B
Aurangabad, Dhule, Mysore and Patancheru,
Vijayanagaram

Note:

1. Cultivar 95444 should be used as an indicator after each treatment
2. Observation of Blast disease should be recorded 30, 45 and 60 days and Downy mildew should be recorded 30 & 60 days, in each treatment.
3. For blast disease severity should be recorded 0-9 scale and PDI should be calculated
4. The soft copy (CD) of the disease incidence of different genotypes of the respective Centre should be recorded and as to submit along with annual report.

PMPT VI: Monitoring of Pearl Millet diseases at Farmers' fields: 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/severity 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.

Recommendations:

1. ICMB 95444 (susceptible check) should be used as an indicator for blast disease screening experiment
2. Observation of Blast disease should be recorded 30, 45 and 60 days and Downy mildew should be recorded 30 & 60 days, in each treatment.
3. For blast disease severity should be recorded 0-9 scale and PDI should be calculated for disease management experiments
4. The soft copy (CD) of the disease incidence of different genotypes of the respective centre should be recorded and as to submit along with annual report.

5. The *coefficient of variation* (CV) values of each experiment should be provided for consideration for further analysis and interpretation of results.

PLAN OF WORK 2020-21 FOR ENTOMOLOGY

The video conference/meeting of pearl millet entomology group was held on 21/4/2020 from 11.00 to 12.30 hrs under the chairmanship of The Project Coordinator, Dr. C. Tara Satyavathi, ICAR-AICRP on Pearl Millet, Mandor, Jodhpur. Prof. Rajkumar P. Juneja, Assistant Research Scientist (Entomology) & PI, JAU, Jamnagar, Dr. R.S. Bajiya, STA (Entomology), RARI, Durgapura-Jaipur, Prof. Vaibhav K. Chuadhari, Assistant Research Scientist (Entomology), RRS, AAU, Anand & Dr. B. K. Athoni, Jr. Breeder & Head, AICRP on Pearl Millet, RRS, Vijayapur attended the meeting. As, Dr. N. R. Patange, Associate Professor (Entomology), NARP, Aurangabad don't have Skype id, could not be included in Skype meeting. However, the matter was discussed on his mobile at length. The PI welcomed all in this meeting.

The PI informed to the Project Coordinator and group that this group has come out with 2 recommendations this year for the management of shoot fly, white grub, termite, stem borer and *Helicoverpa armigera* based on the experiments conducted at Jaipur & Jamnagar centre for three years. They are as under:-

Recommendations:

1. On the basis of 3 years (2016-18) study, it was found that IPM module-IV (Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha + spraying of dimethoate 30 EC 0.03 % at 35 DAG) recorded significantly lowest shoot fly % incidence at ear head stage, highest grain & fodder yield at Jamnagar & Jaipur both. Moreover, this module recorded lowest white grub & termite per cent damage at Jaipur.

N.B.:The insecticides recommended in this trial are registered under Central Insecticide Board & Registration Committee N.H.-IV, Faridabad-121 001 (Haryana), MAJOR USES OF PESTICIDES, (Registered under the Insecticides Act, 1968), UP TO- 31.05.2018 and has not been analyzed for residues. Dimethoate, pp no.22, Imidachloprid, pp no.31.

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 + spraying of novaluron 10 EC 0.01%, at 35 DAG) recorded lowest stem borer % incidence and *Helicoverpa* larval population at ear head stage at Jamnagar.

Dr. R.S. Bajiya suggested the PI to incorporate the promising entries of initial trial and advance entries, resistant/tolerant to shoot fly, stem borer & Leaf roller as recommendation. The Project Coordinator informed that on the basis of one year it could not be done. However, welcomed the suggestion and informed the PI to have table of promising entries to

be included in proceedings which would be helpful to all the scientists especially breeders.

After that the Project Coordinator discussed the technical programme for 2020-21 with members one by one in details.

1. PMET-1A and PMET-1B (Screening trials) will be continued as such in next year also. However, The Project Coordinator inquired about the observations being recorded of grey weevil at Durgapura (Rajasthan). Dr. Bajiya informed that grey weevil used to be a regular pest of pearl millet. However, since last 2 years, this is not appearing. It was decided to record the observations of grey weevil damage for one more year and if it does not appears than it will be dropped from the programme.
2. PMET-2 (Monitoring of insect-pests at research farm) will be continued as such at all the 5 locations. The Project Coordinator inquired about the chaffer beetle incidence at Durgapura. Dr. Bajiya informed that entries showing ergot damage are more prone to this insect.
3. PMET-3 is a survey trial and it will be continued as such. In this trial, The Project Coordinator took the view of white grub, termite, *Helicoverpa*, Fall Army worm and grass hopper situation at different locations. The Project Coordinator gave more emphasis on increasing damage by grass hopper in Rajasthan, *Helicoverpa* in Gujarat and Fall Army worm in Maharashtra. The PI informed that in PMET-5 (IPM) trial, grass hopper & *Helicoverpa* are being taken care at JAU, Jamnagar. But, these pests are not appearing at RARI, Durgapura. The PI & Dr. Bajiya informed the PC that FAW was observed at Kothara-Kutch (Gujarat) and around 10.0% damage was observed during *Kharif* 2019 and it was informed by the head of that station during monitoring. Hon'ble madam suggested the Durgapura scientist to have large scale survey giving emphasis especially on grass hopper covering Jodhpur and Bikaner districts, where there is a huge area of rainfed pearl millet. Dr. Bajiya (STA, Durgapura) informed about the limitations of vehicle movements out of the jurisdiction of SKNAU, Jobner. The Project Coordinator agreed to make the arrangements for permission of vehicle or expenditure from PC unit, Jodhpur.
4. PMET-5 will be continued as such next year also. The PI informed the house that in this trial, DDVP is being used in fish meal traps. Since the manufacturing of this chemical is going to be banned in December 2020, it is to be replaced by chlorpyrifos 20 EC, 0.05%. This point was discussed in Zonal State committees and thus replaced accordingly. The Project Coordinator raised the point that in this trial there are some insecticides which are not in CIB and will create issue in future. The PI informed that, this trial was formulated under the chairmanship of Dr. Mukesh Dhillon (Entomology) ICAR- New Delhi during 54th AGM, held at IARI (15-17th March 2019). He was of the view that research cannot be stopped only due to CIB and

the committee at ICAR level has been constituted and it is likely that the report may come soon. Moreover, we should be prepared with technology for future thrusts.

5. PMET-6 will be continued as such at RARI, Durgapura, Jaipur for white grub & termite management. The Project Coordinator suggested to conclude this trial next year with recommendation.
6. PMET-7 will be continued as such at JAU, Jamnagar. Since, this is a summer survey trial, Prof. Juneja informed to The Project Coordinator that in the present situation of COVID 19 it has not been conducted yet and will be tried the best for this. The Project Coordinator suggested communicating through electronic sources like mobile and getting the feedback so that at least pest situation may be available.
7. PMET-8 will be continued as such. This is storage trial of screening of advance entries to storage pests. The PI informed that the experiment is in progress at Jaipur & Jamnagar at present. Prof. Vaibhav Chaudhari showed the interest in this trial and The Project Coordinator agreed to allot this trial to RRS, AAU, Anand from next season. Since, this is a voluntary centre so some grant has been requested in this matter.
8. PMET-9 will be continued as such for monitoring of FAW through pheromone traps. Dr. N. R. Patange (Aurangabad) has requested for this trial from this year. Hence, one more centre has been added. The PI showed his willingness to provide the traps to all centres during *Kharif* season. The Project Coordinator pointed out that since FAW is a major issue in Maharashtra, all the centres should remain alert in this context.
9. The Incharge of Vijayapur (Karnataka) informed that their centre has been allotted 2 trials (PMET-2 & PMET-3) from last year. Since, there is no entomologist in AICRP on pearl millet, they are facing the problem. He has agreed to conduct the experiment number PMET-2 (Monitoring at research station) by taking the help of entomologist from other sources. But, it is difficult to conduct PMET-3 (Survey) and requested to consider this.
10. During the video conference-zoom meeting on 29th April, 2020, Honorable DDG (CS), ICAR, N. Delhi suggested to consult National Centre for Integrated Pest Management for PMET-5 (Testing of IPM modules against major insect-pest in pearl millet) experiment. The centre was consulted for formulating the trial and the experiment has been modified accordingly.

Summarized statement showing category wise initial/population entries either moderate resistant, tolerant or resistant to major insect-pests in pearl millet

| Insect-pest & Stage | Moderate resistant (0.1-5.0%) | Tolerant (5.1-10.0%) | Resistant (0.0%) |
|-------------------------------|--|---|---|
| Shoot fly Vegetative stage | 2 entries (MH 2461 & MH 2462) | 17 Entries (MH 2490, MH 2480, MH 2465, MH 2473, MH 2491, MH 2513, MH 2459, MH 2498, MH 2479, MH 2540, MH 2525, Dhanshakti, MH 2489, ABV 04, MH 2457, MP 599 & MH 2494) | Nil |
| Shoot fly ear head stage | 15 entries (MH 2520, MH 2521, MH 2459, MH 2523, MH 2482, MH 2469, MH 2519, MH 2533, MH 2493, MH 2506, MH 2480, MH 2478, MH 2507, MH 2458 & MH 2492) | 64 entries (MH 2463, MH 2534, MH 2494, MH 2529, MH 2501, MH 2462, 86M86, MH 2498, MH 2528, MH 2531, MH 2479, MH 2517, MH 2460, MH 2509, MH 2522, MH 2457, JBV 2, MH 2518, MH 2526, MPMH 21, MH 2524, MH 2481, MH 2532, MH 2477, MH 2486, MH 2503, MH 2527, MH 2542, MH 2512, MH 2491, Raj 171, MH 2505, Pusa Comp. 383, MP 595, MP 596, MP 599, Pusa Comp. 612, MH 2530, MH 2495, MH 2474, MH 2475, MH 2471, MH 2535, MH 2465, Pusa Comp. 701, MH 2511, MH 2496, MP 598, MH 2487, MH 2468, MH 2489, NBH 4903, MH 2485, MH 2514, MH 2464, MH 2502, MH 2484, PB 1705, MH 2508, MH 2516, ABV 04, MH 2473, MH 2504, MH 2510) | Nil |
| Stem borer vegetative stage | 20 Entries (MH 2459, MH 2460, MH 2463, MH 2473, MH 2474, MH 2478, MH 2489, MH 2461, MH 2462, MH 2475, MH 2499, MH 2508, MH 2464, MH 2491, MH 2492, MH 2497, MH 2515, MH 2532, ICMV 221 & Dhanshakti) | 34 entries (MH 2465, MH 2488, MH 2504, MH 2507, MH 2533, MH 2542, MH 2457, MH 2477, MH 2480, MH 2482, MH 2503, MH 2506, MH 2539, MP 599, MPMH 21, 86M01, ABV 04, MH 2458, MH 2466, MH 2476, MH 2479, MH 2516, MH 2535, MP 595, MP 598, HHB 272, ICMV 155, MH 2481, MH 2490, MH 2500, MH 2505, MH 2510, MH 2517, MPMH 17) | Nil |
| Stem borer ear head stage | 63 entries (MH 2488, MH 2472, MH 2476, MH 2478, MH 2528, MH 2484, MH 2489, MH 2498, MH 2518, MH 2500, MH 2537, Pusa Comp. 612, MH 2465, MH 2491, MH 2493, MH 2494, MH 2523, MH 2526, MP 598, HHB 272, MH 2460, MH 2461, MH 2515, MH 2525, MH 2541, MP 599, ICMV 221, Pusa Comp. 701, MH 2481, MH 2509, MH 2505, MH 2508, MH 2459, MH 2479, MH 2483, MH 2490, MH 2507, MP 600, MH 2463, MH 2496, MH 2486, MH 2495, MP 595, MH 2466, MH 2499, MH 2534, MH 2539, Raj 171, MH 2512, MH 2471, MH 2502, MH 2468, MH 2470, MH 2520, MH 2529, KBH 108, Pusa Comp. 383, MH 2516, MH 2513, MPMH 21, MH 2517, Kaveri S. Boss, MH 2492) | 29 entries (MH 2462, MH 2457, MH 2497, MH 2469, MH 2519, MH 2521, NBH 4903, MH 2464, HHB 67 Improved, MH 2501, MH 2503, ABV 04, MP-7792, JBV 2, MH 2506, MH 2487, MH 2473, MH 2475, MH 2458, MH 2510, MH 2527, RHB 177, MH 2514, NBH 5767, MH 2536, MH 2467, Dhanshakti, PRATAP, MH 2504) | 15 Entries (MH 2474, MH 2480, MH 2482, MH 2485, MH 2522, MH 2524, MH 2530, MH 2531, MH 2532, MH 2533, MH 2538, MH 2540, MH 2542, MP 597, ICMV 155) |
| Leaf roller ear head stage | 8 entries were found free viz., MH 2465, MH 2468, MH 2469, MH 2488, MH 2496, MH 2509, MH 2539, MP 595 at ear head stage. | | |

Summarized statement showing category wise advance entries either moderate resistant, tolerant or resistant to major insect-pests in pearl millet

| Insect-pest & Stage | Moderate resistant (0.1-5.0%) | Tolerant (5.1-10.0%) | Resistant (0.0%) |
|-----------------------------|--|---|------------------|
| Shoot fly Vegetative stage | Nil | 3 Entries Kaveri Super Boss, ICMV 221 & KBH 108 | Nil |
| Shoot fly ear head stage | One Entry Kaveri Super Boss | 20 Entries (MH 2548, JBV 2, MH 2549, MH 2439, MH 2547, MH 2546, MH 2551, MH 2550, 86M86 (Check), MH 2423, MH 2382, GHB 538 (Check), Pusa Comp. 701, MP-7792 (Check), HHB 67 Imp., MH 2544, RAJ 171, MH 2545, MP 590 & RHB 177) | Nil |
| Stem borer vegetative stage | 9 Entries (ICMV 221, MH 2546, Dhanshakti, MH 2547, MH 2548, MH 2550, HHB 272, GHB 538 (Check) & RAJ 171) | 13 Entries (MH 2385, MH 2545, HHB 67 Imp. , Pusa Comp. 701 , MH 2381, MH 2382, RHB 177, MH 2543, MH 2551, MH 2544, MH 2549, MPMH 21 & MP-7792 (Check)) | Nil |
| Stem borer ear head stage | 30 Entries MH 2545, MH 2546, MH 2547, MH 2548, MH 2549, MH 2550, MH 2551, MP 590, RHB 177, HHB 67 Imp, HHB 272, MPMH 21, GHB 538 (Check), 86M86 (Check), KBH 108 (Check), MP-7792 (Check), Kaveri Super Boss (Check), NBH 5061(Check), RAJ 171, Pusa Composite 383, JBV 2, Dhanshakti, ICMV 221, Pusa Comp. 701 | One Entry (MH 2385) | Nil |
| Leaf roller ear head stage | Only one entry (MH 2382) as found free. | | |

The list of promising advance lines of pearl millet against storage insect-pests.

| | |
|---|---|
| Jamnagar Test Insect: <i>Tribolium castaneum</i> | On the basis of adult population, grain damage & per cent weight loss, the entries viz., MH 2455, MH 2224, MH 2456, MH 2228, MH 2354, MH 2192, Pusa Composite 383, JBV 2, 86M01 & ICMV 221 were found tolerant against <i>Tribolium castaneum</i> |
| Jaipur Test Insect: <i>Rhizopertha dominica</i> | On the basis of adult emergence, grain damage & per cent weight loss, MH 2228, MH 2192, MH 2455 & 86M01 were found tolerant |

Technical Programme for Kharif-2020-21

1. PMET-1A: Screening of pearl millet lines against major insect pests (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 & population 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 pests (Advance lines)

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:** 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, Vijayapur, ARS Mandor

Objective: To study the population fluctuation of key pests of pearl millet.

Experimental details:

Design: Nil (Observation plot)

Replications: Nil

Treatment: Untreated plot

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 m² 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 till maturity. The presence of bio agents will also be recorded simultaneously. Weather data may also be recorded on weekly basis (Meteorological Standard Weather Week) at least, Temperature Minimum & Maximum, RH Morning & Evening, Rainfall mm & Rainy days. If some other facility available than other parameters may be recorded. By this correlation of major insect pest with weather parameters will be worked out.

N.B.: One treated plot may be maintained by taking recommended package of practices for insect pest management to get the information for losses. Correlation will be worked out between major pest & weather parameters for at least 4-5 years to get clear role of abiotic factors.

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

Location: Jamnagar, Anand, Jaipur, Aurangabad & ARS Mandor

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 at ear head stage of bajra crop during *Kharif* season at different locations. Percent incidence of various insect pests and population per 5 plants will be recorded infesting pearl millet. The presence of bio-agents will also be recorded simultaneously.

5. PMET-5: Testing of IPM modules against pest complex of pearl millet (Modified).

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

Location: Jamnagar and Jaipur

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

Gross plot size: 4.0 x 3.0 m (5 rows), **Net plot size:** 3.0 x 1.80 m (3 rows) and

Spacing: 50 x 15 cm.

Treatment details: 7

1. T1-IPM module-I: 10% higher seed rate + seed treatment of imidacloprid 600 FS @ 8.75 ml/kg + removal of shoot fly dead hearts + fish meal trap @ 10/ha.
2. T2-IPM module-II: T1 + seed treatment of PSB @ 10 ml/kg seed + spray azadirachtin 1500 ppm (40 ml/10 litres of water) at 30 DAG and at ear head stage.
3. T3-IPM module-III: T1 + seed treatment of PSB @ 10 ml/kg seed + furrow application of *Trichoderma harzanium* @ 2.5 kg/ha mixed in 500 kg well decomposed FYM at the time of sowing + spray azadirachtin 1500 ppm (40 ml/10 litres of water) at 30 DAG and at ear head stage.
4. T4-IPM module-IV: T1 + seed treatment of PSB @ 10 ml/kg seed + neem cake @ 250 kg/hactare furrow application at the time of sowing + spray azadirachtin 1500 ppm (40 ml/10 litres of water) at 30 DAG and at ear head stage.
5. T5-IPM module-V: T1 + seed treatment of PSB @ 10 ml/kg seed + neem cake @ 500 kg/hactare furrow application at the time of sowing + spray azadirachtin 1500 ppm (40 ml/10 litres of water) at 30 DAG and at ear head stage.
6. T6-IPM module-VI: Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg, installation of fish meal trap @ 10/ha and spraying of NSKE 5% at ear head stage (Standard check-earlier recommendation)
7. T7-Untreated-control

Methodology and observation to be recorded

- a. Per cent incidence of shoot fly at 28 DAG (vegetative stage) and at ear head stage.
- b. Per cent incidence of stem borer at 28 DAG (vegetative stage) and at ear head stage.
- c. Per cent termite and white grub at ear head stage.
- d. Larval population of *Helicoverpa* to be recorded on 5 ear heads in each replication before & after spray (24 hrs before & 1, 3 & 7 days after spray).
- e. Grass hopper per cent damage at 45 DAG of the crop
- f. Yield and economics of the treatments.

N.B.: PSB treatment will be given after imidacloprid treatment, if any other pest appears, that will also be recorded.

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

Locations: Jaipur

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./ha
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. Chlorantraioprole 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.

N.B.: This experiment will be concluded with recommendation next year.

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.

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.

Locations: Jamnagar, Jaipur & Anand

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 & Anand) 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 mean number of adults emerged, mean percentage of seeds damaged, percent weight loss will be recorded. Whereas, germination will be recorded at the end of experiment. The data recorded will be subjected to statistical analysis.

Observations to be recorded:

- Adult emergence at 3 & 6 months
- Per cent grain damage at 3 & 6 months
- Per cent weight loss at 3 & 6 months
- Germination percentage will be recorded at the end of experiment (6 months).

Note: The pearl millet seeds will be used from experiment of PMET-1B (advanced entries) trial after harvesting of *kharif* trial.

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

Locations: Jamnagar, Anand, Jaipur, Aurangabad & ARS Mandor

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

Treatment: Five 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 mean 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. The weather data will also be recorded.

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