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INDIAN COUNCIL OF AGRICULTURAL RESEARCH  
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F. No. 18-8/2018-CS-FFC

Dated: 30.07.2021

To,

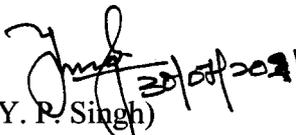
The Director  
ICAR-IIMR,  
Ludhiana-141001.

**Subject: Proceedings and recommendations of the 64<sup>th</sup> Annual Group Meeting of All India Coordinated Research Project on Maize (AICRP on Maize) held online from May 17-19 and June 17, 2021-reg.**

Sir,

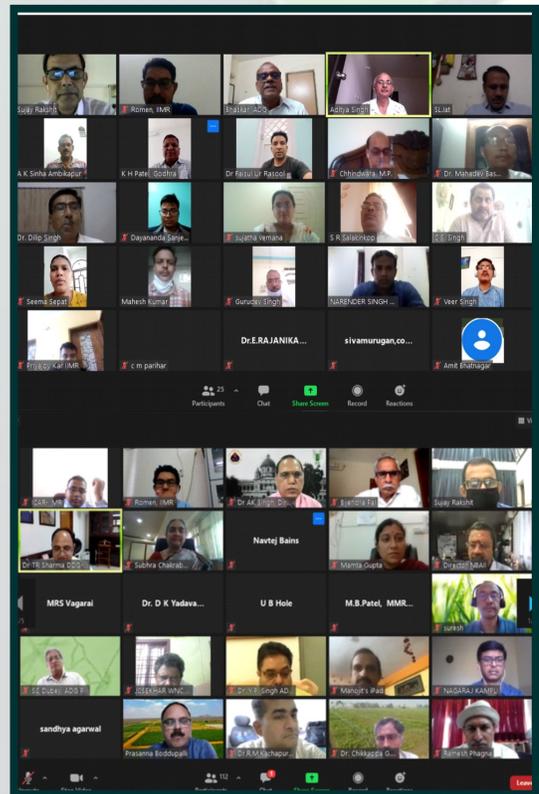
Kindly refer to your email letter dated 28.06.2021 regarding above cited subject. In this context, the approval of Competent Authority is conveyed herewith for the submitted Proceedings and recommendations of the 64<sup>th</sup> Annual Group Meeting of All India Coordinated Research Project on Maize (AICRP on Maize) held online from May 17-19 and June 17, 2021.

Yours faithfully

  
(Y. P. Singh)

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# PROCEEDINGS OF THE 64<sup>th</sup> ANNUAL MAIZE WORKSHOP (ONLINE)



All India Coordinated Research Project on Maize  
ICAR-Indian Institute of Maize Research  
PAU Campus, Ludhiana 141 004



## **Executive Summary**

The 64<sup>th</sup> Annual Group Meeting of All India Coordinated Research Project on Maize (AICRP on Maize) was held online from May 17-19 and June 17, 2021. The group meeting was spread to 11 sessions over four days. The Workshop was inaugurated by Dr. H.S. Gupta, former DG, BISA and Director, IARI and Chairman, Project Advisory and Monitoring Committee (PAMC) in the presence of Dr. S.K. Vasal, World Food Laureate, Dr. I.S. Singh, Dr. P.N. Sharma and Dr. Jella Satyanarayana, members, PAMC. Dr. H.S. Gupta, Chairman, PAMC complimented the maize fraternity for developing technologies leading to over 30 million tonnes of maize production in the country in the current year. But the demand is much more and to reach the target attention is to be given in increasing input use efficiency and improving the nutritional status through bio-fortification. One of the major challenges is seed production, only 25 to 30% is under single cross hybrid cultivation and remaining is under multi-parent hybrids, OPVs and landraces. Dr. S.K. Vasal highlighted the importance of development of multi-parent source populations, heterotic pools, grouping of inbred lines based on heterotic behaviour, recycling of inbred lines within the heterotic group and identification of new testers and inbred lines with better productivity.

The Session I & II was chaired by Dr. H.S. Gupta and Dr. S.K. Vasal and co-chaired by Dr. Sujay Rakshit, Director, ICAR-IIMR. During these two sessions in-charges of AICRP centers presented the work carried out at their respective centers during 2020-21. The centres were advised to focus on releasing hybrids through CVRC instead of SVRC and take up seed production of their own hybrids and hybrids released for their region released by other institutes so that more and more area can be covered by single cross hybrids enabling attainment of production and productivity targets.

The session III had three concurrent sessions on Plant Breeding, Agronomy and outreach and Plant Protection. The Plant Breeding section was also chaired by Dr. H.S. Gupta & Dr. S.K. Vasal and co-chaired by Dr. I.S. Singh, Member PAMC and Dr. D.K. Yadav, ADG (seeds). Dr. S.K. Vasal emphasized the need of germplasm management system for proper categorization of germplasm, gene pool determination and heterotic grouping of the germplasm. Dr. D.K. Yadava, ADG (Seeds), ICAR emphasized to strengthen the work on biotic and abiotic stresses and also underlined the need to popularize bio-fortified hybrids among the farmers through various means. Dr. I.S. Singh also reiterated that germplasm strengthening is the foundation of breeding programme, hence more and more efforts need to be given towards line development, their evaluation, seed and pollen parent classification, heterotic grouping and seed production research. Director, IIMR informed that the heterotic grouping task of 716 maize inbred lines is in advance stage using both test cross and DArT markers. Promotion of entries were finalized in the session. The section of Agronomy and Outreach was chaired by Dr. S.K. Chaudhary, DDG (NRM), ICAR and Dr. S. Bhaskar, ADG (Agronomy & AF), ICAR. Chairman emphasized that weed is the main problem in kharif maize and more chemicals are to be tested for post emergence weed control. Dr. Bhaskar also put emphasis on integrated weed management and need to study the water use efficiency and calculate requirement of water in comparison to rice particularly in IGP. Chairman and co-chairman appreciated the TSP and SCSP programme of the institute and urged scientists to put more emphasis on capacity building under these programmes. Total 9 agronomy trials were decided for kharif, 4 for rabi and 3 for spring. The Plant Protection section was chaired by Dr. P.N. Sharma and Dr. Jella Satyanaryana, members, PAMC. Dr. Sharma urged the need on dedicated resistance breeding and race identification for the different pathogens. Dr. Satyanaryana also urged scientists for insect-resistant breeding. In kharif pathology 9 trials will be executed, while in rabi season two trials and one in spring will be conducted. In Entomology the corresponding numbers are 7, 15 and two.

The session IV was also chaired by Dr. H.S. Gupta & Dr. S.K. Vasal and co-chaired by Dr. Sujay Rakshit, Director, ICAR-IIMR. Dr. Firoz Hussain, In-charge AICRP, Delhi delivered a lecture on “*Molecular Breeding of Quality Traits in Maize*” and Dr. John Joel, TNAU presented a lecture on “*Molecular Breeding to Develop Low Phytic Acid in Maize*”. The session V was chaired by Dr. K. Srinivas, ADG (IPTM), ICAR and Co-chaired by Dr. Sujay Rakshit. Dr. Ramesh Kumar, Nodal Officer, AICRP on maize presented the monitoring reports. He informed the house that 14 monitoring teams monitored the AICRP trials virtually. It was decided that the rabi and spring trials will also be strictly monitored from coming seasons. Geo-tagging of the FLDs for easy and effective monitoring was agreed upon. The session VI was chaired by Dr. J.P. Mishra, ADG (IR). Dr. P.H. Zaidi presented the progress report of ICAR-CIMMYT collaborative projects including sponsored project on Heat Tolerant Maize for Asia (HTMA). It was informed to the house that there is an increased allocation for maize in CIMMYT, which needs to be deployed in the collaborative research between ICAR-IIMR and CIMMYT. More tangible contribution from CIMMYT to NARS in physical terms like infrastructure etc. are to be visible. FAW screen house at the Winter Nursery Centre, Hyderabad will be established by CIMMYT at the earliest. DH facility being established at Kunnigal, Karnataka will be extended to ICAR-IIMR and AICRP partners.

Session VII was on combined work plan for 2021-22 under the chairmanship of Dr. H.S. Gupta and Dr. S.K. Vasal. PI's of different discipline presented the work plan in their respective discipline for 2020-21. It was agreed that the Tryptophan content in QPM should be increased from 0.60% to 0.65% in the current year and then 0.70% so that more nutritious food to the end user may be provided. Locally available/location specific ITKs are to be evaluated for the management of FAW.

During Session IX the PAMC meeting was held with the Director and all PI's were also present. It was decided that all centers should not work on all aspects and specific objectives for each centre is to be decided. Systematic work on resistance breeding is the need of the hour. Advanced and potential centers in every zone were identified. More facilities may be provided to these centres and the advance centres should hand hold the potential centers to develop further. Director of ICAR-IIMR should be a member of the Executive Committee of BISA for better coordination on maize research. A regional center of ICAR-IIMR needs to be established in Karnataka for which the State Government has agreed to provide land.

Session X on Panel Discussion on "Prospect of Bt transgenic at BRL 1 or 2 to be tested for their efficacy against FAW" was chaired by Dr. T.R. Sharma, Hon'ble DDG (CS). Dr. A.K. Singh, Director, IARI, Dr. Y.P. Singh, ADG (FFC), Dr. S.C. Dubey, AGD (PP), Dr. B.M. Prassana, Global Director CIMMYT & CGIAR Research Program on Maize, Dr. N.S. Bains, Director Research, PAU, Dr. Subhra Chakraborty, Director, NIPGR and representatives from private companies, viz., from M/s Bioseeds, M/s Corteva, M/s Mahyco, M/s Rallies India and M/s Bayer Crop Sciences were the panellists. Dr. B.M. Prassana gave an overview on the current scenario of Bt maize around the world against management of FAW. Better understanding of FAW population dynamics and resistance population across Asia will guide the future FAW response strategies. Pyramiding of events and resistance management came out key to manage FAW in a durable manner using GM technology.

Session XI on "Review of work during kharif 2020 and rabi 2019-20 and work plan 2021-22" was also chaired by Dr. T.R. Sharma, DDG (CS) and co-chaired by Dr. Y.P. Singh, ADG (FFC). Dr. Sujay Rakshit, Director, ICAR-IIMR presented the Director's report with major achievements of 2020 of the AICRP on Maize and the institute. He informed the house that ICAR-IIMR scientists has published their research in high impact factor journals like Scientific Reports, Planta, BMC-Genomics etc. DDG congratulated the scientists and director for publishing in very high rated journals when the institute is in developing phase. Eight technical bulletins and a leaflet were released on the occasion. All the PI's presented the progress report of their respective discipline. The success rate of trials were 90% in kharif, whereas it was 96% in case rabi. First time the entries for Low

Phytic Acids were also tested and promoted. In specialty corns also a few sweet corn hybrids namely CP Sweet 2, CPSC 301, DSCH340, FSCH 131, and FSCH 144 with good sweetness and higher yield were promoted. In baby corn first CMS based public bred hybrid completed the AICRP testing and available for identification. The maize group has achieved the target of breeder seed and enough breeder was produced to supply to comply the different MoU's also. In crop production Atrazine @ 1.5 kg/ha pre-emergence followed by Tembotrione (Laudis) @ 120 g/ha at 25 DAS or Topramezone @ 25.2 g/ha at 25 DAS were found effective for weed management in kharif maize. In crop protection Dr. Azoxystrobin 18.2 w/w + Difenoconazole 11.4% w/w SC @ 0.10% spray at 3 days and 18 days after inoculation, Tebuconazole 250 EC @ 0.1% at 30 and 45 days after sowing, *Allium sativum* (Garlic) bulb @ 10% @ 35, 45 and 55 days after sowing were best against control of TLB. Pyraclostrobin 133g/lt + Epoxyconazole 50g/lt @ 0.15 % spray at 3 days and 18 days after inoculation was best against control of MLB. For management of FAW Cyantranilprole 19.8% + Thiamethoxam 19.8% @ 4 ml/kg seed was found effective as seed treatment up to 14 DAG. The Frontline Demonstrations (FLDs) under NFSM was undertaken in 281.23 ha in collaboration with various AICRP on Maize centers throughout the country in the three cropping seasons (*Kharif, Rabi and spring*) of maize. A total of 753 farmers were benefited from the FLD. Beside this, under the STC programme, 238.77 ha were covered under FLD benefiting 741 farmers. Further, a total of 68 training/field day/awareness programmes were conducted in different parts of the country on various aspects of scientific maize cultivation under STC, SCSP and NEH programmes benefiting 3530 farmers. More than 1400 farmers were also benefitted from various inputs distribution programmes. The NEH programme a project on "Maize for Sustainable Livestock Production" has been implemented to assess the effect of supplementation of QPM maize fodder and silage on production performance in pigs and yaks were evaluated under this programme.

The major recommendations of the workshop are given below:

1. Popping percentage and volume are highly influenced by moisture content. It should be calculated at 13% grain moisture content. Expansion ratio is required as 15 times or more centres need to submit the volume data before and after popping. Accordingly, the datasheet will be changed.
2. ICAR Research Complex for NEH will take up the early and medium maturity kharif trials at Arunachal Pradesh, Mizoram, Sikkim and Nagaland as voluntary centers.
3. Kharif sowing in NEH region particularly Arunachal Pradesh, Meghalaya, Manipur, Mizoram and Sikkim centers will be taken up during 2<sup>nd</sup> fortnight of April. Therefore, seeds of trial should reach in first fortnight of April for timely plating of trials.
4. Considering the elevation, Gossaigoan will be a part of Zone III and the sowing of the kharif trials (early and medium) will be taken up in August-September. Similarly, Nagaland (ICAR Research Complex) with similar altitude of Gossaigoan will be part of Zone III and the sowing time will be in May-June.
5. Zone II, III and V have less number of centres. In these zone private sector centres will be included as testing centres to evaluate AICRP entries.
6. AICRP centres at Punjab, Haryana and Uttarakhand will take up only *spring* trials and no *rabi* trials will be taken up by these centers.
7. For estimation of quality parameters in quality breeding trials same protocols are to be followed at both IIMR HQ and IARI New Delhi. For example, for lysine and tryptophan estimation, colorimetric method will be followed. For Pro-vit A content is to estimated using HPLC/UPLC. Uniform standard curve should be followed.
8. Centre-wise priorities are to be defined so that all the centres should not work on all aspects of maize improvement.
9. Maintenance of Pedigree is very important and breeders should not change the name of line or pedigree and due credit should be given to the original developer. All centre should follow an uniform pattern of coding their hybrids and parental lines, prefixed with the centre code as given in Annexure I. A database may be developed to track the materials and their pedigree at the institute and AICRP level.

10. Hybrid seed production of public hybrids should be promoted by signing more MoUs with private seed companies. Revolving Fund for seed production should be provided to ICAR-IIMR to support the seed production of maize hybrids.
11. In the SVRC meeting, the representative from IIMR may be invited particularly when there is proposals on maize.
12. For calling any entry QPM 0.65% tryptophan will be considered for 2022 which will be enhanced to 0.70 % in 2023 onwards instead of current level of 0.6%.
13. Colorimetric methods are to be used for the estimation of essential amino acids such as lysine and tryptophan across different analytical laboratories. For other quality parameters also both labs at ICAR-IIMR and ICAR-IARI should use same protocol and same standard curve.
14. Efforts need to be made in standardizing disease screening at seedling stage, which may be correlated with currently used adult plant based field screening.
15. Race identification of maize pathogens should receive priorities.
16. Host plant resistance-based approaches including genome editing and genetically modified technologies are to be focused on for the sustainable management of FAW. To develop the transgenic maize, instead of focusing on a single gene, introgression of two or three genes together (stacked genes/pyramided genes) to be taken up for durable resistance against FAW.
17. In TSP programme, capacity building and training of at least 25 farmers in each block would be imparted. This will be documented in success stories.
18. Monitoring of outreach activities should be done separately and a separate monitoring team may be constituted apart from AICRP team. Use of geo-tagging of FLDs will be adopted for effective monitoring of FLD under NFSM/TSP/SCSP/NEH.
19. Disease screening, which is being carried out independently by both ICAR-IIMR and CIMMYT with same AICRP centre have to be combined into one trial. CIMMYT will provide the detailed statistical data for compilation in annual report of AICRP on Maize.
20. Source of tolerant lines identified in the screening are to be reported by CIMMYT in the AICRP Annual Report. It was decided that emphasis will be more on biotic and abiotic stresses including water logging apart from high temperature and drought tolerance.
21. BISA at Ludhiana, Samastipur and Jabalpur should contribute more towards maize development rather focusing on wheat and rice. These centres of BISA will take up AICRP trials free of charge under technical guidance from ICAR-IIMR/AICRP on Maize. Director ICAR-IIMR needs to be part of Executive Committee of BISA.
22. There has been an increased allocation for maize in CIMMYT, which needs to be deployed in the collaborative research between ICAR-IIMR and CIMMYT. More tangible contribution from CIMMYT to NARS in physical terms like infrastructure etc. are to be visible. CIMMYT may help in genotyping of NARS lines as well. FAW screen house at the Winter Nursery Centre, Hyderabad will be established by CIMMYT at the earliest. DH facility being established at Kunnigal, Karnataka should be extended to ICAR-IIMR and AICRP partners.

## Detail Proceedings of the 64<sup>th</sup> Annual Maize Workshop (Online)

**Day I: May17, 2021**

### Session I&II: Scientific audit of achievements and work plan of AICRP on maize centres during 2020-21

Chairpersons	Co-Chairman	Experts	Rapporteurs
Dr. S.K. Vasal, World Food Laureate Dr. H.S. Gupta, Chairman, PAMC, AICRP on Maize	Dr. Sujay Rakshit, Director, ICAR- IIMR	Dr. I.S. Singh, Member (Breeding), PAMC Dr. P.N. Sharma, Member (Pathology), PAMC Dr. Jella Satyanarayana, Member (Entomology), PAMC	Drs. K.R. Yathish, Krishnan Kumar, Bhupender Kumar, and B. S. Jat

Dr. Sujay Rakshit, Director, ICAR-IIMR welcomed the chairpersons and members of PAMC and other participants. Dr. S.K. Vasal highlighted the importance of development of multi-parent source populations, heterotic pools, grouping of inbred lines based on heterotic behaviour, recycling of inbred lines within the heterotic group and identification of new testers and inbred lines with better productivity. Dr. H.S. Gupta, Chairman, PAMC complimented the maize fraternity for developing technology for achieving more than 30 million tonnes of maize. He reminded the bigger challenge to double the production by 2025. Current increase in production could be reached by both horizontal as well as vertical expansion of growth. However, to reach the target attention is to be given in increasing input use efficiency and improving the nutritional status through bio-fortification. One of the major challenges is seed production, only 25 to 30% is under single cross hybrid cultivation and remaining is under multiparent hybrids OPVs and landraces. North India is facing depleting ground water problem so policy makers are advising to replace rice with maize, because of its high productivity and less water requirement when compared to rice. With these challenges, road map can be set for coming years with no stone unturned to achieve these objectives.

This was followed by centre-wise presentation. Major observations/comments were as follows:

1. **Srinagar:** Four maize cultivars were released by the center, one identified for release and two entries promoted to AVT I during the reporting period. Center has shared more than 300 lines with different centers. The work done by the centre was appreciated. The centre has released most of the cultivars through SVRC, however, Chairman emphasized the need to develop hybrids which should be released by CVRC for NHZ.
2. **Kangra:** Centre focussed on development of early and medium maturity hybrids and presently one hybrid is in AVT II. They are also trying to group their lines into two heterotic groups by crossing available materials with V 341 and V 346. The centre was advised to focus more on development of hybrids for NHZ which should be released by CVRC. Director suggested the center to focus on the QRT recommendations and follow the template of presentation.
3. **Almora:** Centre is having the DH facility and producing around 1000 DH lines in a year. Four hybrids from the center were commercialized, one hybrid notified and seven entries are promoted in AICRP trials. The work done by the centre was appreciated. They were suggested to put their efforts on developing base populations. Centre should share their materials with other AICRP centres and institutes with proper agreement.
4. **Barapani:** Centre is conducting FLDs, TSP and SCSP programme successfully in NEH region. Around 110 fixed lines being maintained at the centre. The committee advised the center to work in a focused manner

and should utilize their budget properly. It was found that the centres In-charge was not drawing salary from AICRP. This needs to be rectified and the Director should write to the Vice Chancellor to appoint centre In-charge from AICRP staff only.

5. **Gossaigoan:** Centre conducted FLDs in 10 ha. Nine new hybrids have been evaluated in station trial. Performance of the centre is quite poor. Trial execution and quality of data was found very poor. Compliance for administration is not properly followed by this centre. The centre has no active breeding programme, which is a matter of concern.
6. **Imphal:** Centre is conducting FLDs, TSP and SCSP programme successfully in NEH region. The center has found three hybrids suitable for NEH region. Budget utilization needs to be improved. Focus is to be given to develop own breeding programme.
7. **Bajura:** 12 hybrids and two composites are in AICRP testing. Centre actively involved in heterotic grouping of their early and medium maturing lines with different testers. They have developed around 40 lines through DH technology. The work done at the centre is well appreciated by the committee.
8. **Ludhaina:** Two hybrids and three composites were released and six promising hybrids are in different stages of AICRP testing. The work done at the centre was appreciated. Efforts are to be made to realize maize yield on par with the income from rice so that replacement of rice-based cropping pattern could be done on priority. Emphasis should be given to develop hybrids with wider adaptability.
9. **Karnal:** Three hybrids are promoted to AVT 1 stage and more than 100 new crosses were made to develop new hybrids. Though the centre is working well they need to focus on seed production. Checks seeds should be provided timely for smooth constitution of AICRP trials. The centre was suggested to diversify the QPM germplasms.
10. **Delhi:** One baby corn hybrid released during the reporting period and 11 entries are in different stages of AICRP testing. More than 600 new hybrids were tested in station trials and more than 900 new crosses were attempted during this year. Work carried out by the centre was appreciated.
11. **Pantnagar:** Three hybrids were released, one identified for release and seven entries are in different stages of AICRP testing during the reporting period. Teosinte derived maize lines are under investigations for identification of resistance sources for BLSB, PFSR and FAW. The progress of work was satisfactory.
12. **Varanasi:** One QPM hybrid identified for central western zone and centre is involved in making heterotic grouping of around 60 lines with LM 13 and LM 14. Emphasis should be given on hybrid development with wider adaptability.
13. **Dholi:** Two hybrids released by the centre during the reporting period. Around 580 new crosses were made, 445 fixed lines available and 190 breeding lines shared with other partners. Chairman expressed his concern about the executions of trials. Except the entomology, quality of data for rest of the trails is very poor.
14. **Sabour:** Three entries are in AICRP testing and more than 200 fixed lines are being maintained at this centre. Performance of centre is very poor. Breeding and pathology trials are not properly conducted and data not properly recorded. Coordination with ICAR-IIMR is found to be very poor. Pathologist reported no occurrence of disease in the centres, which is difficult to accept.
15. **Ranchi:** Two hybrids are contributed for AICRP testing and two inbreds *viz.*, BAUIM 1 and BAUQIM 1 under the process for registration with NBPGR. The house expressed his concern on the performance of centre, quality of data and trial execution.
16. **Kalyani:** Centre is conducting FLDs, TSP and SCSP programme successfully in this region. Good work is carried out by the centre. Since the state is important for hybrid seed production, centre may be further strengthen and properly utilized.
17. **Bhubaneshwar:** One hybrid released during the reporting period and six entries are in different stages of AICRP testing. Performance of the centre was satisfactory. They were advised to acknowledge National maize programme for obtaining the germplasm and due credit for germplasm sharing need to be given. The centre was suggested to understand the heterotic behaviour of the lines with the centre using LM 13 and LM

- 14 as testers. Relations of these testers with the CIMMYT testes being used by the centre are also to be deciphered.
18. **Baharaich:** The centre has conducted 20 trials and maintaining around 200 inbred lines. Centre has not presented the progress report during the session
  19. **Peddapuram:** Centre has contributed two promising hybrids in AICRP medium trials. Besides, 311 new field corn hybrids were tested under station trials. They are maintaining 250 diverse inbred lines. The progress of work found satisfactory, however, committee emphasizes the centre to further diversify their germplasm base for strengthening their hybrids breeding programme.
  20. **Hyderabad:** In the development, evaluation and maintenance of inbred lines and their utilization in the breeding programme, the centre has developed 14 (Normal Corn), 22 (Sweet Corn) lines. The centre identified three promising maize inbred lines against *C. partellus*, four against *FAW* and 69 against *Macrophomina phaseolina* (charcoal rot). Four hybrids have been contributed in AICRP trials in which one promoted to AVT II and three promoted to AVT I. The centre has shared 50 inbred lines with different centers. Work being carried out at the centre was appreciated.
  21. **Karimnagar:** The work done by the centre was appreciated by the chairman and other members. On the submission of request by Dr. J. C. Sekhar, the chairman urged upon to the AICRP centers growing their materials in WNC that due recognition should be given to the IIMR staff for providing the maize germplasm and other off-season facilities at WNC.
  22. **Coimbatore:** The centre has released five hybrids at central level and one hybrid at State level. In the last five years, total of 20 lines were identified for charcoal rot resistance and five for drought tolerance. These lines are being utilized in the development of new single cross hybrids. As per QRT recommendation the centre is focusing on the development of high yielding medium and long duration normal maize hybrids for *Kharif* and *Rabi* seasons. One promising hybrid has been promoted to AVT I in Zone III (NEPZ), IV (PZ), V (CWZ) and twelve hybrids were nominated in NIVT for testing. The Centre has shared 6 breeding lines with other centers. Work being carried out at the centre was appreciated.
  23. **Vagarai:** The work done at the centre was appreciated. One entry of the centre has been promoted to AVT I (NWPZ). The centre has contributed one promising hybrid for NIVT testing in AICRP trials and shared two inbred lines with different centers. The centre has also identified two lines against drought stress in multi-location testing and evaluated 54 new hybrids in station trials for different types of corn.
  24. **Dharwad:** As per QRT recommendation the centre has initiated work on the development of medium and long duration hybrids. During *Kharif* 2020, center has contributed three hybrids in full season and one in medium maturity. The centre has released one single cross maize hybrid named as GPMH-1101 through SVRC during 2018. The centre tested total of 295 new hybrids in their station trials for field corn, QPM, baby corn, sweet corn and popcorn. The centre was advised to focus more on development and strengthening of their own germplasm and hybrids. Further, they were advised to intimate Director IIMR for taking CIMMYT trials and also to share their details before planting. Chairman also advised that any kind of material CIMMYT wants to evaluate at different AICRP centers, first they need to send the list of trials to IIMR for taking their inputs. Chairman also advised that center should try to release hybrids through CVRC. The work done at the centre was satisfactory.
  25. **Mandya:** As per last QRT recommendation the centre has developed 430 normal maize inbreds for different traits and 58 specialty corn inbreds (SC 20, BC 8, PC 24, QPM 6) and shared 44 breeding lines with different centers. The centre has developed and maintained 10 inbreds lines against SDM resistance and tested 113 new hybrids in their station trials. The centre is also working on maize value-added products and has developed 47 different maize value added products. The work done by the centre was much appreciated. The Chairman suggested that centre should emphasize on releasing hybrids through CVRC.
  26. **Kolhapur:** FLDs, TSP and SCSP programme have been successfully conducted by the centre. The centre is maintaining 396 lines for their breeding programme. They are involved in hybrid seed production with the Rahuri centre. During the year 2020, center has contributed six entries (four in field corn and two in QPM)

in NIVT testing. They have evaluated 101 new hybrids in station trials and attempted 1196 new crosses. The overall work being carried out at the centre was found satisfactory.

27. **Rahuri:** The centre is evaluating normal and specialty maize hybrids for *Kharif* and *Rabi* season and involved in hybrid seed production with the Kolhapur centre. One promising hybrid has been contributed in AICRP trials. Total 210 new hybrids were tested in station trials and shared 63 inbred lines with Buldhana centre. The progress of work found satisfactory. However, the committee advised to strengthen their own maize programme.
28. **Ambikapur:** The progress of work found satisfactory. The center has released one fodder maize variety. They were advised to take the seeds production and popularization of IIMR and other AICRP partners hybrids till they get their own genotypes for the state.
29. **Chindwara:** As per the QRT recommendations for the development of medium to long duration cultivars, the centre has released two maize hybrids and one composite at state level by SVRC viz., Pusa Jawahar Hybrid Maize 1 (PJHM 1), Jawahar Makka-1, and Jawahar maize-218. Under Tribal Sub Plan (TSP), center has shared seed & printed literatures to 200 Tribal farmers. The progress of work found satisfactory. As the Chindwara is a potential maize belt so the Chairman advised the centre to popularize the bio-fortified hybrids developed by IARI and IIMR in their tribal belt.
30. **Udaipur:** The centre has released one hybrid and contributed six new in AICRP trials during 2020-21. They have evaluated, total of 180 hybrids in their station trials. The centre has shared 20 breeding lines to Banswara centre. The work being carried out at the centre was appreciated.
31. **Banswara:** Two hybrids were released such as Pratap Raj hybrid maize (WH) 1095 for *Kharif* season and Pratap Raj hybrid maize (WH) 1010 for *Rabi* season. Ten new hybrids were tested under station trials. The centre has also developed resource conservation technologies for different cropping systems. The progress of work found satisfactory.
32. **Godhra:** The centre has released two specialty maize hybrids viz., GASCH11 (Sweet corn hybrid) and GAPCH21 (Popcorn hybrid). One hybrid has been promoted to AVT I. They have tested 107 new hybrids in their station trials. The progress of work found satisfactory.

## Recommendations

- Introgression of temperate and sub-tropical germplasm into tropical material should receive importance.
- Centre-wise priorities are to be defined so that all the centres should not work on all aspects of maize improvement.
- The performance of the centers in Zone III (NEPZ), particularly Dholi, Sabour and Ranchi may be reviewed seriously in coming years as their performance was not satisfactory.
- Maintenance of Pedigree is very important and breeders should not change the name of line or pedigree and due credit should be given to the original developer.
- Centre-wise priorities are to be defined. All the centers should not work on all aspects of maize improvement. Some centers should assign the work on QPM, specialty corn and other centers on normal field corns. There is need to share the material developed by the established centre to the other for strengthening their breeding programme.
- Hybrid seed production of public hybrids should be promoted by signing more MoUs with private seed companies. Chairman and experts appreciated the Director ICAR-IIMR, for commercialization of their hybrids.
- Standard nomenclature procedure for newly developed and release hybrids and parental lines from all the centers is to be followed (which is detailed in Annexure I).
- In the SVRC meeting, the Director or his representative from ICAR-IIMR should be invited particularly when there is proposal on maize.

## Session III Formulation of Work Plan (Concurrent Session)

### A. Breeding

Chairpersons	Co-Chairman	Experts	Rapporteurs
Dr. S. K. Vasal, World Food Laureate Dr. H.S. Gupta, Chairman, PAMC, AICRP on Maize.	Dr. I.S. Singh, Member (Breeding), PAMC Dr. D.K. Yadav, ADG(Seeds), ICAR	Drs. Sujay Rakshit, SB Singh, N. Sunil, Ramesh Kumar, Chikkappa G.K. & Bhupender Kumar	Drs. A.K. Das, M.C. Dagla & Seema Sheoran

The session was attended by 79 participants online. Chairperson, Dr. S. K. Vasal emphasized that efforts need to be directed towards germplasm management system for proper categorization of germplasm, gene pool determination and heterotic grouping of the germplasm. A well-established method for classification of germplasm in seed and pollen parents can help to reduce the male: female ratio in the hybrid seed production block. Further, simplification of operation in cost effective manner is the need of the hour. Dr. H S Gupta emphasized that maize with 4% growth rate, highest among all the cereal, did very well in last two decades. However, to achieve the target of 58-60 mt by 2025 sufficient fund should be provided to the maize research. Germplasm is the very basic building block of maize hybrid breeding, so the free flow of genetic material without any hurdle from CIMMYT/NBPGR must be ensured. Though SCH are being promoted, still there is 50-60% area is under other cultivars, so increased production of parental lines of hybrids, their commercialization and seed production research need be initiated. Dr. D K Yadava, ADG (Seeds), ICAR, emphasized to strengthen the work on biotic and abiotic stresses and also stressed on the popularization of bio-fortified hybrids among the farmers through various means. Dr. I.S. Singh also reiterated that germplasm strengthening is the foundation of breeding programme, hence more and more efforts need to be given towards line development, their evaluation, seed and pollen parent classification, heterotic grouping and seed production research. Director, IIMR informed that the heterotic grouping task of 716 maize inbred lines is in advance stage using both test cross and DArT markers.

### The following decisions were taken

- *Promotion of entries:* The list of promoted entries was mailed to all and put in the institute website. Feedbacks of the contributors were invited. After thorough discussion the list were accepted and details are given in Annexure II.
- For NIVT existing practice of calculating grain yield based on plot cob weight, moisture and shelling percentage of 10 random cobs will continue. However, for AVT I and AVT II trials all the cobs will be shelled and plot grain yield will be estimated based on total grain weight and adjusted using moisture content.
- Zone II, III and V have less number of centres. In these zone private sector centres will be included as testing centres to evaluate AICRP entries. Details are given in Annexure II.
- For calling any entry QPM 0.65% tryptophan will be considered for 2022 which will be enhanced to 0.70 % in 2023 onwards instead of 0.6%.
- For estimation of quality parameters in quality breeding trials same protocols are to be followed at both IIMR HQ and IARI New Delhi. For example, for lysine and tryptophan estimation, colorimetric method will be followed. For Pro-vit A content is to estimated using HPLC/UPLC. Uniform standard curve should be followed.
- Popping percentage and volume are highly influenced by moisture content. It should be calculated at 13% grain moisture content. Expansion ratio is required as 15 times or more centres need to submit the volume data before and after popping. Accordingly, the datasheet will be changed.
- New checks to be included and old one are to be phased out as follows:
  - LQMH1 (IMHQPM 1530, IQMH 202 and IQMH 203 in QPM trial from next year
  - LPCH3 (IMHP1540) in popcorn trial
  - Shalimar popcorn to be dropped as check in popcorn trial.

- VL Amber Popcorn and Vivek QPM 9 will remain check for next two years, thereafter it will be discontinued.
- ICAR Research Complex for NEH will take up the early and medium maturity kharif trials at Arunachal Pradesh, Mizoram, Sikkim and Nagaland as voluntary centers.
- Kharif sowing in NEH region particularly Arunachal Pradesh (ICAR Research Complex), Meghalaya (Barapani), Manipur (Imphal), Mizoram (ICAR Research complex), Sikkim (ICAR Research complex) centers will be taken up during 2<sup>nd</sup> fortnight of April. Therefore, seeds of trial should reach in first fortnight of April for timely plating of trials.
- Considering the elevation, Gossaigoan will be a part of Zone III and the sowing of the kharif trials (early and medium) will be taken up in August-September. Similarly, Nagaland (ICAR Research Complex) with similar altitude of Gossaigoan will be part of Zone III and the sowing time will be in May-June.

### **B. Agronomy & Outreach**

<b>Chairpersons</b>	<b>Co-Chairman</b>	<b>Conveners</b>	<b>Rapporteurs</b>
Dr. S.K. Chaudhary DDG(NRM), ICAR	Dr. S. Bhaskar, ADG (Agronomy &AF), ICAR	Dr. A.K. Singh, PI(Agronomy) & Dr. S.L. Jat, PI (Outreach)	Drs. Seema Sepat, Romen Sharma & Priyajoy Kar

The online meeting was attended by 59 scientists through video conferencing. There were two presentations made on the achievement during 2020-21 on Agronomy by Dr. A.K. Singh and on outreach by Dr. S.L. Jat as PI of the respective programme. The work plan of agronomy and outreach was also discussed and formulated for 2021-22. In agronomy, 10 trials having 135 experiments were carried out to develop production practices in maize for various agro-ecologies.

The following recommendations emerged out of these experiments:

- In Ecological intensification, best treatment (N:P:K: 150:64:113+mulch @ 6t/ha) recorded higher maize and wheat (N:P:K: 140:60:68+mulch @ 6 t/ha ) grain yield and high net returns.
- Post emergence application of Topramezone 25.2 g/ha+Atrazine 750g/ha at 2-5 leaf stage 15 DAS found comparable with post emergence application of Tembotrione (120 g/ha) + Atrazine (750 g/ha) in maize.

Following decisions were taken

- A total of 10 agronomic trials are to be implemented in kharif 2021, rabi 2021-22 and spring 2022 which includes two new experiments for enhancing sustainability of baby corn based intensive cropping system and one for water use efficiency.
- Integrated weed management programme for maize need to be tested instead of proposed testing of only herbicides for economical weed management strategies in maize based cropping system.
- In outreach programme, 300 ha frontline demonstrations (FLDs) under NFSM were conducted. In this, baseline survey of the farmers should be conducted and typology of farmers can be identified with due consideration of socio-economic status of the farmers and biophysical indicators. In this regard, ICAR-IIMR, Ludhiana on cropping system research should consult ICAR- IIFSR, Modipuram.
- In TSP programme, capacity building and training of at least 25 farmers in each block would be imparted. This will be documented in success stories.
- Details of agronomy trials in 2021-22 are given in Annexure III and Outreach in Annexure IIIa.

### **C. Plant Protection**

<b>Chairperson</b>	<b>Convener</b>	<b>Rapporteurs</b>
Dr. P.N. Sharma, Member, PAMC (Pathology) Dr. Jella Satyanaryana, Member, PAMC (Ento)	Dr. J.C. Sekhar, PI (Plant Protection)	Drs.Suby SB, Lakshmi P Soujanya & SK Aggarwal

Total 34 scientists attended the group meeting. Dr. J.C. Sekhar, PI, Crop Protection welcomed the participants and briefed about the pathology and entomology plan of work for *kharif* 2021, *rabi* 2021-22 and spring 2022 along with new initiatives on multi-disease and pest screening. Pathology and Entomology plan of work for *kharif* 2021, *rabi* 2021-22 and spring 2022 was followed by deliberations and discussions. It was suggested that all the germplasm developed and available including land races shall be screened in few locations in a systematic programme i.e. 100 lines/year. The disease (TLB, MLB)/insect resistance status of Indian germplasm will have to be properly documented. First these are to be screened under field conditions with artificial infestation/inoculation in hot spot locations. The best entries will be confirmed under artificial inoculation techniques in a few locations which have the screen house facilities. The identified materials are to be provided to the breeders for maize improvement programme. Discipline-wise decisions are as follows:

**a. Entomology**

- The data generated in the concluded experiments of Entomology and Pathology to be published.
- State wise integrated crop management booklet/ready reckoner need to be brought out by considering the pest succession data recorded.
- Insecticide Spinosad to be included along with other insecticide molecules for the management of FAW.
- Locally available/location specific ITK technologies to be evaluated for the management of FAW and the doses need to be clearly defined.
- Data on natural enemies to be taken in insect pest succession studies.
- Wild boar damage in various places needs to be assessed and incorporated in IPM package. Technologies developed on wild boar management by AINP on Vertebrate Pest Management, PJTSAU to be validated in wild boar problem centers.
- Details of Entomology trials in 2021-22 are given in Annexure IV.

**b. Pathology**

- Development of differential set for different diseases: Focus must be on major disease like TLB and MLB. For MLB Dr. Robin Gogai can include other centres to study racial pattern at broader level.
- For the development of indigenous differential set, select a panel of 15-20 resistant lines found resistant in different locations and screen with diverse isolates. Diversity of pathogen and genetic makeup of lines can be worked out afterward using the characterized virulence/ pathotypes.
- Import differential set of TLB to identify the pathogenic variability in Indian populations.
- Studies on the genetics of resistance of disease (TLB, MLB)/insect in collaboration with breeders and mechanisms of resistance in selected germplasm need to be initiated.
- Details of Pathology trials in 2021-22 are given in Annexure V.

**Session IV: Discussion on Quality Breeding**

<b>Chairman</b>	<b>Co-chairman</b>	<b>Speaker</b>	<b>Rapporteurs</b>
Dr. S.K. Vassal, World Food Laureate Dr. H.S. Gupta, Chairman PAMC of AICRP on Maize	Dr. Sujay Rakshit, Director, ICAR-IIMR	Dr. Firoz Hussain Dr. John Joel	Drs. Dharam Paul, Bharat Bhushan and Alla Singh

Dr. Firoz Hussain made an elaborative presentation on "Molecular Breeding of Quality Traits in Maize". He discussed the molecular approaches to enhance the quality traits including essential amino acids, provitamin A components and vitamin E. The young scientists were urged to adopt the newest molecular tools towards improvement of quality traits in maize. The second presentation was made by Dr. John Joel on "Molecular Breeding to Develop Low Phytic Acid in Maize". The importance of low phytic acid and the technology to

reduce this anti-nutritional component in order to enhance the availability of micronutrients were discussed at length. The following decisions were taken in the discussion followed:

1. Colorimetric methods are to be used for the estimation of essential amino acids such as lysine and tryptophan across different analytical laboratories.
2. The threshold concentration of tryptophan in the endosperm protein is to be enhanced from the present 0.6% to 0.65% immediately and then to 0.70% in the next two years in order to designate maize hybrids as QPM.
3. Same standardisation protocols are to be used for the estimation of pro-vitamin A components through HPLC/UPLC across different analytical laboratories
4. Estimation of iron and zinc is to be explored from different analytical laboratories.

#### Session V: Presentation of monitoring reports

Chairpersons	Co-Chairman	Presenter	Rapporteurs
Dr. K. Srinivas, ADG (IP&TM), ICAR	Dr. Sujay Rakshit, Director, ICAR-IIMR	Dr. Ramesh Kumar, Nodal officer, AICRP	Drs. S.L. Jat & K.R.Yathish

#### Comments or Recommendations:

- All the centers are to submit data on time and more emphasis should be given to utilize the budget fully and properly.
- Dholi and Sabour centers did not responded at the time of presentation.
- There is a need to monitor *rabi and spring* trials of AICRP. Voluntary centers are also to be included in the monitoring.
- Punjab, Haryana and Uttarakhand regions will take up only *spring* trials of AICRP and no *rabi* trials will be taken up by these centers.
- Monitoring of outreach activities should be done separately and a separate monitoring team may be constituted apart from AICRP team. Use of geo-tagged picture technology for monitoring of FLD under NFSM/TSP/SCSP/NEH needs to be explored and used
- Monitoring team report should also go to all PIs.

#### Session VI: ICAR-CIMMYT International Collaborative Research

Chairperson	Presenter	Rapporteurs
Dr. JP Mishra, ADG(IR), ICAR	Dr. PH Zaidi, CIMMYT	Drs. N. Sunil & Seema Sepat

Dr P.H. Zaidi from CIMMYT presented the various ICAR-CIMMYT collaborative projects including Heat Tolerant Maize Asia (HTMA). The following points came out of the discussion:

- Disease screening, which is being carried out independently by both ICAR-IIMR and CIMMYT with same AICRP centre have to be combined into one trial. CIMMYT will provide the detailed statistical data for compilation of annual report of ICAR-IIMR.
- Source of tolerant lines identified in the screening are to be reported by CIMMYT in the AICRP Annual Report. It was decided that emphasis will be more on biotic and abiotic stresses including water logging apart from high temperature and drought tolerance.
- BISA at Ludhiana and Jabalpur should contribute more towards maize development rather focusing on wheat and rice. In this direction, Director IIMR, Ludhiana need to be part of Executive Committee of BISA.
- There has been an increased allocation for maize in CIMMYT, which needs to be deployed in the collaborative research between ICAR-IIMR and CIMMYT. More tangible contribution from CIMMYT to NARS in physical terms like infrastructure etc. are to be visible. CIMMYT may help in genotyping of NARS lines as well. FAW screen house at the Winter Nursery Centre, Hyderabad will be established by CIMMYT at the earliest. DH facility being established at Kunnigal, Karnataka should be extended to ICAR-IIMR and AICRP partners.

## Session VII Finalization of Work Plan 2021-22

Chairperson	Co-Chair	Rapporteurs
Dr. S. K. Vasal, World Food Laureate Dr. H.S. Gupta, Chairman, PAMC, AICRP on Maize	Dr. Sujay Rakshit, Director, ICAR-IIMR	Drs. Chikkappa G. Karjagi., Mamta Gupta & Priyajoy Kar

The work plan for the year 2021-22 was presented by the respective Principal Investigators of different sections namely Crop Improvement, Agronomy, Crop Protection and Outreach Programme. The salient final plan of work under each section is given below.

### **Breeding**

1. The details list of entries promoted from NIVT to AVT-I and AVT-I to AVT-II in different trials are presented in Annexure II. The list of check entries to be used during *kharif* 2021, *rabi* 2021-22 and *spring* 2022, *kharif* 2022, *rabi* 2022-23 and *spring* 2023 along with the check entries which would be discontinued from *kharif* 2021 from NIVT trials are also finalized and the details of the same are given in Annexure II.
2. The conduct of *kharif* trials in north-eastern states namely Nagaland, Sikkim, Manipur, Meghalaya, Assam etc. differs with rest of India. For example, the sowing time for conducting *kharif* trials generally starts during June-July in most part of India, whereas in most of the north-eastern states it starts in April (Mizoram, Sikkim, Arunachal Pradesh, Manipur, and Meghalaya) – May (Nagaland). Therefore, in order to align *kharif* trials to actual growing season of north-eastern states, the *kharif* trials for the north eastern states would be constituted and dispatched in the first week of April every year. Therefore, the cut-off date for submission of entries along with seed has been fixed at last week of March. However, for Assam, the *kharif* trials would be conducted during September-January.
3. Three new centres have been finalized to conduct *kharif* trials in north-eastern states namely the regional stations of ICAR Research Complex for NEH located at Mizoram, Sikkim and Arunachal Pradesh.
4. North-Eastern Plain Zone (NEPZ) being one of the important maize growing regions of the country, it was proposed to increase the number of testing locations in the zone. Accordingly, the following centres namely, IARI-Jharkhand; RMR&SPC, ICAR-IIMR, Begusarai and BISA-Samastipur were finalized as three new voluntary centres to conduct the trials.
5. The focused efforts on Quality Protein Maize over several decades has led to development of breeding material with improved lysine and tryptophan levels. Therefore, it was decided to consider the level of tryptophan from 0.60 to 0.65 and then from 0.65 to 0.70 from 2023 and 2024 onwards, respectively while identification and release of the QPM cultivars to align with international standards. It was also decided to follow common standard protocol to estimate lysine and tryptophan estimation at IIMR, Ludhiana and IARI, New Delhi.
6. The estimation of iron and zinc level in QPM trails of AVT-II may be considered. Dr. Dharam Paul will coordinate between Mandya and IARI to undertake this activity.
7. Regular hands-on trainings may be organized at ICAR-IIMR, Ludhiana or its centres to newly joined scientists at different AICRP Centres and are involved in maize breeding programme as per the priority/mandate of the AICRP Centre.

### **Agronomy**

1. It was suggested to include both pre- and post-emergence herbicides in a 1-meter row experiment with 20-40 inbred lines to know the phytotoxic effect in the trails.
2. The water meter should be installed in all centers for agronomic trails to measure the water use efficiency. For this fund under AICRP testing fees may be utilized.
3. Maize Agronomic Trail 9 (MAT 9: Agro-ecological options for fall armyworm management should be dropped on multi-locations. It should be continued in IIMR-Delhi Centre with all possible combinations. Then best combinations should go for multi-location trials.

4. MAT 10 (Observational experiments at farmer's field) should be withheld for some period based on the results of other trials.
5. In the newly proposed MAT 11 (Enhancing sustainability of baby corn-based intensive cropping system) consequent baby corn trails should be conducted year-round.
6. Crop rotations should be altered, manure and recommended dose of fertilizers can be changed according to the need of the experiment.

#### ***Crop Protection***

1. In order to identify reliable source of resistance to various biotic stresses, evaluation of germplasm under controlled artificial infested conditions is most important. Therefore, it was advised to have polyhouses/glasshouses in some of the centers.
2. It has been advised to identify and establish the Center of Excellence for Breeding, Entomology, and Pathology in each zone which can facilitate high-quality research.
3. In the newly proposed Maize Pathological trail 11 (MPT 11: Identification of racial pattern against TLB of maize) it was advised to identify some sources of resistance, nature of resistance, and population structure of pathogen.

#### ***Outreach Programme***

1. In order to make FLDs more attractive, a suggestion was made to increase the fund allocation in the FLDs.
2. Both North-Eastern Plain Zone (NEPZ) and Central Western Zone (CWZ) can play an important role in increasing the overall maize production of the country. Therefore, it was suggested to make suitable changes in allocations of FLDs in these zones. It was also suggested to design and prepare small Bulletin about the details of FLDs for better dissemination of technologies and outreach.
3. It was also suggested to assign GPS coordinates for FLD locations.

### **Day 3: May 19, 2021**

#### **Session IX: PAMC Meeting of AICRP on Maize**

The following members were present:

1. Dr. HS Gupta, Former Director General, BISA- Chair
2. Dr. IS Singh, Former Professor, GBPUA&T Pant Nagar- Member
3. Dr. PN Sharma, Ex-Professor, Plant Pathology, SKHPKVV, Palampur-Member
4. Dr. J. Satyanarayana, Dean of Students Affairs, PJTSAU, Hyderabad- Member
5. Dr. J.S. Mishra, Director, Directorate of Weed Research, Jabalpur- Co-opted Member
6. Dr. Sujay Rakshit, Director, ICAR-IIMR, Ludhiana
7. Dr. Ramesh Kumar Nodal Officer, AICRP, IIMR Ludhiana
8. Dr. SB Singh, PI, Plant Breeding, ICAR-IIMR, Ludhiana
9. Dr. AK Singh, PI, NRM, ICAR-IIMR, Ludhiana
10. Dr. JC Shekhar, PI, Crop Protection, ICAR-IIMR, Ludhiana
11. Dr. SL Jat, PI, Outreach Program, ICAR-IIMR, Ludhiana

The committee participated in all the sessions of the 64<sup>th</sup> Annual Group Meeting held in virtual mode during May 17-18, 2021 and the observations of the committee are as follows:

Maize is the 3<sup>rd</sup> most important cereal after rice and wheat and has recorded highest growth rate of 4% during the last decade resulting in production of around 30 million metric tons (MMT) of maize from 9.2 Mha area during 2020; however, the projected requirement of maize in 2025 is around 60 MMT (32 MMT for feed, 15 MMT for industry, 4 MMT for food and 8-10 MMT for export). In addition, the country needs to diversify area under rice in north India (for saving water and addressing the issue of residue burning) and in central India for enhancing productivity of areas cultivating rain-fed upland rice. Thus, the ICAR-IIMR and AICRP on Maize

faces a formidable challenge to develop and disseminate technology for a quantum jump in maize productivity in general and of *kharif* maize in particular and this will require intensification of maize research with higher investment.

The AICRP on Maize currently operates with 32 centres spread over the country with AICRP's HQ at Ludhiana. While the HQ of ICAR-IIMR is being established and infrastructure is being created; the glass houses and net houses need to be constructed on priority not only at the HQ but at some of the AICRP centres to undertake screening for diseases and insect-pests.

In view of the above, the committee deliberated and prioritized its recommendations as follows:

1. Prioritization of Research Areas: To address the formidable challenge of developing hybrids for normal grain maize, efforts need to be made so that every center does not work on every aspect of maize improvement. Thus, the Director, ICAR-IIMR should decide the priorities of the centers and assign work on specialty corn to only few centers with adequate scientific manpower and resources. Rest of the centers should focus on hybrid development for main *Kharif* and *rabi* season, depending on the location.
2. Germplasm acquisition from all possible sources is to be given priority. In the process, semi-dent, dent, sub-tropical and temperate germplasm should receive priority. Germplasm needs to be classified and documented properly for grain type and tolerance to diseases and pests. A systematic and uniform pedigree recording is to be followed across AICRP rather following random nomenclature.
3. Systematic work should be undertaken on breeding for resistance/tolerance to biotic and abiotic stresses and use of multiple resistant lines in crossing.
4. Data from central India showed that maize has higher productivity over rain-fed upland rice, therefore, maize should be disseminated to replace rain-fed upland rice in Odisha, Jharkhand, Chhattisgarh and parts of Bihar & West Bengal for obtaining higher system productivity.
5. While developing and releasing new hybrids, high productivity of seed parent should be kept in mind and breeding program should be pursued accordingly.
6. The committee recommends elevation of one center in each zone to the status of '*Advance Center*' and the same should be provided with all possible facilities so that these centers should focus on specific trait improvement for the zone they are situated in and also do hand holding of other centers in that zone. In addition, one potential center should also be identified in each zone and they should have three scientific positions (a Plant Breeder, an Agronomist and a Plant Pathologist/Entomologist). The potential centre's performance should be closely monitored by the AICRP HQ and the Advance Center of the zone so that they bring in quantum jump in their research output. The details of these centers are as follows:

<b>Zone</b>	<b>Advance Centres</b>	<b>Potential Centres</b>
I	Bajaura	Srinagar
II	Ludhiana	Pant Nagar
III	Dholi	Bhubaneswar
IV	Coimbatore	Kolhapur
V	Udaipur	Chindwara

7. Construction of glass houses and polyhouses for screening of diseases and insect-pests should be taken up on priority so that breeding for pest resistance receives priority.
8. In view of poor performance of the AICRP centers in Zone-III (Eastern India) and presence of very few testing centers in Zone II (North Western Plains), the committee recommends conduct of the trials in these zones by private sector and Pusa center of BISA.
9. In order to multiply the inbred lines of public sector hybrids and their hybrid seed production, a *Revolving Fund* of Rs. 125 lakhs may be sanctioned which will be refunded by IIMR in due course.
10. In view of acute shortage of technical staff (only three in the institute); the committee recommends posting of at least 20 technical staff from other institutes of the Crop Science Division where a large number of technical assistants are already in position.

11. CIMMYT should be asked to distribute germplasm/inbred lines rather than readymade hybrids. This will reduce complacency among the breeders of AICRP centers and consequently, they would start using locally adapted lines as one of the parent in the crossing programs. In addition, BISA center of Ludhiana should be partner with IIMR in conducting 100 demonstrations of maize in Punjab to demonstrate advantage of maize over rice in productivity, use of water and profitability.
12. Directors of ICAR-IIMR should also be a member of the Executive Committee of BISA or else he may be invited as special invitee so that the issues related to maize are also addressed adequately.
13. A regional center of ICAR-IIMR needs be established in Karnataka for which the State Government has agreed to provide land.

#### Day 4 (June 17, 2021)

#### Session X: Panel discussion on "Prospect of Bt transgenic at BRL 1 or 2 to be tested for their efficacy against FAW"

Chairman	Panellists	Convener	Rapporteur
Dr. T.R. Sharma, DDG (CS), ICAR	Director (IARI), Director (NIPGR), Director (NBAIR), Director of Research (PAU), Director (GMP, CIMMYT), ADG FFC, ADG PP&B, Representatives from private stakeholders (Bayer crop science Bioseed Research India Ltd, Corteva Agri sciences, Mahyco Pvt Ltd, Rallis India (Metahelix), Syngenta India)	Drs. Sujay Rakshit & J.C. Sekhar	Drs. S. B. Suby, P. Lakshmi Soujanya, Pardeep Kumar

The session was attended by 126 participants from both public and private sector. Dr. Sujay Rakshit, Director, ICAR-IIMR welcomed the participants and briefed about the programme. Chairman of the session Dr. T.R. Sharma, DDG (CS), ICAR elaborated the significance of *Bt* technology in saving losses caused by insect pests around the globe. He highlighted the commitments of ICAR towards testing of all biotech crops through a network of institutes of ICAR and DBT and the development of gene-edited crops. Dr. B.M. Prasanna, Global Maize Director, CIMMYT & CGIAR Research Program on Maize gave an overview on the current scenario of Bt maize around the world against management of FAW. Better understanding of FAW population dynamics and resistance population across Asia will guide the future FAW response strategies. Dr. AK Singh, Director, ICAR-IARI highlighted the need of policy interventions to harness the benefit of deployment of GM crops in India. FAW resistance sources are to be pooled and deployed in resistance breeding. Dr. Subhra Chakraborty, Director, NIPGR emphasized the need of pyramided events and resistance management. The genotyping and metabolomics facility in NIPGR could be used for deciphering resistance mechanisms in pre-breeding lines. Dr. N. Baktavalsalam, Director, ICAR-NBAIR discussed the IPM package developed with pheromone technology and bioagents and expressed his concern over resistance development in *Bt* maize. Dr. Navtej Bains, Director of Research, PAU stressed the importance of the pyramided events and networking among institutes and partnering with Pvt Sector. Dr. P. Suresh from Bayer Crop Sciences briefed about the technical feat on *Bt* technology and policy regulations. Bayer conducted large-scale trials of pyramided events in Vietnam, Philippines and Pakistan in the last two years with very encouraging results. However, in India, there was no progress in GM crops after 2015 due to policy regulations. Combination of stalked products, crop refuge management along with other IPM technology can ensure sustainable management of FAW, otherwise, resistance would be expected in 8-9 years. Dr. S. Venkatesh of Corteva Agriscience stressed upon the primary step on developing native genetic resistance, deployment of transgenic traits pragmatically, surveillance of the pest in an array of crops and price regulations. Dr. Bharat Charndra of Mahyco emphasized the mode of action and deployment of suitable events and level of resistance in the local population. As resistance appears to be dominant in FAW, resistance management and other technologies such as sterile insect technology need to be looked upon. Dr. Nagaraj K of Rallis India Ltd. (erstwhile Metahelix) stressed on host plant resistance especially by *Bt* maize which was successfully deployed in other countries. This needs to be revived in India by

easing the regulations on transgenics. Dr. Manojit Ghosh of Syngenta India stressed on IPM technology where Bt corn could be integrated. Dr. Bijendra Pal of Bioseed Research India Ltd. also stressed the need of an enabling environment towards adoption of Bt corn in India. Dr. S.C. Dubey, ADG (PP&B), ICAR stressed on cropping system-based IPM technology suitable for different agro-ecosystem. Host plant resistance either by conventional breeding or transgenics or both needs to be focused. Insect populations need to be closely monitored for resistance. Dr. Y.P. Singh, ADG (FFC) stressed on survey and surveillance of FAW and characterization of populations and life table parameters in different agro-ecological conditions. Dr. Sujay Rakshit, Director, ICAR-IIMR called upon a consortium of public and private sector to pool GM events and test their efficacy against FAW under controlled condition. Dr. J.C. Sekhar, PI Crop Protection, ICAR-IIMR briefed about the ongoing programme. HPR is the main focus where evaluation of germplasm is being carried out under AICRP where current year onwards screening will be done under artificial infestation in net houses. Promising seed treatment and chemical control have been evaluated against FAW under AICRP. Dr. T.R. Sharma in his concluding remarks stressed upon IPM, understanding the population structure of FAW and enabling the policy for deployments of transgenic crops.

The following actionable points were emerged based on the discussion by the panelists.

1. Host plant resistance-based approaches including genome editing and genetically modified technologies are to be focused on for the sustainable management of FAW. To develop the transgenic maize, instead of focusing on a single gene, introgression of two or three genes together (stacked genes/pyramided genes) to be taken up for durable resistance against FAW.
2. Host plant resistance mechanisms are to be deciphered in pre-breeding lines by utilizing the genotyping and metabolomics facility in NIPGR. Resistance management studies between two crops *Bt* cotton and *Bt* maize to be taken up simultaneously for observation of cross-resistance.
3. Studies to be taken upon on population dynamics of FAW in relation to meteorological parameters. Understanding the biology and life tables of FAW helps in the formulation of effective management strategies.
4. Developing native genetic resistance, deployment of transgenic traits pragmatically, surveillance of pests in an array of crop and price regulations are of utmost importance for effective management of FAW.
5. Measurement of the changes in the susceptibility of FAW populations to be undertaken by considering its versatility in rapidly evolving resistance to insecticides and ability to survive on several hosts.
6. To delay the evolution of resistance, insecticide resistance management strategies are to be designed with an emphasis on the efficient use of insecticides to conserve the maize ecosystem for better management of FAW.
7. Development of cropping system-based IPM technology suitable for different agro-climatic conditions where *Bt* maize as one of the important components is the need of the hour.
8. Networking among institutes and partnering with the private sector for the deployment of transgenic technology are required to tackle the invasive pest, FAW.

### Session X: Variety Identification Committee meeting

The proceedings of the VIC meeting is attached in Annexure VI.

### Session X: Review of work during kharif 2020 and rabi 2019-20 and work plan 2021-22

Chairman	Co-chairman	Experts	Rapporteurs
Dr. T.R. Sharma, DDG CS, ICAR, New Delhi	Dr. Y.P. Singh, ADG FFC, ICAR, New Delhi	Dr. H.S. Gupta, Chairman, PAMC Dr. I.S. Singh, Member (Breeding) Dr. R.N. Singh, Member (Agronomy) Dr. P.N. Sharma, Member (Pathology) Dr. Jella Satyanarayana, Member (Ento)	Drs. Pardeep Kumar, Romen Sharma and Seema Sheoran

The session was attended by 124 participants through virtual mode. Dr. T.R.Sharma, DDG (CS) and chairman of the session in his opening remarks appreciated the fruitful discussion of three days of 64<sup>th</sup> Annual Maize Workshop. He also appreciated the panel discussion on “Prospect of Bt transgenic at BRL 1 or 2 to be tested for their efficacy against FAW” in which representatives from the national, international and private sector agencies participated and given their inputs. He highlighted the importance of maize and emphasized that the recommendations of workshop will be included in the EFC 2021-26.

Dr. Sujay Rakshit, Director, IIMR Ludhiana presented the Director’s report with major achievements of 2020 of the AICRP on Maize and the institute. Dr. Sharma congratulated the institute for significant improvement in publication and targeting high impact factor journal to publish their research work. He also appreciated the pre-breeding efforts to utilize maize germplasm efficiently.

The following PIs of various disciplines presented the reports of rabi 2019-20 and kharif 2020 and the plan of work for 2021-22:

Trials and Nurseries	: Dr. N. Sunil
Breeding (Field corn)	: Dr. S.B. Singh
Breeding (QPM)	: Dr Ramesh Kumar
Breeding (Specialty corns)	: Dr. Chikappa G.K.
Crop Production	: Dr. A.K. Singh
Crop Protection	: Dr. J.C. Shekhar
BSP	: Dr. Chikappa G.K.
Outreach programme	: Dr. S.L. Jat

Significant points coming out from the presentations are as follows:

### ***I. Trial and nurseries***

Dr. N. Sunil, Principal Scientist, Plant Breeding, ICAR-IIMR, WNC, Hyderabad presented the report on Trials and Nurseries. In Kharif 2020, 274 maize entries were evaluated in AICRP trials, among them, 186 were contributed by public and 88 by the private sector. Out of 274 entries evaluated in different stages, 157 were in National Initial Varietal Trial (NIVT), 33 in Advanced Varietal Trial-I (AVT-I), 12 in Advance Varietal Trial-II (AVT-II), 43 in Quality Protein Maize (QPM), and 20 in Specialty Corns Trials (7 in baby corn, 12 in sweet corn, and one in popcorn trials), rainfed 11 and 9 in OPV trials (conducted in NHZ only). All normal maize entries were tested under three maturity groups, viz., late, medium and early. During rabi, 2019-20 total 109 entries were tested of which 75 were at NIVT, 18 were at AVT-I, 8 were at AVT-II, 4 in QPM and 4 in popcorn trial. The success rate of trials were 90% in Kharif, 2020 whereas it was 96% in case Rabi, 2019-20.

### ***II. Breeding***

#### ***A. Field Corn***

Dr. S.B. Singh presented the results of field corn breeding trials conducted during *kharif* 2020 and *rabi* 2019-20. During *kharif* 2020, there were 274 test entries available for the promotion, of which 66 entries were promoted for their advance stages of testing. Out of 274 test entries, 157 were in NIVT late, medium and early of which 66 were promoted and remaining, 33 were in AVT-I and 9 in OPV, of which 16 namely KMH 18-15, DKC 8209(Z-I), AH 4142 (Z-II), KMH 8322 (Z-II, III, IV), DKC 7204 (Z-II, III), IMHSB-19-2, JH 18065, SYN916801, HT 519074 (Z-III), JKMH 1481 (Z-IV, V), SYN 916801 (Z-III, IV), NMH 4144, BH 417182, NMH 4313HT (Z-IV), DKC 9207, EH 2936 (Z-V) and NMH 4143 (Z-II, V) were promoted to AVT-II. Rests of 6 entries were tested in rainfed trials, out of which none of the entry can be promoted. Among 9 OPVs tested, two (DOP-339 and KDM -30) were promoted for next stage of testing (OPV II) and one (L 316) reached OPV

III stage. During *rabi* 2019-20, total 93 entries were available for promotion, of which only 31 were promoted to next stage of testing. Of total 93 entries, 75 were tested in NIVT late and medium, of which 18 entries were promoted to next stage of testing, 18 were available for promotion in AVT-I of which 15, IMHSB-17R-9, IMHSB-17R-8, IMHSB-17R-16, IMHSB-17R-17 (Z-II), PM-18206L and PM-18208L (Z-III), PM-18205L, PM-18202L (Z-IV, V), PM-18204L and IT-8582 (Z-II, III, IV, V), IMHSB-17R-14, NHM-4320 and PM-18202L (Z-IV), NHM-4320 (Z-V) and NHM 4140 (Z-II, III, IV, V) were promoted to AVT-II and total 4 entries evaluated for popcorn trial, of which five (DZ-99, IPCH-1901 and IPCH 1902) were got promoted to next stage.

### **B. QPM**

Results of QPM breeding trials were presented by Dr. Ramesh Kumar. Two trials were conducted for QPM i.e. one in NHZ and one for other four zones. In QPM combined trial (QPM I, II & III) was conducted due to less number of entries. A total of 25 entries were tested in Zone I (NHZ) along with 7 checks. Out of these nine QPM entries (DQH 113, HQPM 29, IQPMH 2004, IQPMH 2002, DQH 112, HQPM 30, LQMH 1920, DQH 114 and IQPMH 2003) were promoted and one entry (FLPH 19) was promoted for Low Phytic Acid and one entry (FPVH 1) was promoted for Pro-vit A for testing in AVT I. In second trial which was conducted in Zone II, III, IV and V, a total of 27 entries were tested. Out of these 27 entries, 23 were QPM, two were Low Phytic Acid and two were Pro-Vit. Four QPM entries (DQH 114, IQPMH 2007, DQH112 and DQH 113) were promoted in Z-II, four in Z-IV (IQPMH 2007, IQPMH 2012, DQH 113 and IQPMH 2001) and two in Z-V (DQH 113 and IQPMH 2012). No entry promoted from AVT I to AVT II. Under EDV category two LPA entries namely LPAP 1 and LPAP 6 were promoted for testing at next stage in Zone II and Zone III, respectively where two Pro-vit A entries namely APH 3 and APH 4 were promoted for testing at next stage in zone II, III, IV and V.

### **C. Specialty corn**

Results on Specialty Corn Breeding trials were presented by Dr. Chikkappa G. Karjagi. Specialty corn trials comprise separate trials of baby corn (BC), sweet corn (SC), and popcorn (PC). The total number of trials that were conducted under specialty corn were five, namely, BC-NHZ (Trial No. 791), BC-I-II-III (Trial No. 844), SC-NHZ (Trial No. 792), SC-I-II-III (Trial No. 832), and PC-NHZ (Trials No. 793). The trials 791, 844, 792, 832, and 793 were conducted at 6, 24, 6, 23, and 6 locations respectively. The total numbers entries excluding check/filler entries evaluated in trials 791, 844, 792, 832, and 793 were 7, 6, 12, 11, and 1 respectively. However, the number of unique entries evaluated across 30 locations in baby corn trial were seven, out of which three entries viz., DBCH 331, IMHSB 19KB-2, and IMHSB 20KB-3 were promoted from NIVT to AVT-I, whereas no entries were promoted from AVT-I to AVT-II. Similarly, the numbers of unique sweet corn entries evaluated across 29 locations were 12. Out of which five entries (CP Sweet 2, CPSC 301, DSCH 340, FSCH 131, and FSCH 144) from NIVT to AVT-I and one entry (CPSC 301) from AVT-I to AVT-II were promoted. One popcorn trial, PC-NHZ (Trial No. 793) was conducted in NHZ comprising one each of test entry (DPCH 311) and check entry (VL Amber Popcorn). The test entry, DPCH-311 was promoted from NIVT to AVT-I for NHZ based on yield superiority (4123 kg/ha) over check entry VL Amber Popcorn (2643 kg/ha).

### **D. Breeder seed production**

Dr. Chikkappa G. Karjagi presented the Breeder Seed Production report. The total breeder seed indent received during 2019-20 was 71.14 quintals which includes 31.26 quintals were of OPVs or composites and 39.88 quintals were for parental lines of hybrids. The total quantity of breeder seed produced during the period was 238.35 quintals which included 67.61 quintals of OPVs and composites and 170.74 quintals of parental lines of hybrids. There were 16 ICAR/SAUs institutions involved in undertaking the breeder seed production during 2019-20 across 15 states.

### **III. Agronomy**

Dr. A.K. Singh, PI of agronomy presented the results of crop production. Total 10 and 8 trials were conducted in *Kharif* 2020 and *Rabi* 2019-20, respectively. The major agronomic research trials on maize-based systems

during *Kharif* 2020 were focused on nutrient and planting density optimization for different maturity pre-released maize hybrids, precision nutrient management and tillage optimization, integrated nutrient management, ecological intensification, weed management, crop residue management in traditional and emerging cropping system and agro-ecological approaches for fall armyworm management in maize systems. The *Rabi* 2019-20 agronomic trials mainly focussed on pre-release genotypes of different maturity, tillage and nutrient management, sensor guided nitrogen management, integrated nutrient management, ecological intensification and weed management in maize systems for enhancing productivity and profitability of maize systems in various agro-ecologies. The major findings are as follows:

- Zero tillage (ZT) along with better nutrient management (SSNM or RDF) gives higher system yield and returns of maize-wheat-cowpea sequence over farmer practices.
- For getting best realization of yield RDF with 5 t/ha FYM or RDF with 5 kg Zn/ha is required.
- Based on two years results it was found that 100% RDF with 5 t/ha FYM is better option for higher maize productivity a rather than only use of organic sources.
- Atrazine @ 1.5 kg/ha pre-emergence followed by Tembotrione (Laudis) 120 g/ha PoE at 25 DAS or Topramezone 25.2 g/ha 25 DAS were found effective for weed management in kharif maize
- Ecological intensification proved to be best option with best management practice significantly increased yield (13.4 to 101% over farmers practice) where weed management and nutrient management were found to be critical for potential yield realization.

#### **IV. Crop Protection**

Dr. J.C. Sekhar, PI (Plant Protection) presented the progress of pathology and entomology trials. In case of pathology, a total of 269 trials of 26 experiments during *Kharif* 2020 and 80 trials of 8 experiments during *Rabi* 2019-20 were conducted including both coordinated and management trials across the zones. The major findings of the pathology were presented as below:

- Azoxystrobin 18.2 w/w + Difenoconazole 11.4% w/w SC @ 0.10% spray at 3 days and 18 days after inoculation, Tebuconazole 250 EC @ 0.1% at 30 and 45 days after sowing, *Allium sativum* (Garlic) bulb @ 10% @ 35, 45 and 55 days after sowing were best against control of TLB. Pyraclostrobin 133g/lt + Epoxyconazole 50g/lt @ 0.15 % spray at 3 days and 18 days after inoculation was best against control of MLB.
- Different Chemical and IDM modules were effective against management of different important maize disease like MLB, CLS, RDM and SDM.

In entomology during *Kharif* 2020, total 12 and *Rabi* 2020, six experiments were conducted for screening resistance and management through chemical and bio-pesticide for pink stem borer, spotted stem borer, fall army worm, shoot fly and *Helicoverpa armygera*. The major findings presented as below:

- During *Kharif* 2020, out of 87 AICRP entries screened against spotted stem borer (SSB) under artificial infestation, 85 were moderately resistant, only two entries were susceptible and none of the entries were observed to be resistant.
- Among the 87 entries screened against fall armyworm (FAW) under natural infestation, only one entry, NK6240 ( $\leq 3.0$ ) was found promising.
- Out of 99 accessions evaluated against SSB under artificial infestation, one accession IIMR PBT Pool was found to be resistant.
- Out of 17 and 15 maize entries in the AVT I & II late and medium maturity group, screened under artificial infestation against pink stem borer at Hyderabad and SSB at Kolhapur none of the entries found resistant.
- Out of 17 maize AICRP entries in AVT I & II late maturity group screened under natural infestation against *Atherigona sp.* at Karnal and Ludhiana centers during *spring* 2020, the lowest mean percent dead hearts were found in PM 17201L (16.0) and was followed by NMH 4313(17.1).

Maize recommendations are:

- Cyantraniliprole 19.8% + Thiamethoxam 19.8% @ 4 ml/kg seed was found effective as seed treatment against FAW upto 14 DAG.
- Chemical insecticides, *viz.*, Chlorantraniliprole 18.5% SC, Chlorantraniliprole 9.3% + Lambda-cyhalothrin 4.6% ZC, Emamectin benzoate 5 SG, Spinetoram 11.7% w/w SC, Novaluran 5.25% + Emamectin benzoate 0.9% w/w SC and Flubendamide 480 SC were found effective in the management of FAW.
- Biopesticides NBAIR *Bt* 25, 2% @ 2ml/l and *Metarrhiziumanisopliae*, NBAIR-Ma 35, 0.5% @ 5g/l were found effective in the management of FAW.
- Spraying of recommended insecticide molecule at 7 & 14 DAG followed by 10 & 20 DAG was found effective in the management of FAW.

#### V. Outreach programme

Dr. S.L. Jat presented the progress report of outreach programme. The institute reaches out to its farmer stakeholders through conducting programmes, *viz.*, Frontline Demonstrations (FLD) sponsored by Department of Agriculture and Cooperation, Government of India under National Food Security Mission (NFSM), the Scheduled Tribe Component (STC), North Eastern Hill (NEH) component, Scheduled Caste Sub Plan (SCSP) and Mera Gaon Mera Gaurav (MGMG). The Frontline Demonstrations (FLDs) under NFSM was undertaken in 281.23 ha in collaboration with various AICRP on Maize centres throughout the country in the three cropping seasons (*Kharif, Rabi and spring*) of maize. A total of 753 farmers were benefited from the FLD. Beside this, under the STC programme, 238.77 ha were covered under FLD to benefiting 741 farmers. Further, a total of 68 training/field day/awareness programmes were conducted in different parts of the country on various aspects of scientific maize cultivation under STC, SCSP and NEH programmes benefiting 3530 farmers. More than 1400 farmers were also benefitted from various inputs distribution programmes. The NEH programme a project on "Maize for Sustainable Livestock Production" has been implemented to assess the effect of supplementation of QPM maize fodder and silage on production performance in pigs and yaks were evaluated under this programme.

The major actionable points came out from the discussion during the session are:

1. To avoid narrowing down of the genetic base of the maize germplasm population improvement programme to derive diverse inbred lines for hybrid development is to be emphasized.
2. A database may be developed to track the materials and their pedigree at the institute and AICRP level.
3. Need to focus on the resistance breeding through developing a standard screening procedure at seedling stage in artificial condition. Identified source for disease or insect/pests should be included in crosses to develop the mapping population and study the genetics/inheritance pattern and finally map the gene/QTLs.
4. The seed production of the maize hybrids is very crucial activity. Revolving fund for seed production needs to be provided to the maize programme to support this activity.
5. The racial response of maize disease needs to be understood at single spore level in artificial condition.
6. Need to emphasize on designing own differentials hosts for different races and development of resistant cultivars in different genetic backgrounds with having different resistant level for different parts of the country.
7. It is advised that, in addition to mentioning disease grade, percent disease index or severity of disease should also be given to effectively differentiate the incidence and intensity of disease occurrence.
8. Residual toxicity of pesticide specifically in baby corn and sweet corn and their ranking may be done according to toxicity level.

The following publications were released on the occasion besides felicitation of retiring AICRP scientists:

<b>Sl. No.</b>	<b>Publication Name</b>	<b>Author Name</b>
1.	Annual Progress Report (Rabi Maize)	AICRP Maize and IIMR Ludhiana
2.	Annual Progress Report (Kharif Maize)	AICRP Maize and IIMR Ludhiana
3.	Maize Production for Food, Feed and Fodder	S.D. Bamboriya, Mukesh Choudhary, Alla Singh, S.L. Jat and Sujay Rakshit
4.	Mechanized Maize Production for Enhanced Productivity and Profitability	S.D. Bamboriya, S.L. Jat, D. Sreelatha, D. M. Mahala and Sujay Rakshit
5.	Major Insect Pests of Maize and their Management	P. Lakshmi Soujanya, S.B. Suby, J.C. Sekhar, V. Vasudeva Rao and Sujay Rakshit
6.	Major Diseases of Maize and their Management	S.K. Aggarwal, Robin Gogoi and Sujay Rakshit
7.	Manual of Hybrid Seed Production Technology in Maize	Shyam Bir Singh, Chikkappa G. Karjagi, Bhupender Kumar, Ramesh Kumar, Shankar Lal Jat, Lakshmi P. Soujanya, Sumit Kumar Aggarwal, Seema Sheoran, J. C. Sekhar, D. K. Yadava and Sujay Rakshit
8.	Standard Operating Procedures for All India Coordinated Research Project on Maize	Bhupender Kumar, Sunil Neelam, Ramesh Kumar, S.B. Singh, Chikkappa G Karjagi, J.C. Sekhar, SL Jat, Sumit Kumar Aggarwal, AK Singh, P. Lakshmi Soujanya, Suby SB and Sujay Rakshit
9.	Value added Maize Products	Navjot Kaur, Ramesh Kumar and Sujay Rakshit

## Codes to be used by centres to nomenclature centre hybrids and the parental lines

S. No.	Name of the Centre	Centre Code	Hybrid Code	Inbre code
<b>Zone I</b>				
1	Almora	F/V	FH	V
2	Bajaura	L	LH	LI
3	Barapani	BR	BRH	BRI
5	Imphal	T	TH	TI
6	Kangra	KG	KGH	KGI
7	Srinagar	KD	KDH	KDI
<b>Zone II</b>				
8	Delhi	A	AH	AI
9	Karnal	HK	HKH	HKI
10	Ludhiana	J/LM	JH	LM
11	Pantnagar	D	DH	DI
<b>Zone III</b>				
12	Bhubaneswar	O	OH	OI
13	Baharaich	X	XH	XI
14	Dholi	M	MH	MI
4	Gossaigaon	GO	GOH	GOI
15	Kalyani	KL	KLH	KLI
16	Sabour	S	SH	SI
17	Ranchi	BA	BAH	BAI
18	Varanasi	VR	VRH	VRI
28	Ambikapur	AM	AMH	AMI
<b>Zone IV</b>				
19	Coimbatore	C/U	COH	UMI
20	Dharwad	G	GH	GI
21	Hyderabad	B	BH	BML
22	Karimnagar	KM	KMH	KML
23	Kolhapur	Q	QH	QI
24	Mandya	MA	MAH	MAI
25	Peddapuram	P	PH	PI
26	Rahuri	R	RH	RI
27	Vagarai	VA	VAH	VAI
<b>Zone V</b>				
29	Banswara	W	WH	WI
30	Chhindwada	CH	CHH	CHI
31	Godhra	GD	GDH	GDI
32	Udaipur	E	EH	EI
<b>Indian Institute of Maize Research</b>				
33	IIMR	IM	IMH	IML

To name a hybrid while contributing to AICRP trial centre to add last two digits of contributing year in NIVT hyphen whatever no. centre wants to give after respective centre code for hybrid. A space is to be given between the centre code and numeric code. For example Udaipur will name EH 22-\*\*\*\* for entries contributed in 2022. For inbreds year of contribution not needed. It may be noted that if the inbred has been taken from other centre and used directly in hybrid combination then original centre inbred code is to be used. Say Vagarai centre is developing a hybrid using their own line the inbred will be numbered as VAI \*\*\*\* but if they have taken from Mandya and directly used in hybrid combination then MAI \*\*\*\*, not VAI \*\*\*\*. It is always preferred when finished inbreds are shared the original centre gives name to the inbred in first place so that no confusion arise at later stage. There should be space between alpha and numeric.

**TECHNICAL PROGRAMME OF MAIZE BREEDING UNDER AICRP ON MAIZE FOR KHARIF-2021, RABI-2021-22  
AND SPRING-2022**

**I. NIVT (Field corn) - Early, Medium and Late for NHZ, NWPZ, NEPZ, PZ and CWZ:** New entries are invited.

**II. AVT I - Field Corn Early:**

**NHZ:** IU7514

**NWPZ:** FH 3947, AH 8067, EH 3531, AH 8106, FH 3941, EH 3573, IAHM 2018-47

**NEPZ:** IU 7514

**PZ:** Nil

**CWZ:** AH 8727, IU 7514, AH 8106, JH 32487

**III. AVT I - Field Corn Medium:**

**NHZ:** PM20101M, PM20104M, HM 20105, BMH-18-2, IU8229, PM20103M, JKMH 4646

**NWPZ:** LMH 4020, BH417206, PM20105M, BMH-18-2, ZH17359, IU8229, PM20103M, SMH 2741, HM20304, JKMH 4243, PM20101M, PM20104M, BH417175, OMH 19-14, VaMH 15028, PM20102M, BRM 17-3, BRM 17-4

**NEPZ:** PM20103M, IU8229, BH417206, PM20105M, LMH 4020, EH 3562, HM20304, OMH 19-14, BH417175, BH417167, BRM 17-6, IMHSB 20K-12, IMHSB 20K-13, IMHSB 20K-10, HM 20104, IMHSB 20K-11, HM 20105, BRM 17-4

**PZ:** JKMH 4243, BH417175, IM 17118, PM20103M, OMH 19-14, BH417206, HM 20105, IMHSB 20K-10, HM 20104

**CWZ:** PM20104M, PM20105M, BMH-18-2, JKMH 4243, HM 20104

**IV. AVT I- Field Corn Late**

**NWPZ:** ADV7251, IU8539, HM20303, PM20107L, BH417157, SAI-6677, IU8424, PM20108L, BIO012, VNR-37635, CP 508, BRMH -10, GK 3302, PM20109L, SYN016802, CP 889, GK 3303, IU8636

**NEPZ:** IU8424, IU8539, CP 508, IU8636, VNR-37635, ADV7251, BH417157, PM20112L

**PZ:** ADV7251, PM20112L, PM20113L, HM 20308, PM20111L, CP 508, IU8424, IU8636, SAI-6677, VNR-37510, R3414, IU8539

**CWZ:** PM20112L, IU8424, ADV7251, CP 508, PM20107L, IU8636

**V. AVT II- Field Corn Early**

**NHZ:** KMH 18-15

**NWPZ:** DKC 7204

**NEPZ:** DKC 7204

**CWZ:** EH-2936

**VI. AVT II- Field Corn Medium**

**NHZ:** DKC 8209

**NWPZ:** AH 4142

**NEPZ:** IMHSB-19-2, NMH 4144, JH 18065

**PZ:** NMH 4144, JKMH 1481, BH 417182

**CWZ:** JKMH 1481

**VII. AVT II-Field Corn Late**

**NWPZ:** KMH 8322

**NEPZ:** SYN916801, KMH- 8322, HT 519074

**PZ:** SYN 916801, KMH 8322, NMH 4313

**CWZ:** DKC 9207, NMH 4143

**VIII. OPV-I** New entries invited

**IX. OPV II & III** DOP-339, KDM 30, L316

**X. QPM-I (Across the zones)** New entries invited

**XI. QPM II & III (Across the Zone)**

**NHZ:** DQH 113, HQPM 29, HQPM 30, IQPMH 2002, IQPMH 2003, IQPMH 2004, DQH 114, LQMH 1920, FQH 165, FPVH 1,FLPH 19

**NWPZ:** DQH 112, DQH 113, DQH 114, IQPMH 2007, LPAP 1, APH 4, APH 3

**NEPZ:** LPAP6, APH 3, APH 4, IQPMH 18-2(AVT II),

**PZ:** DQH 113, IQPMH 2001, IQPMH 2007, IQPMH 2012, APH3, APH 4,

**CWZ:** DQH 113, IQPMH 2012, APH3, APH 4, IQPMH 18-2(AVT II),

**XII. Baby corn I (Across the Zones)** New entries invited

**XIII. Baby Corn II&III (Across the Zones)**

**NHZ:** AVT-I: DBCH-331, IMHSB-19KB-2, IMHSB-20KB-3, ABHS4-1

**NWPZ:** AVT-I: IMHSB-20KB-3

NEPZ: Nil

PZ: AVT-I: IMHSB-19KB-2

CWZ: AVT-I: IMHSB-19KB-2

XIV. Sweet Corn I (Across the Zones) new entries invited

XV. Sweet Corn II & III (Across the Zones)

NHZ: AVT-I: CP Sweet 2, CPSC 301, FSCH 144

NWPZ: AVT-I: DSCH-340, FSCH 131, FSCH 144

NEPZ: AVT-I: FSCH 144; AVT-II: CPSC 301

PZ: AVT-I: FSCH 131, FSCH 144

CWZ: Nil

XVI. Pop Corn I New entries invited

XVII. Popcorn II & III

NHZ: DPCH-311 (AVT-I)

XVIII. EDVs New entries invited

XIX. IDVs (QPM and Pro-A) Given with QPM

**Note:**

1. No Popcorn trial in Zone NWPZ, NEPZ, PZ and CWZ during Kharif season. The Popcorn trial in these zones will be conducted during Rabi season.
2. New entries in first year in QPM and specialty corn trials will be evaluated in the same set with year II and III. Entries promoted in Rabi 2019-20 trials are already in Rabi report and under field evaluation. The entries in Rabi-2021-22 AVT trial will be those which promote from Rabi-2020-21.

**Checks to be used:**

Checks to be used in kharif, rabi and spring trials are presented in. Table 2A, 2B and 2C.

**Table 2A: List of Checks to be used during kharif- 2021 in different trials**

Maturity Group	Check Name	Zone	Centre/Company Name
<b>Field corn</b>			
Early	Bio 605	1,4	Bioseeds Research India Ltd
	DKC 7074	2,4,5	Monsanto
	Vivek Hybrid 51	5	VPKAS, Almora
	Vivek Hybrid 45	1	VPKAS, Almora
Medium	CHM 08-292	2,3,4,5	TNAU, Coimbatore
	Bio 9544	All	Bioseeds Research India Ltd
	DHM 121 (BH 41009)	3,5	ANGRAU, Hyderabad
Late	CHM 08-287	3,4	TNAU, Coimbatore
	CHM 08-282	5	TNAU, Coimbatore
	Bio 9682	2,5	Bioseeds Research India Ltd
	NK 6240	2,4	Syngenta India Ltd
<i>Quantity of seeds required 30 kg each</i>			
<b>QPM and specialty corn</b>			
QPM	HQPM 1, HQPM 4, HQPM 5, HQPM 7, Partap QPM Hybrid 1, Vivek QPM 9. <b>Newly proposed checks w.e.f. 2022</b> LQMH 1 (IMHQPM 1530), IQMH 202 and IQMH203.	All  1 (Early)	CCSHAU, Uchani, Karnal MPUAT, Udaipur VPKAS, Almora  ICAR-IIMR, Ludhiana
Sweet Corn	Misthi	1,2,4	Nuziveedu Seeds Ltd
	VL Sweet Corn1	1,2,4,5	VPKAS, Almora
	ASKH 4	1,2,3,4	IARI, New Delhi
Pop corn	VL amber Popcorn	1	VPKAS, Almora
	BPCH 6	1	PJTC, Hyderabad
	DMRHP 1402,	1	ICAR-IIMR, Ludhiana

	LPCH 3 (IMHP 1540: To be used from kharif 2022)	1	ICAR-IIMR, Ludhiana
<i>Quantity of seeds required: QPM= 20 kg; Sweet Corn =10 kg; Baby Corn= 25 kg; Pop Corn= 2 kg</i>			
<i>The concerned centre bound to provide the seed of relevant check well in time</i>			

**Table 2B: List of Checks to be used during rabi-2021-22 in different trials.**

Maturity Group	Check Name	Zone	Company/Centre Name
Medium	BIO 9544	1, 2, 3, 4, 5	Bioseed Research India Pvt. Ltd.
	DHM 117	4	ANGRAU, Hyderabad
	Biscox1 (Bisco 506)	3, 4	Bisco Biosciences Ltd
Late	P3522	2, 3, 4, 5	Pioneer Overseas Corporation
	NMH713	3, 4	Nuziveedu Seeds Ltd.
	KMH25K45	2, 4, 5	Kaveri Seed Company Ltd
Pop corn	VL amber Popcorn	2,3,4,5	VIPKAS, Almora
	BPCH 6	2,3,4,5	PJTC, Hyderabad
	DMRHP 1402; LPCH 3 ( to be used from Rabi 2022-23)	2,3,4,5	IIMR, Ludhiana
QPM	HQPM 1,HQPM 4, HQPM 5, HQPM 7, Partap QPM Hybrid 1,Vivek QPM 9	2,3,4,5	CCSHAU, Karnal and VPKAS, Almora
<i>Quantity of seed required normal corn =25 kg each and Popcorn= 5 Kg (Each)</i>			

**Table 2C: List of Checks to be used during Spring-2021 in different trials.**

Maturity Group	Check Name	Zone	Company/Centre Name
Early	PMH 5	2	PAU, Ludhiana
	Bio 605	2	Bioseeds Research India Ltd
	DKC 7074	2	Monsanto
Medium-Late	BIO 9544	2	Bioseed Research India Pvt. Ltd.
	DHM 117	2	ANGRAU, Hyderabad
	P3522	2	Pioneer Overseas Corporation
	KMH25K45	2	Kaveri Seed Company Ltd
<i>Quantity of seed required normal corn =10 kg each</i>			

### 1. Requirement of seeds:

The quantity of seed required for various trials during *kharif-2021*, *rabi-2021-22* and *Spring-2022* is given in table no.3 A and 3B, respectively.

**Table 3A: Seed requirement of entries during Kharif-2021**

Sl. No.	Trial	Year of testing	Seed quantity (Kg)	Mode of conduct
1	National Initial Varietal Trail (NIVT)	First	3.5Kg/Entry	Across the zones
2	Advance Varietal Trial-I (AVT-I)	Second	6 Kg/Entry/Zone	Zone specific
3	Advance Varietal Trial-II (AVT-II)	Third	10 Kg/Entry/Zone	Zone specific
4	Baby corn	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>	4 Kg/ Entry 1 <sup>st</sup> and 2 <sup>nd</sup> , 5.0 Kg/entry for 3 <sup>rd</sup> year	Across the zones
5	QPM	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>	7 Kg/Entry	Across the zones
6	Sweet corn	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>	3.5Kg/ Entry for 1 <sup>st</sup> and 2 <sup>nd</sup> , 6.0 Kg/entry for 3 <sup>rd</sup> year	Across the zones
7	Popcorn	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>	1.0Kg/ Entry for 1 <sup>st</sup> and 2 <sup>nd</sup> , 3 Kg/entry for 3 <sup>rd</sup> year	Zone-1 (NHZ)
8	National Maize Demonstration-Hybrids	1 <sup>st</sup>	1.0 Kg/Hybrids	Ludhiana

9	National Maize Demonstration-Parents of hybrids in National Demonstration	1 <sup>st</sup>	0.25 Kg/Hybrids	Ludhiana
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**Table 3B: Seed requirement of entries during *Rabi-2021-22* and *Spring-2022***

Sl. No.	Trial	Year of testing	Seed quantity (Kg)	Mode of conduct
1	Initial Varietal Trail (NIVT)	First	3.5Kg/Entry	Across Zone
2	Advance Varietal Trial-I (AVT-I)	Second	6 Kg/Entry/Zone	Across Zone
3	Advance Varietal Trial-II (AVT-II)	Third	10 Kg/Entry/Zone	Across Zone
4	QPM	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>	7 Kg/ Entry	Across Zone
5	Popcorn	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>	2.0Kg/ Entry for 1 <sup>st</sup> and 2 <sup>nd</sup> , 3 Kg/entry for 3 <sup>rd</sup> year	All zones excluding NHZ

**Note: Spring trials will be conducted only in NWPZ.**

## 2. Locations for various trials:

### A. Kharif season

#### NIVT –Early

- Zone I : Almora, Bajaura, Kangra, Srinagar, Imphal, Barapani, Gossaigaon  
 Zone II : Ludhiana, Karnal, Delhi, Pantnagar  
 Zone III : Dholi, Sabour, Ranchi, Bhubaneswar, Varanasi  
 Zone V : Banswara, Udaipur, Chindwara, Ambikapur, Godhra,

#### NIVT-Medium

- Zone I : Almora, Bajaura, Kangra, Srinagar, Gossaigaon,  
 Zone II : Ludhiana, Karnal, Delhi, Pantnagar  
 Zone III : Dholi, Sabour, Ranchi, Bhubaneswar, Varanasi  
 Zone IV : Dharwad, Mandya, Karimnagar, Hyderabad, Coimbatore, Vagarai, Peddapuram, Kolhapur, Rahuri  
 Zone V : Banswara, Udaipur, Chindwara, Ambikapur, Godhra

#### NIVT-Late

- Zone II : Ludhiana, Karnal, Delhi, Pantnagar  
 Zone III : Dholi, Sabour, Ranchi, Bhubaneswar, Varanasi  
 Zone IV : Dharwad, Mandya, Karimnagar, Hyderabad, Coimbatore, Vagarai, Peddapuram, Kolhapur, Rahuri  
 Zone V : Banswara, Udaipur, Chindwara, Ambikapur, Godhra

#### AVT-I-II

- NHZ : Bajaura, Kangra, Srinagar, Rajauri, Barapani, Imphal, ICAR-RC Tripura, ICAR-RC Arunachal Pradesh; ICAR-RC, Mizoram; ICAR-RC; Nagaland, ICAR-RC Sikkim, Gossaigaon  
 NWPZ : Ludhiana, Gurdaspur, Kapurthala, Karnal, Delhi, Pantnagar, Aligarh, Jhansi, Banda, Jalandhar (Syngenta), Kannauj (UP) (Bioseeds), Hoshiarpur (Pb.) (Corteva).  
 NEPZ : Dholi, Sabour, Ranchi, Bhubaneswar, Varanasi, Baharaich, Begusarai (ICAR-IIMR), Risia (CP Seeds) (Baharaich), Mujafarpur (Corteva), IARI, Jharkhand, BISA (Pusa)  
 PZ : Hyderabad, Karimnagar, Peddapuram, VRDC KSSC Dharwad, Dharwad, ARS Devihosur, Kolhapur, Mandya, Vagarai, Coimbatore, Dhule, Parbhani, Niphad Nasik, Rahuri, Buldana  
 CWZ : Banswara, Chindwara, Balaghat, Ambikapur, Jagadapur, Godhra, Bhiloda, AAR Dahod, RARS Ujjain, ARS Kota, Chittarkoot, Anand (Shaktivardhak seeds), Menar (Chittorgarh) (Kaveri),

*Note: AVT-I-II late trials will not be conducted in NHZ.*

*Kharif (early) trial will not be in Zone-IV (PZ).*

#### QPM: QPM I-II-III

Almora, Bajaura, Kangra, Srinagar, Gossaigoan, Delhi, Ludhiana, Karnal, Pantnagar, Kannauj (Bioseeds), Hoshiarpur (Corteva), Ganganagar, Dholi, Ranchi, Bhubaneswar, Varanasi, Bahraich, Sabour, IARI Jharkhand, Dharwad, Mandya, Karimnagar, Hyderabad, Peddapuram, Coimbatore, Vagarai, Kolhapur, Rahuri, Udaipur, Banswara, Chindwara, Ambikapur, Godhra, Balaghat,  
*Note: QPM Quality traits evaluation: IARI, New Delhi and ICAR-IIMR, Ludhiana*

#### **Sweet Corn I-II-III:**

Almora, Bajaura, Kangra, Srinagar, Gossaigoan (Jorhat), Imphal, Barapani, Delhi, Ludhiana, Karnal, Pantnagar, Kannauj (Bioseeds), Hoshiarpur (Corteva), Dholi, Ranchi, Bhubaneswar, Varanasi, Bahraich, Sabour, Kalyani, Dharwad, Mandya, Karimnagar, Hyderabad, Peddapuram, Coimbatore, Kolhapur, Rahuri, Udaipur, Banswara, Chindwara, Ambikapur, Godhra, Balaghat

#### **Baby Corn -I-II-III**

Almora, Bajaura, Kangra, Srinagar, Gossaigoan (Jorhat), Imphal, Barapani, Delhi, Ludhiana, Karnal, Pantnagar, Kannauj (Bioseeds), Dholi, Ranchi, Bhubaneswar, Varanasi, Bahraich, Sabour, Kalyani, Dharwad, Mandya, Karimnagar, Hyderabad, Peddapuram, Coimbatore, Kolhapur, Rahuri, Udaipur, Banswara, Chindwara, Ambikapur, Godhra, Balaghat

#### **Popcorn-I-II-III**

Kharif (NHZ): Almora, Bajaura, Kangra, Srinagar, Gossaigoan (Jorhat), Imphal, Barapani

*Note: Quality data of speciality trials (BC, SC & PC) will be recorded by following centres, viz., Zone I: Srinagar and Almora; Zone II: Ludhiana and Delhi (IARI); Zone III: Varanasi and Dholi; Zone IV: Hyderabad, Mandya, Dharwad, Coimbatore; Zone V: Udaipur and Godhra.*

#### **B. Rabi season:**

##### **Normal Corn**

Bahraich, Aligarh Varanasi, Dholi, Sabour, Ranchi, Kalyani, Kolkata, Bhubaneswar, Dharwad, Mandya, Coimbatore, Hyderabad, Karimnagar, Peddapuram, Rahuri, Kolhapur, Banswara, Godhra, BISA (Pusa)

##### **QPM Trials**

Bahraich, Varanasi, Dholi, Sabour, Ranchi, Kalyani, Bhubaneswar, Dharwad, Mandya, Coimbatore, Hyderabad, Karimnagar, Peddapuram, Rahuri, Kolhapur, Banswara, Godhra

##### **Popcorn-I-II-III**

Ludhiana, Karnal, Delhi, Pantnagar, Dholi, Ranchi, Bhubaneswar, Varanasi, Bahraich, Sabour, Kalyani, Dharwad, Mandya, Karimnagar, Hyderabad, Peddapuram, Coimbatore, Kolhapur, Rahuri, Udaipur, Banswara, Chindwara, Ambikapur, Godhra

*Note: Ludhiana, Karnal, Delhi and Pantnagar will conduct the trials in Spring season only.*

Barapani, Imphal, ICAR-RC Tripura, ICAR-RC Arunachal Pradesh; ICAR-RC, Mizoram; ICAR-RC; Nagaland, ICAR-RC Sikkim will conduct the rabi trial next year taking up sowing in April

#### **C. Spring Trials:**

Normal and QPM (Early and Medium) : Ludhiana, Karnal, Pantnagar and Delhi

#### **3. General instructions:**

- Last date for receiving seed at WNC, ICAR-IIMR, Rajendranagar, Hyderabad- *Kharif* season-May 10, 2021, for *Rabi*- 10 Oct, 2021 and for Spring 31<sup>st</sup> December, 2021.
- For Zone: NHZ (Z-1): The trials will also be constituted at WNC, Hyderabad by 30<sup>th</sup> March.
- Testing Fee (Private/Non-ICAR organizations) – 75, 000 + 18% GST/entry/trial. This will be applicable after acceptance of proceeding by ICAR, which will be communicated in due course of time.
- DD should be in favour of Director, ICAR-Indian Institute of Ludhiana, Punjab-141004
- **Seed of all entries must be Untreated and graded properly.**
- Seed and all correspondence must be dispatch to:  
**Dr. N. Sunil, Principal Scientist & Incharge Trials & Nursery (AICRP on Maize) Winter Nursery Center, Maize, ICAR-IIMR, Rajendranagar, Hyderabad, Telangana-500030.**
- Breeder who submit the entry must mentioned their contact no. and email ID in covering letter for further communication
- Detailed information of entry in attached format must be provided; the superiority (10%) over the zone-specific check in one year data, the female productivity should be given

#### **4. Recommendations for trials**

**A. National Initial Varietal Trials (NIVT-I) (Across the zones) :**

No. of rows – 2 (net)  
Row length – 4 m (net)  
Spacing- 60 cm × 20 cm in Irrigated  
Replications – 3  
Fertilizer – As per recommendations  
Locations:

**B. Advance Varietal Trials-I (Zone specific) :**

No. of rows – 4 (net)  
Row length – 4 m (net)  
Spacing- 60 cm × 20 cm in Irrigated  
Replications – 3  
Fertilizer – As per recommendations  
Locations:

**C. Advance Varietal Trials-II (AVT-II) or (AVT I-II) (Zone specific) :**

No. of rows – 6 (net)  
Row length – 4m (net)  
Spacing- 60 cm × 20 cm in Irrigated  
Replications – 3  
Fertilizer – As per recommendations  
Locations:

**D. Specialty corn (QPM/SC/PC/BC-I-II-III (Across the zone) :**

No. of rows – 4 (net)  
Row length – 4 m (net)  
Spacing- 60 cm × 20 cm in Irrigated,  
BC: 60 cm × 15cm  
Replications – 3  
Fertilizer – As per recommendations  
**No. of rows in baby corn trial =2 (net)**  
Locations:  
**Rainfed/OPV: 70 x 25cm; Rep: 3; Rows length: 4m; Row No.4/Rep**  
Locations:

**5. Observations to be recorded in initial and advance trials**

**6A. Field corn**

1. Initial plant stand (No. /Plot)
2. Days to 50% Anthesis - Rounded to 0 decimals
3. Days to 50% Silking - Rounded to 0 decimals
4. Plant Height (cm) - Rounded to 0 decimal
5. Ear height placement (cm) - Rounded to 0 decimal
6. Days to maturity – 75% dry husk/appearance of black layer
7. Plant population at harvest (No. /Plot)
8. Cobs count at harvest (No. /plot) in NIVT, and grain yield in AVT-I & II
9. Fresh cobs weight at harvest (Kg/plot) in NIVT, and grain yield in AVT-I & II after drying of ears for 7-10 days and then shelling.
10. Grain Moisture at the time of shelling in NIVT in minimum two replications, and after 7 to 10 days drying in AVT-I & II in all replications
11. Shelling percentage (%) - should be recorded in two replications in NIVT (for this purpose 10 cobs from first 10 plants of 2<sup>nd</sup> row are to be considered and grain moisture also to be recorded from shelled grains of these cobs). Shelling % in AVT-I & II should be recorded at the time of taking grain weight after drying. Observations from Sr. No.9 to 11 are to be taken simultaneously.

**6B. Quality Protein Maize (QPM)**

1. Initial plant stand (No. /Plot)
2. Days to 50% Anthesis - Rounded to 0 decimals
3. Days to 50% Silking) - Rounded to 0 decimals
4. Plant Height (cm) - Rounded to 0 decimal
5. Ear height placement (cm) - Rounded to 0 decimal
6. Days to maturity – 75% dry husk/appearance of black layer
7. Plant population at harvest (No. /Plot)
8. Cobs count at harvest (No. /plot)
9. Grain weight after harvest and sun drying of ears for 7 to10 days then shelling (Kg/plot)
10. Grain Moisture at the time of taking grain weight (%).
11. Shelling percentage (%) after harvest and sun drying of ears for 7 to10 days.  
Observations from Sr. No.9 to 11 are to be taken simultaneously. Lysine and tryptophan (%) – should be recorded in selfed cobs of two replications (Only at specified centers) .

**6C. Popcorn**

1. Initial plant stand (No. /Plot)
2. Days to 50% Anthesis - Rounded to 0 decimals
3. Days to 50% Silking) - Rounded to 0 decimals
4. Plant Height (cm) - Rounded to 0 decimal
5. Ear height placement (cm) - Rounded to 0 decimal
6. Days to maturity – 75% dry husk/appearance of black layer
7. Plant population at harvest (No. /Plot)
8. Cobs count at harvest (No. /plot)
9. Grain weight after harvest and sun drying of ears for 7 to10 days then shelling (Kg/plot)
10. Grain Moisture at the time of taking grain weight (%).
11. Shelling percentage (%) after harvest and sun drying of ears for 7 to10 days.  
. Observations from Sr. No.9 to 11 are to be taken simultaneously.  
Popping volume and percentage-Should be recorded from selfed cobs at all centres

**6D Sweet corn**

1. Initial plant stand (No. /Plot)
2. Days to 50% Anthesis - Rounded to 0 decimals
3. Days to 50% Silking) - Rounded to 0 decimals
4. Plant Height (cm) - Rounded to 0 decimal
5. Ear height placement (cm) - Rounded to 0 decimal
6. Green cob sweetness (%) (TSS) - should be recorded in 3 selfed cobs in each replication at 18-20 days after pollination (Specified centers)
7. Plant population at harvest (No. /Plot)
8. Green cob count at harvest – (No/plot)
9. Fresh green cob weight at harvest (Kg/plot) -with husk
10. Fresh green cob weight at harvest (Kg/plot) - without husk

Note: Observations from sr. no.9 and 10 are to be recorded simultaneously.

**6E. Baby corn**

1. Initial plant population
2. Days to 50% Silking) - Rounded to 0 decimals
3. Plant Height (cm) - Rounded to 0 decimal
4. Baby corn height/placement (cm) top most baby corn - Rounded to 0 decimal
5. Plant population at last picking
6. No. of baby corn/ plot in each picking
7. Date of harvest of un-pollinated baby corn and number of baby corn count for each harvest (No. /plot)
8. Fresh weight of baby corn/plot -with husk in each picking (Kg) - Rounded to 0 decimal
9. Fresh weight of baby corn/plot without husk (Kg) in each picking - Rounded to 0 decimal
10. Total weight of baby corn with husk (in all the harvest) (kgs)
11. Total weight of baby corn without husk (in all the harvest) (kgs)

12. Length of baby corn (cm) - Rounded to 0 decimal
13. Diameter of baby corn (cm)
14. Fodder yield (Kg) .

## 6. Promotion Criteria for promotion of entries to next stage of testing

The test entries will be promoted from first year (NIVT) to second year (AVT-I), second year (AVT-I) to third year (AVT-II) on the basis of the following criteria:

- Entries must be numerically superior over the best check in a zone for yield and should have non-significant differences in yield from the best entry (rank 1<sup>st</sup>) of the trial at CD ( $P=0.05$ ) .
- In early and medium trials, besides yield, the test entry should not exceed the relevant best check by 2.0 days in days to 50% Anthesis.
- The disease reaction of test entries to the disease of national average will be considered for promotion.
- In specialty corn, viz., sweet corn and popcorn, besides yield, the quality parameters were also be considered while promotion. e. g. (SC: TSS  $\geq 15\%$ ; PC: Popping% age  $\geq 85\%$  and expansion in the ratio of 1:15) .
- In QPM, all entries will be compared with best check except for NHZ (Zone I) where the test entries found to be early based on days to 50% anthesis criteria will be compared with Vivek QPM 9
- In addition to the above, the entry should have resistance to moderately resistance response on scale 1-9 for major diseases on national level.

In addition to existing promotion criteria, the following points are to be taken into consideration at the time of identification in VIC:

1. The entries with negative superiority over best check in final year of testing will not be considered for identification.
2. In case of hybrids to be compared with hybrid check the yield superiority must be  $\geq 5\%$  for identification (in late maturity), QPM and specialty corns and  $\geq 10\%$  for all others however in case of comparison of hybrid with composite as a check yield superiority in hybrid over composite should be  $\geq 20\%$ .

## 7. New Recommendations

### a) Best sowing time in NEH region-

- In NEH region, due to heavy rains during crop season, crop does not perform well. In order to mitigate this, sowing time has been changed.
- Sowing time for Arunachal Pradesh, Mizoram, Nagaland, Sikkim, Meghalay and Manipur centers will be first fortnight of April. Nagaland will be sent one trial for sowing in June also.
- Nagaland and Gossaigaon will be clubbed for sowing time in late kharif August-September.
- For Zone-I, cut-off date for contributing entries will be April 10.
- In NEH region, seeds of trial will reach in first fortnight of April, and sowing will be completed in second fortnight of April.

### b) No consideration of 80% shelling, fresh weight for final grain yield

- For NIVT trials shelling % consideration will be same as the usual procedure
- For AVT-I and AVT-II trials grain yield need to be recorded on all cobs after drying it for 7-10 days. Shelling % and moisture% will also be recorded at the time of taking grain weight.

### c) Quality data reporting and late submission

- Every centre has to ensure quality data submission, needs to re-check all data properly before submission.
- Data should be submitted timely without fail.

### d) Dropping of defaulter centers-

- Arbhavi, Indore, Majhian (WB), Sriniketan (WB), Kolkata (WB) Agartala center has been dropped from voluntary centre. Regarding Agartala and Kapoorthala centre communication needs to be sent to the University . Buldhana centre has given one year grace period to improve its performance

### e) Addition of voluntary centers in zone 2, 3 and 5

- IARI, Barhi (Jharkhand), IIMR Begusarai (Bihar) and BISA Pusa Bihar included as voluntary centre in Zone III.
- Some private companies agreed to be voluntary centre as follows:
  - Corteva agreed to provide testing locations at Jaipur, Hoshiyarpur and Muzaffarpur.
  - Bioseed agreed to provide testing location at Kanpur.
  - Shaktivardhak seeds agreed to provide testing location at Anand.
  - Kaveri seeds agreed to provide testing location at Mena (Chittorgarh) and Purnia (Bihar)
  - Syngenta company agreed to provide testing location at Jalandhar

- Rasi seed will provide centre for advance trial in Bihar (Zone III)
  - CP seeds agreed to provide testing location at Risia block in Baharaich.
- f) **Issue of anthesis consideration**
- Issue of two days relaxation in anthesis consideration in early and medium maturity for promotion was deferred for later discussion
  - A Core committee may be formed for the same to discuss and submit recommendation on proper criteria.
  - Right now consideration already decided will be followed.
- g) **Quality parameters for QPM**
- Criteria of tryptophan level will be 0.65%in during 2021-22 and it will be 0.7% since 2022 onwards.
  - Same protocol to be followed at every centre for biochemical estimation (colorimetric method, same standard curve etc.).
  - Estimation of Fe and Zn may be done for entries cleared in AVT II by concerned breeder in QPM
- h) **Recording of popping traits:**
- Popping percentage and volume are highly influenced by moisture content, so 13% MC ideal for estimation.
  - Expansion ratio is required as 15 times or more but centres are giving data in cm<sup>3</sup>/gm that need to be corrected
- i) **Supply of seed of checks/ New checks**
- If any centre unable to supply/discontinue the seed of check, they must inform at least 2 years in advance.
  - Replacement of some checks in QPM (IIMRQPM 1530) and Popcorn with LPC3 were recommended.
  - Shalimar popcorn check will be dropped due to poor yield from this season
  - LQMH 1, IQMH 202 and IQMH 203 hybrids of IIMR to be included in the trials as check in the coming next 2 years.

**Technical Programme of Agronomy Group**  
**Work Plan of Maize Agronomic Trial (MAT)**  
*Kharif 2021, Rabi 2021-22 and spring 2022*

**MAT-1. Performance of pre-release genotypes under varying planting density and nutrient levels in kharif/rabi/spring season**

**Objective:** To study the response of pre-release genotypes to different planting density and NPK levels with their interactions.

**Main-plot: Planting density (2)**

1. Normal (state recommendation)
2. High (20-25% higher than state recommendation)

**Sub-plot: Fertility levels (N:P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O kg/ha)**

1. **RDF**
2. **150% RDF**

Sub-sub plot: Genotypes (as per promotion list) + checks

Design: Split-split plot\*      Replications: 3 Sub-sub plot size: >10 m<sup>2</sup>

*\*Wherever >5 entries (check +test entries) are there in AVT-2 Agronomy trial, these will be tested at only recommended density in factorial RBD at two nutrient levels.*

*Note: A minimum of 350g seed per entry per location & 3 locations per zone needed for generation of Agronomy data.*

**Locations:**

**NHZ:** Bajaura, Gossaingaon, Imphal, Almora

**NWPZ:** Ludhiana, Karnal, Pantnagar, Delhi

**NEPZ:** Bahraich, Kalyani, Varanasi, Bhubaneswar, Ranchi, Dholi

**PZ:** Dharwad, Coimbatore, Kolhapur, Karimnagar, Hyderabad, Peddapuram, Vagarai

**CWZ:** Ambikapur, Chhindwara, Godhra, Banswara, Udaipur

**(Details of the MAT-1 at each centre will be communicated one month in advance)**

**Note: Split N application MAT 1**

➤ Nitrogen to be applied in **three equal splits** at basal, knee high and tasseling stage in kharif season.

➤ Nitrogen to be applied in **four equal splits** in all MAT 1(f) at basal, knee high, pre-tasseling and tasseling stage in rabi season.

**The data on disease and insect in MAT-1 and other trial to be recorded and reported by pathologist and entomologist, wherever applicable.**

**Observations to be recorded in MAT 1 Normal maize /QPM:**

1. Plant population at 25 DAS & at harvest (thousands/ha)
2. Plant height at harvest (cm)
3. Days to 50% tasseling
4. Days to 50% silking
5. Number of cobs (thousands/ha)
6. 100-seed weight (g)
7. Grain yield at 15% moisture content (kg/ha)
8. Stover yield on dry basis (kg/ha)
9. Insect-pest and disease incidence **(by subject expert)**
10. Net return and B:Cratio

**Observations to be recorded in MAT 1 pop corn:**

1. Plant population at 25 DAS and at harvest (thousands/ha)
2. Plant height at harvest (cm)
3. Number of cobs (thousands/ha)
4. Days to 50% tasseling
5. Days to 50% silking
6. Popping (percentage)
7. 100-seed weight (g)
8. Grain yield (kg/ha)
9. Stover yield (kg/ha)
10. Insect-pest and disease incidence **(by subject expert)**
11. Net returns and B:Cratio

**Observations to be recorded in MAT 1 sweet corn:**

1. Plant population at 25 DAS and at harvest (thousands/ha)
2. Number of cobs (thousands/ha)
3. Plant height at harvest (cm)
4. Days to 50% tasseling
5. Days to 50% silking
6. TSS (Total soluble solids) at harvest (percentage)
7. Green Cob yield (kg/ha)
8. Green fodder yield (kg/ha)
9. Insect-pest and disease incidence, if any
10. Net returns and B:Cratio

**Observations to be recorded in MAT 1 baby corn:**

1. Plant height at harvest (cm)
2. Plant population at 25 DAS and at harvest (thousands/ha)
3. Days to first picking
4. Number of pickings
5. Baby corn yield with husk in each picking (kg/ha)
6. Baby corn yield without husk in each picking (kg/ha)
7. Green fodder yield (kg/ha)
8. Insect-pest and disease incidence (by subject expert)
9. Net returns and B:Cratio

**MAT-2: Nutrient management in maize-wheat-green gram cropping system under different tillage practices**

**Objective:** To find out effective nutrient and tillage practices for yield maximization in intensified cropping system

Tillage practices (Main-plots)	Nutrient management (Sub-plots)
1. Zero till	1. 33% RDN + GS (sub surface banding* (SSB) at KH and surface banding at TS)
2. Conventional Till	2. RDF (SSB at KH and surface banding at TS)
3. Permanent bed	3. SSNM based on nutrient expert (SSB at KH and surface banding at TS)

Design: Split Plot      Replications: Three      Sub-plot size: 50 m<sup>2</sup>

Locations: Pantnagar, Dholi, Udaipur

**\*Sub-surface banding at around 5 cm depth at KH stage. However, at tasseling stage surface banding to be followed.**

**Observations to be recorded:**

1. Plant population (thousands/ha) in maize and mungbean at harvest
2. Effective tillers of wheat per square meter
3. Plant height (cm) at harvest of all crops
4. Yield attributes and yield of all crops
5. Days to reproductive stage of each crop
6. Days to maturity of each crop
7. System productivity
8. Stover/straw yield of all crops (kg/ha)
9. Net returns and B: C ratio
10. N, P and K uptake by all crops
11. Insect-pest and disease incidence (by subject expert)
12. Initial and final (after completion of three year cropping sequence) physical and chemical parameters of soil

**MAT-3: Nutrient management in rice-maize -maize cropping system under different tillage practices**

**Objective:** To find out effective nutrient and tillage practices for yield maximization in emerging cropping system

Tillage practices (Main-plots)	Nutrient management (Sub-plots)
1. Zero till	1. 33% RDN + GS (sub surface banding* (SSB) at KH and surface banding at TS)
2. Conventional Till	2. RDF (SSB at KH and surface banding at TS)
3. Permanent bed	3. SSNM based on nutrient expert (SSB at KH and surface banding at TS)

Design: Split Plot      Replications: three      Sub-plot size: 50 m<sup>2</sup>

Locations: Dholi, Kalyani

**\*Sub-surface banding at around 5 cm depth at KH stage. However, at tasseling stage surface banding to be followed.**

**Observations to be recorded:**

1. Plant population (thousands/ha) in maize at harvest
2. Effective tillers of rice per square meter
3. Plant height (cm) at harvest of all crops
4. Yield attributes and yield of all crops
5. Days to reproductive stage of each crop
6. Days to maturity of each crop
7. System productivity
8. Stover/straw yields of all crops (kg/ha)
9. Net returns and B: C ratio
10. N, P and K uptake by all crops
11. Insect-pest and disease incidence(**by subject expert**)
12. Initial and final (after completion of three year cropping sequence) physical and chemical parameters of soil

**MAT-4: Nutrient management in maize based rainfed cropping systems under different tillage practices**

**Objective:** To find out effective nutrient and tillage practices for yield maximization in rainfed cropping system

Tillage practices (Main-plots)	Nutrient management (Sub-plots)
1. Zero till	4. 33% RDN + GS (sub surface banding* (SSB) at KH and surface banding at TS)
2. Conventional Till	5. RDF (SSB at KH and surface banding at TS)
3. Permanent bed	6. SSNM based on nutrient expert(SSB at KH and surface banding at TS)

Design: Split Plot      Replications: three      Sub-plot size: 50 m<sup>2</sup>

**Locations:** Maize-Oat/mustard cropping system-Srinagar, Banda, Chhindwara, Banswara

**\*Sub-surface banding at around 5 cm depth at KH stage. However, at tasseling stage surface banding to be followed.**

**Observations to be recorded:**

1. Plant population in maize, chickpea and mustard at harvest
2. Plant height (cm) of all crops at harvest
3. Yield attributes and yield of all crops
4. Days to reproductive stage of each crop
5. Days to maturity of each crop
6. System productivity
7. Stover/straw yields (kg/ha)
8. Net returns and B: C ratio
9. N, P and K uptake by all crops
10. Insect-pest and disease incidence(**by subject expert**)
11. Initial and final (after completion of three year cropping sequence) physical and chemical parameters of soil

**MAT-5: Long term trial on integrated nutrient management in maize system**

**Objective:** To assess the long-term effect of integrated nutrient management in maize system

**Location:**

**Maize –wheat:** Pantnagar, Banswara

**Maize-mustard/-chickpea :**Chhindwara, Dharwad

**Maize alone:** Karimnagar, Kolhapur, Ambikapur, Bhubneshwar, Coimbatore, Srinagar

**Treatment details\*:**

T1	Unmanured
T2	100% RDF
T3	75% RDF
T4	50% RDF
T5	FYM 10t/ha + Azatobactor
T6	Maize + legume intercropping(for economic produce) with FYM 10 t/ha +Azatobactor
T7	100% RDF + 5 t/ha FYM

T8	75% RDF + 5 t/ha FYM
T9	50% RDF + 5 t/ha FYM
T10	100% RDF + 5 kg Zn/ha
T11	FYM 5 t/ha (state practice)

Design: RBD      Replications: 3      Plot size: 15 m<sup>2</sup>

**\*Important note:**

- In treatment T1, T5, T6 and T11 it is advised not to use any of the agrochemical and instead manual weeding, biopesticide should be used, and it is desirable to go for crop residue recycling, if any.
- The experiment to be conducted on the fixed site over the years.

**Observations to be recorded:**

1. Soil chemical, physical and biological parameters before start of the experiment
2. Soil chemical, physical and biological parameters after completion of every cropping cycle
3. Disease and insect incidence monitoring
4. Weed dynamics study
5. Plant population (thousands/ha) in maize at harvest
6. Effective tillers of wheat per square meter
7. Plant height (cm) at harvest of all crops
8. Yield attributes and yield of all crops
9. Days to reproductive stage of each crop
10. Days to maturity of each crop
11. System productivity
12. Stover/straw yields of all crops (kg/ha)
13. Net returns and B: C ratio of each crop and cycle
14. N, P, K and micronutrient content and uptake by crops
15. Insect-pest and disease incidence, if any

**MAT-6: Weed management in maize systems**

**Objective:** To develop weed management options in maize cropping system.

**Locations:**

**Maize-wheat:** Pantnagar, Bajaura, Karnal, Ludhiana, Ranchi, Dholi, Banswara

**Maize-oat:** Srinagar

**Maize-mustard:** Ambikapur, Bhubneshwar, Imphal, Baharaich, Chhindwara

**Rice-maize:** Dholi, Kalyani, Gossaigaon

**Maize alone:** Vagarai, Arbhavi, Buldana, Kolhapur, Coimbatore, Chitrakoot, Peddapuram

<b>T1</b>	Weedy check
<b>T2</b>	Weed free check
<b>T3</b>	Atrazine 1000 g/ha (PE) <i>fb</i> Hand weeding at 25 DAS
<b>T4</b>	Atrazine 750 g/ha (PE) <i>fb</i> Topramezone 25.2 g/ha at 25 DAS
<b>T5</b>	Atrazine 750 g/ha (PE) <i>fb</i> Tembotrione 120 g/ha at 25 DAS
<b>T6</b>	Atrazine 1000 g/ha (PE) <i>fb</i> Topramezone 25.2 g/ha at 25 DAS
<b>T7</b>	Atrazine 1000 g/ha (PE) <i>fb</i> Tembotrione 120 g/ha at 25 DAS

<b>T8</b>	Topramezone 25.2 g/ha + Atrazine 750 g/ha at 15 DAS
<b>T9</b>	Tembotrione 120 g/ha + Atrazine 750 g/ha at 15 DAS

**Design:** RBD

**Replications:** 3

**Plot size:** 15 m<sup>2</sup>

**Observations to be recorded:**

**For crop:**

1. Plant population at 25 DAS and at harvest (thousands/ha)
2. No. of cobs (thousands/ha)
3. Cob yield (kg/ha)
4. Maize grain yield (kg/ha)
5. System productivity as maize equivalent yield
6. Insect pest and disease incidence, if any
7. Economics: Net return and B:C ratio
8. Phytotoxic effects on crops, if any

**For weeds:**

1. No. of grassy, broadleaf weeds and sedges/m<sup>2</sup> at 50 DAS and at harvest.
2. Weed dry matter at harvest/m<sup>2</sup> of grassy, broadleaf weeds and sedges separately.

**MAT-7: Crop residue management in traditional and emerging maize systems**

**Objectives**

- ❖ To study the effect of bio inoculants on ease of residue management in maize systems.
- ❖ To study the effect of decomposed residues on nutrient availability in maize systems.

In collaboration with Dept of Microbiology, College of Agriculture, PJTSAU; NBDC, Ghaziabad and ICAR-IARI, New Delhi.

**Treatments**

**Main-plots: (Residue management)**

M1: Residue removal

M2: Residue incorporation

M3: Residue incorporation + spray of microbial consortium on residue

M4: Zero-tillage + residue retention and spray of microbial consortia on residue

**Sub-plots: Nutrient management (2)**

N1: 100% RDF of NPK

N2: 100% RDN & P and 50% RDK

Design: Strip plot Replication: 3 Sub Plot size: >50 m<sup>2</sup>

**Locations:**

Soybean-maize: Hyderabad, Banswara, Chhindwara

Maize-maize: Karimnagar, Peddapuram, Gossaigoan

Rice-maize or maize-rice: Dholi, Kalyani

Maize-wheat: Pantnagar, Banswara

Spring maize-green manure/rice-potato: Karnal, Ludhiana, Baharaich

Maize-mustard: Banda, Ambikapur

Maize-chickpea: Dharwad, Chitrakoot

**Observations to be recorded:**

1. Plant height (cm) at harvest.
2. Effective tillers of rice and wheat at harvest.
3. Number of cobs (thousand/ha) in maize.
4. Days to reproductive stage of each crop.
5. Days to maturity of each crop.
6. 100-seed weight (g).
7. Grain yield (kg/ha) of all crops in the cropping system.
8. Stover yield (kg/ha) of all crops in the cropping system.
9. Insect-pest and disease incidence, termite incidence in crops.
10. Assessment of weed population.
11. Net returns and B: C ratio.
12. Amount of residue applied in each crop and treatment (t/ha)
13. Initial and post-harvest soil properties after each crop (pH, EC, OC, Available NPK).

14. Nutrient use efficiency indicators, PFP (Partial Factor Productivity), AE (Agronomic efficiency), RE (Recovery efficiency), PNB (Partial Nutrient Balance).

#### **MAT-8: Enhancing water use efficiency in spring maize**

**Objectives:** To find out best planting and residue application method on water use efficiency in spring maize.

**Centers:** Karnal, Ludhiana, Pantnagar, Baharaich

#### **Treatment details:**

Factor A: Planting method

1. Conventional till flat planting
2. Zero-till flat planting
3. Ridge slope planting (1/2 of ridge height)

Factor B: Residue management

1. Without mulching
2. With organic mulching (6 t/ha)

Design: FRBD                      Replication: 3                      Sub Plot size: >50 m<sup>2</sup>

#### **Observations to be recorded:**

1. Plant height (cm) at harvest.
2. Number of cobs (thousand/ha) in maize.
3. Days to reproductive stage.
4. Days to maturity.
5. 100-seed weight (g).
6. Grain yield (kg/ha)
7. Stover yield (kg/ha)
8. Insect-pest and disease incidence.
9. Assessment of weed population at Knee high, tasseling and at harvest.
10. Net returns and B: C ratio.
11. Initial and post-harvest soil properties after each crop (pH, EC, OC, Available NPK).
12. N, P, and K uptake in grain, straw/stover by all the component crops.
13. Water-use and water-use efficiency
14. Nutrient use efficiency indicators, PFP (Partial Factor Productivity), AE (Agronomic efficiency), RE (Recovery efficiency), PNB (Partial Nutrient Balance).

#### **MAT-9: Enhancing sustainability of baby corn based intensive cropping system**

#### **Objectives:**

- To study effect of different baby corn cropping system on productivity
- To develop sustainable baby corn based intensive cropping system for enhanced profitability and soil health.

**Locations:** Karnal(1-10 Treatments), Kalyani(1-7 Treatments)

#### **Treatments:**

1. Continuous baby corn with famers practice
2. Continuous baby corn with RDF
3. Continuous baby corn with RDF + green manuring once a year
4. Continuous baby corn with 5 t/ha FYM/year + RDF
5. Continuous baby corn with 10 t/ha FYM/year + RDF
6. Continuous baby corn with 15 t/ha FYM/year + RDF
7. Continuous baby corn with 20 t/ha FYM/year + RDF
8. Short duration paddy: baby corn intercropped with fenugreek : baby corn with 10 t/ha FYM/year + RDF
9. Baby corn : wheat: baby corn +/-green manuring with 10 t/ha FYM/year + RDF
10. Baby corn: potato: baby corn +/- green manuring with 10 t/ha FYM/year + RDF

Design: RBD                      Replications: 3                      Plot size: 25 m<sup>2</sup>

#### **Observations to be recorded:**

1. Plant population per ha initial and at harvest
2. No. of picking for baby corn
3. Picking period (days)
4. Fresh weight of baby corn per plot with husk (kg/ha)
5. Fresh weight of baby corn per plot without husk (kg/ha)
6. Days to reproductive stage of each crop.

7. Days to maturity of each crop.
8. Grain yield (kg/ha) of all crops in the cropping system.
9. Stover yield (kg/ha) of all crops in the cropping system.
10. System yield (kg/ha)
11. Cost of cultivation, Net returns and B: C ratio of system.
12. Insect-pest and disease incidence.
13. Assessment of weed population.
14. Initial and post-harvest soil properties after each cropping year (pH, EC, OC, Available NPK).
15. N, P, and K uptake in grain, straw/stover by all the component crops.

#### **MAT-10: Enhancing water use efficiency in maize**

**Objective:** To find out efficacy of organic superabsorbent on water use efficiency in maize.

#### **Centers:**

Maize- chickpea: Bhubaneswar, Udaipur

Maize-mustard: Ludhiana, Dholi, Chhindwara, Imphal

Maize alone: Godhra, Srinagar, Karimnagar, Gossaingaon (autumn planting)

#### **Treatment details:**

1. Control, only RDF (no Fasal Amrit)
2. Fasal Amrit @ 5 kg/ha +RDF
3. Fasal Amrit @ 10 kg/ha + RDF
4. Fasal Amrit @ 15 kg/ha + RDF
5. Fasal Amrit @ 20 kg/ha + RDF
6. Fasal Amrit @ 15 kg/ha + 85% RDF
7. Fasal Amrit @ 20 kg/ha + 85% RDF

**Design:** FRBD

**Replication:** 03

**Plot size:** 20 m<sup>2</sup>

**Note:** Apply Fasal Amrit as seed coating/seed dressing

#### **Observations to be recorded:**

1. Plant population 25 DAS and at harvest (thousands/ha)
2. Plant height (cm) of maize
3. Days to 50% silking
4. Days to maturity
5. Yield attributes and yield of maize
6. Maize equivalents of crop and cropping system (kg/ha)
7. Stover yield of maize (kg/ha)
8. Net returns and B: C ratio
9. Moisture-use efficiency
10. Insect-pest and disease incidence, if any

#### **General instructions on conduct and reporting:**

- ❖ Data should be submitted in **prescribed format as per the decided treatment combination order** in proceedings only otherwise data will not be included in report.
- ❖ The official communication Emails are [redmragronomy@gmail.com](mailto:redmragronomy@gmail.com) and [pdmaize@gmail.com](mailto:pdmaize@gmail.com)
- ❖ The last date for submission of research data will be up to **31<sup>st</sup>December** for *Kharif* and up to **31<sup>st</sup> August** for Rabi season. Data received after these dates will not be included in report.
- ❖ **Inclusion of Metadata** of each trials like cropping history; date of sowing and harvesting; crop management; irrigation; weed management; irrigation & Daily meteorological data on sunshine hours; relative humidity; temperature and rainfall.

#### **Other research priorities:**

1. Survey of the farmers field for the Farmer practices for cultivation of kharif, rabi and specialty corn practices in the various states.
2. Zone-wise and national level publications shall be brought out on the experiment completed on nutrient management, tillage management, density, weed management, biofertilizers, etc. For this zone coordinators decided as NHZ (Dr F. Rasool), NWPZ (Dr Veer Singh), NEPZ (Dr B. Parmanik), PZ (Dr Rajnikant) and CWZ (Dr G. Mahajan).

**Technical Programme of Outreach Programme  
(Nodal email: totdmr12@gmail.com)**

**A. Frontline demonstrations (total: 300 ha)**

**Allocation of FLDs is as follows:**

Implementing centre	Allocation (ha)		Aspect/s	Cultivars
	Target	Season		
AAU, Gossaingaon	10	Rabi	Hybrid maize/ zero-till maize	CP808 (2017)
CAU, Imphal	10	Kharif	QPM/ Hybrid maize/ FAW management	DMRH1308 (2018)
VPKAS, Almora	10	Kharif	Hybrid maize	Vivek hybrid maize 274/55 (2017)
SKUAST, Srinagar	20	Kharif	Hybrid maize/weed management	Shalimar QPM-1 (2021), KG-2
GBPUAT, Pantnagar	10	Spring	Hybrid maize	DKC9108 and Pnat Sankar Makka 5
IIMR, Ludhiana	20	Kharif /rabi/ spring	Hybrid maize/ weed management/ zero-till maize	PMH-13 (2021)/CP838 (2018)/ LQMH-202 (2020)
PAU, Ludhiana	10	Kharif	Hybrid maize/weed management/ FAW management/	PMH-13 (2021)
CCSHAU, Karnal	10	Kharif	Weed management/ Hybrid maize	-
BCKV, Kalyani	20	Rabi	Zero-till maize/intercropping	DMRH1301 (2017)
BHU, Varanasi	10	Kharif	Ridge planting/hybrid maize	Shaktiman-5 (2018)
DrRPCAU, Dholi	20	Kharif/ rabi	QPM/ ridge planting/zero-till maize	Shaktiman-5 (2018)
RMRSPC, Begusarai	10	Rabi	Hybrid maize/intercropping	DMRH1301 (2017)
MPKV, Kolhapur	10	Kharif	Hybrid maize/insect/weed management	CP838 (2018)
PJTSAU, Hyderabad	10	Rabi	Pop corn hybrid	BPCH-6 (2015)
ANGRAU, Peddapuram	10	Kharif/ Rabi	Zero-till maize/hybrid maize	DHM-121 (2016)
TNAU, Coimbatore	10	Kharif/ Rabi	Hybrid maize/FAW management	CMH 12-686 (2021)
UAS, Dharwada	20	Kharif	Hybrid maize/weed management / FAW management/	CP999 (2018)
UAS, Mandya	10	Kharif	FAW management/ Hybrid maize	CP838 (2018)
WNC, IIMR, Hyderabad	10	Rabi	FAW management/ Hybrids maize	DHM-121 (2016)
AAU, Godhara	10	Kharif /Rabi	Hybrid maize/ QPM	GAWMH-2 (2018)
JNKVV, Chhindwara	10	Kharif	Hybrid maize/ weed management/intercropping	PJHM-1 (2019)
MPUAT, Banswara	20	Kharif /Rabi	Intercropping/ weed management/ hybrid maize	CP838 (2018)-K/ DMRH1308 (2018)-R
MPUAT, Udaipur	20	Kharif	QPM/ FAW management/ intercropping/ weed management	Partap QPM-1 (2013)/ CP838 (2018)

- All the FLD to be monitored along with AICRP monitoring, without monitoring data will not be accepted.

**A2: Fund bifurcation for FLD:**

Component	Rs/ha
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Cost of critical inputs (seeds/ biofertilizers/PP chemicals/ herbicides) to supplement the cultivation charges	5100
Organization of Field Day	250
Display board and publicity material (posters/pamphlets/leaf lets etc.)	250
Visit of scientists excluding TA/DA, but hiring of Taxi/POL etc.	300*
Contingencies/typing of results/ minutes etc.	100
Total	6000

\*Nodal FLD implementing Institute/Directorate will retain 50% of the amount for effective monitoring of FLDs across the country.

\*Hence, centre will receive Rs 5850 per ha for organizing FLD.

### A3: Reporting of FLD:

#### Annexure I

- Details of the input distributed. (to be given 15 days after input distribution)
- Name of the implementing agency : .....

S. No.	State	Districts	Village	Name of the farmers with father/ husband name	Gender (M/F/ T)	Category (SC/ST/ OBC/ General)	Contact No.	Aadhar No	FLDs (ha)	New technology given	Input given (Name, price and quantity)	Latitude	Longitude

- ❖ Geo-tagging needs to be done for all FLDs
- ❖ Varieties which are within 3 years either of own production or SAUs sources be used (5 years for problematic areas viz, hills, Saline. Alkaline Soils etc.)
- ❖ Reasons for yield gap between FLDs and farmers' practice should be mentioned.
- ❖ Cluster approach of 10 hectares

#### Annexure II

- FLD performance. (to be given 15 days after harvest of the crop, before December 31, 2020)
- Name of the implementing agency : .....

Name of the farmer	Address (name of village, sub-division, district)	Aadhar no.	FLD technology	Area (ha)	Check / Farmer practice details	Yield (q/ha)		Net returns ('000 Rs/ha)		Yield gains (%)	Net return gain (Rs/ha)	Rejected/ accepted by farmers (Give rating 1-10) with reasons if any
						FP	FLD	FP	FLD			

- Report on Field Day with photograph
- Report on monitoring with photograph
  - 3-4 Good quality photograph will be required along with final report

### B: TSP/STC: 2021-22

Centre	Aspiration district/s	Budget (Rs. in lakhs)	FLDs (ha)	Training (No.)	Main aspect
AAU, Godhra (GJ)	Narmada and tribal districts	7.00	50	4	QPM/intercropping
IGKVV, Ambikapur (Chhattisgarh)	Bastar, Sukma, Kanker, Dantewada, Kondagaon, Narayanpur, Korba, Rajandgaon	10.00	80	5	Upland rice vs maize; QPM/Hybrid maize/weed management/ridge planting
JNKVV, Chhindwara (M.P.)	Barwani and tribal districts	8.00	50	6	Upland rice vs maize; QPM/Hybrid, maize/intercropping/weed management
MPKV, Kolhapur	Tribal districts	7.00	40	4	
MPUAT, Banswara	Tribal districts	7.19	40	6	
MPUAT, Udaipur	Tribal districts	3.00	15	2	
OUAT, Bhubneshwar (Odisha)	Rayagada, Koraput and tribal districts	9.00	60	5	Upland rice vs maize, QPM
BAU, Ranchi (Jharkhand)	Chanho, Mandar, Burmu	12.84	100	6	Upland rice vs hybrid maize/QPM
BCKV, Kalyani	Tribal districts	3.00	15	2	Hybrid, maize/intercropping, Upland rice vs maize
GBPUAT, Pantnagar	Tribal districts	2.00	10	1	Summer rice vs hybrid maize
BHU, Varanasi	Tribal districts	3.00	15	2	Ridge planting/hybrid maize
PJTSAU, Hyderabad	Tribal districts	5.00	30	4	Mechanization/pop corn
TNAU, Vagarai	Tribal districts	3.00	15	2	Hybrid maize/weed management
Total		80.00	520	49	

- Plough/ seed drill/ intercultural implement; sprayer, seed, organic manures/ fertilizers/ biofertilizers/ biopesticide, agrochemicals; storage bins
- Rs 7000 per ha for FLDs & Rs 40-50 thousands/training; rest and saving for input distribution & others

#### C : SCSP : 2021-22

Centre	Budget (Rs. in lakhs)	FLDs (ha)	Training (No.)	Aspect/s
ARS PJTSAU, Karimnagar	8.35	70	4	Mechanization/ weed management/ stress resilient hybrid/ pop corn; upland rice vs hybrid maize
RARS, PJTSAU, Polasa, Jagtial	7.00	60	2	
ARI, Rajendranagar, PJTSAU, Hyderabad	5.05	40	2	

ZARS, UAS, Mandya	8.00	70	3	Hybrid maize/ weed management; upland rice vs hybrid maize
ANGRAU, Peddapuram	3.00	20	2	
BAU, Sabour	6.00	50	3	QPM/ upland rice vs hybrid maize/ hybrid maize
BCKV, Kalyani	8.04	70	3	Upland rice vs hybrid maize/ intercropping
DGKVKRMA, Sargarchi, WB	11.73	110	3	Upland rice vs hybrid maize/ intercropping
MPKV Kolhapur /Rahuri	5.18	40	2	Upland rice vs hybrid maize/ intercropping
CAU Imphal	5.20	40	2	Hybrid maize/ QPM/ upland rice vs maize
RLBCAU, Jhansi	9.80	90	3	Hybrid maize
JNKV Chhindwara	4.60	30	4	Hybrid maize/ intercropping; upland rice vs hybrid maize
<b>Total</b>	<b>81.95</b>	<b>690</b>	<b>33.0</b>	

#### TSP/SCSP Activities

- Capacity building and training (training of at least 25 farmers each)
- Seed: production, storage, bank and village
- Infrastructure for grain storage
- Demonstrations on the poultry and goat production
- Interventions and demonstrations for post-harvest technologies/primary processing
- Demonstrations on integrated farming
- Linkage to Gramin Retail Infrastructure
- Study of agriculture and allied production and management system, marketing and value addition
- ❖ **Programme to be implemented preferably in mentioned aspirational districts only.**
- ❖ **Allocation will be on the basis of BE 2021-22**
- ❖ **Need to finish all activities by December 2021**

#### D: NEH programme

Name of the collaborator	Budget (Rs. in Lakhs)	FLDs (ha)	Training (No.)	Aspects
ICAR-NRC on Yak, Dirang, Arunachal Pradesh	6.0	10	2	Fodder/QPM in Yak; research on maize for Yak
ICAR-NRC on Pig, Rani, Guwahati, Asom	9.0	10	2	QPM in Pig; research on maize for Pig
ICAR-NRC on Mithun, Nagaland	5.0	10	2	Fodder/QPM in Mithun; research on maize for Mithun
ICAR RC NEH centre in Meghalaya, Arunachal Pradesh and Manipur	20.0	40	9	QPM/hybrid maize/sweet corn; FAW management; research on germplasm and cropping system; upland/jhumland rice vs hybrid maize
CAU, Imphal (Manipur, Arunachal Pradesh and Mizoram)	6.0	20	4	Sweet corn/QPM/hybrid maize/ FAW management; upland/jhumland rice vs hybrid maize
CAU, Barapani, Meghalaya	4.0	10	5	
<b>Total</b>	<b>50.0</b>	<b>100</b>	<b>24</b>	

#### E: TSP/SCPSP/NEH Reporting (Quarterly basis)

**Output 1 (Farm material distribution) :** Number of farmers benefitted /Individual farmers / farm families benefitted/ Supply of farm inputs/ seeds/ farm tools/ Honey production/ pollinators boxes/ inputs for / bio-fertilizer/ biopesticides etc.

SL. No.	Description	Unit	Q1/Q2/Q3/Q4 Targets	Q1/Q2/Q3/Q4 Achievements

**Output 2 (knowledge and skill dissemination):** Number of demonstration trials/ field days/ kisan goshtees/ trainings/ plant protection technology demonstration/ biofertilizer/ biopesticides technology

SL. No.	Description	Unit	Q1/Q2/Q3/Q4 Targets	Q1/Q2/Q3/Q4 Achievements

**TSP/SCSP/NEH reporting (Annual)**

**Annexure I: Beneficiary details of the TSP training programme.**

S. No.	Date	Place	Topic	Address of beneficiary	Expenditure incurred	ST population benefitted (No.)

**Annexure II: Report on input distribution programme.**

S. No.	State	Districts	Name of the farmer with address	Aadhar No	Contact number	Input given (Name and quantity)	Total price of the inputs (Rs)

- Please complete whole money spent by 31st November 2021.

**TSP/SCSP/NEH FLDs reporting (Annexure)**

**Annexure II: Report on the FLD under TSP/SCSP/NEH Programme**

Name of the farmer	Address (name of village, sub-division, district)	Aadhar no.	FLD technology	Area (ha)	Check / Farmer practice details	Yield (q/ha)		Net returns ('000 Rs/ha)		Yield gains (%)	Net return gain (Rs/ha)	Rejected/ accepted by farmers (Give rating 1-10) with reasons if any
						FP	FLD	FP	FLD			

- ❖ 5-7 Good quality photograph for each activity required alongwith final report
- ❖ It is desired to give information on activity in print & electronic media

**E : Potential yield realization of maize-based cropping systems in Punjab and Haryana**

- ICAR-IIMR and CIMMYT-BISA in active collaboration with stakeholders in ecosystems (State Deptt, Pvt Companies, CHC,NGOs/SHGs/ aggregators/ dryer/machinery manufacturer)
- Cluster approach
- Farmer’s have harvested over 35 q/acre in Punjab during kharif season
- It is to be replicated in more field
- Proven technology package will be compared and validated in villages of selected blocks/districts having
  - *low maize/rice productivity,*
  - *water crisis,*
  - *soil texture issues etc.*
- **Kandi belt along with Ludhiana and Jalandhar districts of Punjab, priority areas during the current year.**
- Evidence and data on key performance indicators on traditional vs. new cropping systems
  - *System yield,*
  - *Economic returns,*
  - *Water/electricity*
  - *Environmental footprints*
- Size of the demonstrations: one-acre land preferably
- Nearby conventional rice-based systems to be taken as a check.
- Year-round presence at the demonstration platform; whole cropping system is planned for demonstration

❖ **Potential pockets**

<b>Cropping system</b>	<b>District/block</b>	<b>No of validation trials</b>
Maize-wheat-mungbean or maize-mustard-mungbean	Pathankot, Nawanshahar, Ropar	40
Maize-wheat-mungbean with CA	Hoshiyarpur, Ludhiana	40
Maize-wheat-mungbean with CA	Jalandhar	20
Maize-wheat-mungbean with CA	Fatehabad (Ratiya as rice area)	10
Maize-wheat-mungbean with CA	Karnal	10
Maize-wheat-mungbean with CA	Kurukshetra	15
Maize-wheat-mungbean with CA	Ambala	15

- Operations: Planting, herbicide spray, earthing up, pesticide spray, harvesting, drying, market linkages
- High-yielding stable long duration hybrids with proven performance during *Kharif*: DRONA, CP838, DKC9164
- Family labour very high, the mechanization will be focused for sowing, inter-culture, harvesting and drying with the available latest machinery
- 4 hybrid (Public+CIMMYT+Pvt) in 3 places

**F: Problem/constraint identification**

- Agro-ecosystem challenges for maize crops
- Typology of the farmers (Socio-economic, bio-physical etc.) : *will be done/used as with ICAR-IIFSR*
- Variety, soil, weeds, diseases/ pest, water, climate etc.
- Tradition/ attitudes of farmers
- Knowledge gap
- Input availability
- Yield gap
- Cost and return of maize crops
- Access to technical advice/credit
- Problem in institutional arrangement
- Marketing challenges

**G: Baseline survey and impact assessment**

- **Baseline survey of farmers:-**
  - Household characteristic ( eg. age, education, family size, experiences, access to credit etc.)

- Farm characteristic (land holding, irrigated area, cropping pattern, area under different crops, topography etc. )
- Maize system (Area, seed source, variety, irrigated area, cultivation practices, mechanization, preferences etc. )
- Economics (yield, production, net income, cost of cultivation etc.)
- Post- Harvest management/marketing (storage, processing, marketing and it channels etc.)
- Problem / constraint face
- **Impact assessment :-**
  - *Success stories and survey base*
  - Impact of technology(ies) adoption, training programmes etc.
  - Indicators: Yield, income , increase in knowledge *etc.*

**H: Documentation of Success Stories of Maize Technologies**

(One by one) – **At least one success story from each aspect** on given topic from each state covering various aspects. The same aspect should not be repeated from same state.

- ✓ Maize as for grain production
- ✓ QPM and poultry rearing farming
- ✓ QPM and piggery/fishery/other livestock farming
- ✓ Seed production
- ✓ Specialty corn: (sweet corn)
- ✓ Specialty corn: (baby corn)
- ✓ Specialty corn: (Pop corn)
- ✓ Maize for fodder/silage production
- ✓ Maize based intercropping system/Sequential maize based cropping system
- ✓ One story from each state if possible on secondary dissemination of the intervention (i.e. where it has been adopted where we did not directly intervene but farmer to farmer dissemination, where first farmer was our target beneficiary)

1. **Title:**
2. **Contributors:**
3. **Farmers details**

<b>Name of Farmer</b>	:	Mr. T. Sataban	
<b>Age</b>	:	55	
<b>Address</b>	:	Khurai village, Imphal East	
<b>Education</b>	:	Graduate	
<b>Land holdings</b>	:	1.00 ha	
<b>Geographical Coordinates</b>	:	Latitude – 24°83’ N, Longitude - 93°97’ E	
<b>Altitude</b>	:	773 m	

**4. Introduction/Challenge**

**Start with the challenge, problem, issue or opportunity that the Systems has aimed to address. (250-300 words):** following points may kindly be incorporated

- ✓ What is existing cropping system?
- ✓ Why its need to be change?
- ✓ What is yield gap?
- ✓ What is income from existing system?
- ✓ Soil fertility status (from soil health card/analysed from lab before adoption)
- ✓ Marketing channels
- ✓ Technological and social problems
- ✓ Need of the diversification of cropping system/HYVs

**5. Initiative and Rationale of the technology:**

Describe what the Systems researchers have done to address the challenge. Showcase the research strategy and timeline of actions. How were different research users engaged in or consulted in the research process? Specify who benefitted from the research and how is the research knowledge that was produced being used now by different beneficiaries (farmer, community, policy maker, private sector, university, etc.) to change their practice, policy, investments, etc. **(250-300 words words)**

**Table 1. Participatory demonstration**

State	Name of District	Name of Village	No. of farmers covered under demonstration	Area covered under demonstration (ha)
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**Table 2. Capacity building programme**

State	Name of District	Name of Village	No. of farmers covered under demonstration	Area covered under demonstration (ha)
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**6. Details of Technology/Methodology:** Details methodology and package and practices as clear-cut intervention as we have done in TOT or Participatory demonstration (it should be in simple term, use flow chart, bullets wherever possible). **(200-250 words)**

**7. Key result/insight/interesting fact:** productivity, economics, and employment generation and soil quality observation **(support with one simple table and graph (bar diagram or pie chart etc))**

Describe the key result/insight/interesting fact stemming from the research. What were the key research outputs such as recommendations, models, trials, research papers, etc.? Provide evidence of this result/outcome by giving links to scientific journal articles, reports, and other references that document the research. **(200-300 words)**

**8. Impacts:** On cropping intensity, livelihood, Adoptability, local demand etc.

Provide a short summary of the actual change (on knowledge, attitude, skills, practice, or policy) that took place and how this could lead to large-scale impact at system level and significant progress towards Identified Deliverable outputs/Outcomes. Provide quantitative measures, where possible and use simple graphs or tables to illustrate a point. **(200-250 words)**

**9. Interview** of 1-2 farmers with photo

**10. Lessons Learned**

- ✓ What did you learn in this process? What was difficult or challenging?
- ✓ How did you overcome the challenges faced?
- ✓ If you were to do it all over again, what would you do differently? **(150 - 200 words)**

**10. Convergence/linkages:** Acknowledge who ever organizations, KVKs, SHGs, Line Dept contributed.

11. Constraints for larger adoption

**12. Supporting Quotes and Images**

First person accounts or account of a community or group: Please provide 3-4 quotes of 50-words each from different people that bring a different perspective to the story (including name of person, who they are/position, location). These could be account from a single beneficiary or a group of people who talk about how the Systems research has made a tremendous difference in their livelihood, community, behaviours/attitudes, policies, investment, etc. **(150 - 200 words)**

Photo: Provide 2-3 quality photographs, with a **10–20 word caption**. The photograph should capture the person/people/landscape in the story context.

**Plan of work entomology kharif 2021, rabi 2021-22 and spring 2022****Kharif 2021**

**ET1:** Evaluation of maize AICRP entries against *Chilopartellus* (Swinhoe) under artificial infestation (AVT I and II)

**Entries to be tested:** Early, Medium, Late, Normal; QPM, Sweet corn, Popcorn and Baby corn.

**Locations (hot spots):** Dholi, Hyderabad, Karnal, Kolhapur, and Udaipur

Number of Entries:

Number of rows: 1, Row length: 2.0 m; Replications: 2; Spacing: 75×20cm/60 x 25 cm

Date of Infestation: Release of 10-12 neonate larvae into the whorl of maize plant at 12 days after germination in all the plants in the each row

Observations: Leaf injury rating on 1-9 scale at 35 days after infestation (Sarup *et al.* 1977)

The resistant, moderately resistant and susceptible entries are defined by LIR 1-3, >3-6 and >6-9, respectively.

**ET2:** Evaluation of maize AICRP entries against *Spodoptera frugiperda* (J.E. Smith) under artificial infestation (please check) (AVT I and II) during *Kharif*

**Entries to be tested:** Early, Medium, Late Normal; QPM, Sweet corn, Popcorn and Baby corn.

**Locations (hot spots):** Coimbatore, Ludhiana, Hyderabad, Kolhapur and Udaipur

Number of Entries:

Row length: 2.00 m; Replications: 2; Spacing: 75×20 cm/60x25 cm and Number of rows: 1

Date of infestation: release of 5 neonates into the whorl of the plant at V5 stage

- Observations: Whorl feeding injury rating on 1-9 scale (modified Davis scale) and Percent plants infested at 4 and 6 weeks after infestation
- Ear damage rating at harvest on 1-9 scale Davis scale

**ET 3: Evaluation of maize inbred lines against *C. partellus* under artificial infestation**

Locations: Dholi, Karnal, Kolhapur, Hyderabad and Udaipur (1<sup>st</sup> Year)

Number of Entries: Design: Augmented.

Row length: 2.00m; Spacing: 75×20 cm/ 60×25 cm Date of Infestation: Release of 10-12 neonate larvae into the whorl of maize plant at 12 days after germination

Observations: Leaf injury rating (LIR) on 1-9 scale at 35 days after infestation

**ET 4: Evaluation of inbred lines against fall armyworm, *S. frugiperda* under artificial infestation (1<sup>st</sup> Year)**

**Locations:** Coimbatore, Hyderabad, Kolhapur, Ludhiana and Udaipur

Number of Entries: 100, Design: Augmented,

Row length: 2.00 m; Replications: 2, Spacing: 75×20 cm/ 60×25 cm

Methodology: Release of 10-15 neonates / plant at V5 stage

Observations:

Percent plants infested and Davis Score at 7, 14, 21 and 28 days after infestation

Ear damage rating at harvest based on Davis scale on 1-9 scale

**ET5: Monitoring of fall army worm *Spodoptera frugiperda* by pheromone traps with NBAIR slow releasing dispenser**

**Locations:** Coimbatore, Delhi, Dholi, Godhra, Hyderabad, Imphal, Kalyani, Karnal, Kolhapur, Ludhiana, Mandya, Pantnagar, Peddapuram, Rahuri, Udaipur and Vagarai

Select two locations at each centre Number of

traps per location: 4/acre

Time of installation of traps: commencing from the time of sowing/ from June 1, 2021

Data to be recorded: Number of moths per trap at weekly interval throughout the season as per SMW (preferably once in 3 days to identify the species trapped) & daily weather data on RH-min. & max.; T- min. & max.; wind speed, rain fall & sunshine hours. While reporting data, give co-ordinates of the location of traps.

**ET6: Monitoring of *Helicoverpa armigera* by pheromone traps**

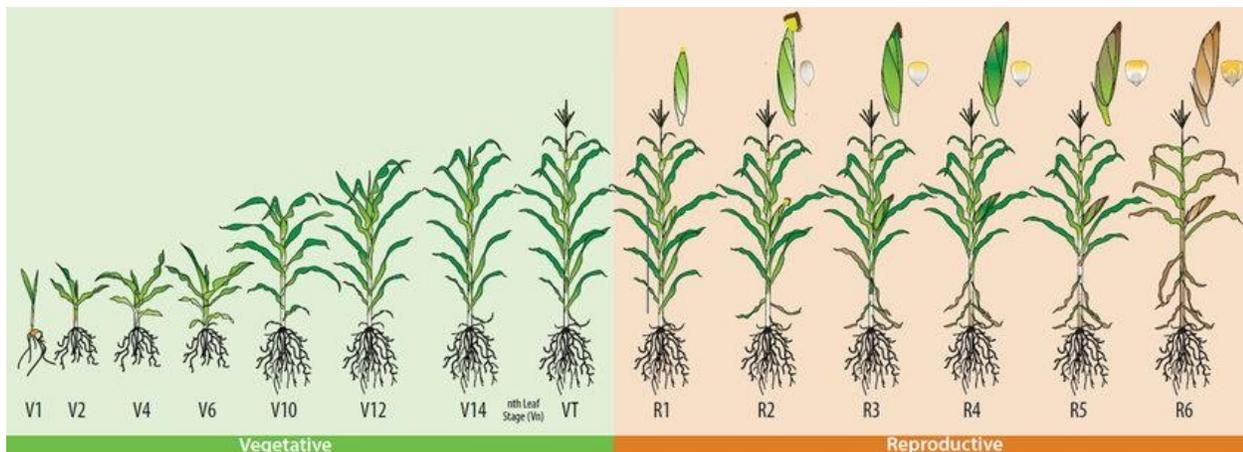
**Locations:** Delhi, Karnal, Imphal and Udaipur

Number of traps per location: 4/acre

Two locations at each centre

Time of installation of traps: 6 leaf stage

Taking observation and lure change: change lure once in two weeks, take weekly observation till harvest.  
 Data to be recorded: Number of moths per trap at weekly interval as per SMW and the stage of crop at the time of observation V8, V9, VT, R1, R2 etc. Purpose is to know which stage of crop growth attracts the moths, which will help to manage it, as per the recommendations in workshop.



**ET 7. Evaluation of seed treatment against fall army worm during kharif 2021**

Locations: Kharif 2021: Dholi, Imphal, Godhra, Karnal, Ludhiana and Rahuri

Rabi 2021-22: Dholi

Cultivar to be used: Notified hybrid.

Number of treatments: 7, Number of Replications: 3, number of rows/ treatment: 5 Row length: 3.0m,

Observations:

- Tag 20 plants/plot (leaving border rows), record number of plants infested and Record Davis score of tagged plants at 7, 14, 21, 28 DAG.
- Record phyto toxicity symptoms if any
- Record grain yield/plot at 12% moisture.

**Ear damage rating at harvest based on 1-9 Davis scale and grain yield kg/plot at 12% Moisture.**

S. No.	Insecticide	Dose ml/kg seed
T1	Cyantraniliprole 19.8%+Thiamethoxam 19.8%	6.0 ml
T2	Cyantraniliprole 600 FS	2.4 ml
T3	Chlorantraniliprole (Lumivia 50 FS)	5.6 ml
T4	Thiamethoxam 350 FS	8.0 ml
T5	Imidacloprid 600 FS	8.0 ml
T6	Chlorantraniliprole 18.5 SC* (spray std. check)	0.5ml/l
T7	Untreated control	-

**ET 8: Evaluation of insecticides as seed treatment and spray for the management of fall army worm (1st year)**

Locations: Coimbatore, Hyderabad, Kolhapur, Ludhiana, Karnal and Udaipur

Cultivar to be used: Notified hybrid.

Number of treatments: 15, Number of Replications: 3,

Number of rows/ treatment: 5 Row length: 3.0m,

Observations:

- Tag 20 plants/plot (leaving border rows), record number of plants infested and Record Davis score of tagged plants before spraying and 10 days after each spray.
- Record phytotoxicity symptoms if any,

Ear damage rating at harvest based on 1-9 Davis scale and grain yield kg/plot at 12% Moisture.

S. No.	Treatment
1	Thiamethoxam 30FS @ 8ml/kg seed
2	Cyantraniliprole 19.8% + Thiamethoxam 19.8% @ 6ml/kg seed
3	Cyantraniliprole 600 FS @ 2.4 ml

4	Chlorantraniliprole (Lumivia) as seed treatment @5.6 ml/kg seed
5	Thiamethoxam30FS @8ml/kg seed and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 3 weeks after germination
6	Cyantraniliprole19.8% + Thiomethoxam19.8% @ 6ml/kg seed and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 3 weeks after germination
7	Cyantraniliprole 600 FS @ 2.4 ml and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 3 weeks after germination
8	Chlorantraniliprole (Lumivia) as seed treatment @5.6 ml/kg seed and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 3 weeks after germination
9	Thiamethoxam30FS @8ml/kgseed and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 4 weeks after germination DAG
10	Cyantraniliprole19.8% + Thiomethoxam19.8% @ 6ml/kg seed and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 4 weeks after germination DAG
11	Cyantraniliprole 600 FS @ 2.4 ml and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 4 weeks after germination
12	Chlorantraniliprole (Lumivia) as seed treatment @5.6 ml/kg seed and Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 4 weeks after germination
13	Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 10 % foliar damage or Davis score 3.0
14	Chlorantraniliprole 18.5% SC 0.4 ml/ litre spray at 20% foliar damage or Davis score 3.0
15	Untreated control

**ET 9 : Evaluation of insecticides as spray based on incidence for the management of stem borers (2<sup>nd</sup> year)**

**Locations:**

**Kharif-Dholi, Karnal, Udaipur (Spotted stem borer)**

**Rabi-Hyderabad, Ludhiana (Pink stem borer)**

Cultivar to be used: Any notified hybrid.

Number of treatments: 10, Insecticide to be used: Recommended One Number of

Replications: 3, Number of rows/treatment: 5, Row length: 3.0m

**Data to be recorded:**

- Tag 20 plants/plot (leaving border rows), record number of plants infested and dead hearts formed and calculate the percent infestation and percent dead hearts formed by *Chilo/Sesamia* just before spray and 10 days after each spray.
- Record LIR (1-9 Scale) at 35-40 days old plants + Before 2nd spray
- Record phyto-toxicity symptoms if any,
- Record grain yield/plot at 12% moisture.

Sl. No.	Treatment (Recommended insecticide used in Kharif 2020 to be continued- (Chlorantraniliprole 18.5% SC 0.3 ml/ litre)
1	AT 5% INCIDENCE (Visible leaf feeding damage)
2	AT 10% INCIDENCE (Visible leaf feeding damage)
3	Appearance of Dead Heart(1)
3	At 7DAG
4	At 14DAG
5	At 7 & 14DAG
6	At 10DAG
7	At 20DAG
8	At 10 & 20DAG
10	Untreated Control

**ET 10. Evaluation of insecticides as spray based on incidence for the management of stem borers (2<sup>nd</sup> Year)**

**Locations: Coimbatore, Kolhapur, Ludhiana, Hyderabad and Udaipur**

Number of treatments: 10, Number of Replications: 3, Number of rows/treatment: 6

Row length: 3.0m, sprays to be given: at Davis score 3

Observations to be recorded on 20 pre-determined plants/plot

Pre-treatment count –percent plants infested and Davis score

Post treatment count for percent plants infested and Davis score on1-9 scale at 10days after each spray. Ear damage rating at harvest based on1-9 Davis scale and grain yield/plot at12 % moisture

Sl. No.	Treatment (Recommended insecticide used in kharif 2020 (Chlorantraniliprole 18.5% SC 0.4 ml/ litre)
1	At5%INCIDENCE
2	At10%INCIDENCE
3.	Davisscore2
4.	Davisscore4
5.	AT7DAG
6.	AT 14DAG
7.	AT7&14DAG
8.	AT 10DAG
8	AT 20DAG
9	AT10 &20DAG
10	Untreated Control

#### ET 11. Evaluation of newer molecules for the management of FAW (2<sup>nd</sup> Year)

**Locations: Kharif: Coimbatore, Kolhapur, Ludhiana, Hyderabad and Udaipur**

**Rabi 2021-22:Dholi, Coimbatore, Kolhapur**

Number of treatments:10, Number of Replications:3,Number of rows/treatment:5.

Row length: 3.0m, sprays to be given: at Davis score3

Observations: to be recorded on 20 pre-determined plants/plot

Pre-treatment count –percent plants infested and Davis score.

Post-treatment count for percent plants infested and Davis score on1-9scale at10 days after each spray.

Ear damage rating at harvest based on1-9 Davis scale and grain yield/plot at 12% moisture.

Sl.No.	Treatment	Doseml/kg
1	Chlorantraniliprole 9.3% + Lambdacyhalothrin 4.6% ZC	100 ml per acre (0.5 ml/litre)
2	Novaluron 5.25% + Emamectin benzoate 0.9% w/w SC	350 ml per acre (2 ml/ litre)
3.	Emamectin benzoate 5 % SG	80g/ha (0.4 g/ litre)
4.	Spinetoram 11.7% w/w SC	100 ml per acre (0.5 ml/ litre)
5.	Chlorantraniliprole 18.5% SC	80 ml per acre (0.4 ml/ litre)
6.	Flubendamide 480 SC	60 ml per acre (0.3 ml/ litre)
7.	Spinosad 45SC	100 ml per acre (0.5 ml/l)
8	Cyantraniliprole19.8%+Thiomethoxam 19.8% as check	6 ml /kg seed treatment
9	Untreated Control	-

#### ET 12. Evaluation of bio-pesticides/bio agents against fall armyworm Rabi 2021-22

**Locations: Coimbatore, Kolhapur and Hyderabad**

Cultivar to be used: Notified hybrid.

Number of treatments: 12, Number of Replications: 3, Number of rows/ treatment:5Row length:3.0m, sprays to be given: at Davis score3

Observations: to be recorded on 20 pre-determined plants/plot

Pre-treatment count –percent plants infested and Davis score

Post-treatment count for percent plants infested and Davis score at10days after each spray.

Ear damage rating at harvest based on1-9 Davis scale and grain yield/plot at12 % moisture.

Sl. No.	Treatment	Dose
1	EPN <i>H.indica</i> NBAIRH38	10g/l

2	<i>Pseudomonas fluorescens</i> (Pf DWD 2%)	20g/l
3	NBAIR <i>Bt</i> 252%	2ml/l
4	<i>Metarhiziumanisopliae</i> NBAIR-Ma35,0.5%	5g/l
5	<i>Beauveria bassiana</i> NBAIR-Bb45,0.5%	5g/l
6	SpfrNPV(NBAIR1)	2ml/l
7	NSKE5%	5ml/l
8	Neemformulation1500ppm	5ml/l
9	Chlorantaniliprole18.5 SC	0.4ml/l
10	Emamectinbenzoate5%SG	0.4g/l
11	Commercial Bt formulation	6ml/kg seed treatment
12	Untreated Control	-

**ET 13. Evaluation of indigenous technology knowledge (ITK) practice for the management of fall armyworm, *Spodoptera frugiperda* in kharif and rabi maize**

**Locations: Kharif 2021- Imphal, Ludhiana**

**Rabi 2021-2022: Rahuri, Hyderabad**

Cultivar to be used: Notified hybrid.

Number of treatments: 9, Number of Replications: 3, Number of rows/ treatment: 5Row

length:3.0m,Application method: Around 0.5g/whorl of V6 stage plants (6 fully opened leaves)

Observations: to be recorded on 20 pre-determined plants/plot

Pre-treatment count –percent plants infested and Davis score

Post treatment count for percent plants infested and Davis score at 7, 14, 21days after each application.

Ear damage rating at harvest based on1-9 Davis scale and grain yield/plot at 12% moisture.

S.No.	Treatment	Dose	Percent plant infestation (days after germination)					Grain yield (q/ha)
			14 (Pre-treatment)	21	28	35	42	
T1	Soil	15 kg/ acre (~0.5g/pl ant)						
T2	Soil + insecticide (Chlorantaniliprole18.5 SC)	5 ml/ kg soil						
T3	Soil + Lime	8: 2 (800g soil+200 g lime)						
T4	Soil + Bt	25g Bt/kg soil						
T5	Soil+ <i>Metarhiziumanisopliae</i>	65g/kg soil						
T6	Soil+ <i>Beauveria bassiana</i>	65g /kg soil						
T7	Sand	(~0.5g/pl ant)						
T8	Bait + Chlorantaniliprole18.5 SC)	5 ml/ kg bait (bait-600g soil+130 g jaggery+ 70 g sand+						

		200ml water)					
T9	Chlorantaniliprole 18.5 SC	0.4 ml/ l spray					
T10	Untreated control	-					

**ET14: Study on Pest succession of insect-pests in kharif sown maize**

**Locations:** Coimbatore, Dholi, Hyderabad, Imphal, Kolhapur, Karnal, Ludhiana & Udaipur

Number of cultivars: one susceptible, Number of rows: 10, Row length: 3m

**Method of observation:** Weekly observations on occurrence of various insect pests and natural enemies on minimum on **1 tagged plant/row** will be observed during the cropping season (asper SMW, table 4)

**Table 4. Pest succession table**

SMW No.							
Insect	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant No.	
No. of FAW							
Davis score							
No. of Chilo							
Chilo LIR							
Aphid							
Any other pest (sesamia/.)							
No. of Chaffer beetle (record species)							
Cob borer (record species)							
Cob damage score							
Termite damage							
Coccinellid							
Any other natural enemy							

**ET15: Study on incidence of *Chilopartellus* and *Spodoptera frugiperda* in Kharif sown maize/rabi sown maize in relation to plant age and meteorological factors**

**Objective:** To develop pest incidence prediction model for maize growing ecologies

**Locations:** Coimbatore, Dholi, Hyderabad, Imphal, Karnal, Kolhapur, Ludhiana and Udaipur

Number of cultivars: one susceptible and one resistant, Number of rows: 5 rows of 3m for each cultivar

Number of sowings: At least 6 sowing dates from start to crop season for *C. partellus* (kharif) and *S. frugiperda* (kharif & rabi)

**Methodology to accommodate *Chilo* and/or AW (Table 3)**

- Record date of germination; take observation on 8<sup>th</sup> day of germination and every week till grain filling stage
- Total number of plants & No. of infested plants
- Record the no. of larvae and the species-FAW/Chilo/Sesamia etc.
- Record no. of natural enemies & genus/species. This can be done by dissecting 10% of the infested plants since most of them hide in the whorl.
- Score infested plants in 3<sup>rd</sup> and 5<sup>th</sup> week of infestation- LIR if *Chilo* & Davis scale if FAW (take representative photographs)
- Record tassel/ear infestation
- Record ear damage by rating scale in 5 randomly selected ears/plot

**Table 3. Data table for sowing No. 1 for cultivar No. 1**

**Date of sowing: 27.06.2021 Date of germination: 01.07.2021**  
**Genotype: Notified hybrid**

Date of observation (weekly intervals from date of germination)	Total number of plants at start of each observation	No. of infested plants	Total number of larvae/insects recovered from 10% infested plants in the second week of infestation (Eg. Dissect 2 plants if the no.of infested plants Is 16)	No. of dead hearts/dead plants	No .of plants with tassel damage	No. of plants with ear damage
08.07.2021	75	10				
15.07.2021	75	16	91 No. of Chilo-No. of FAW-Any other pests-Spider-Rove beetle-Coccinellid-Any other-			
22.07.2021	73	10		Dead plants by Chilo-By FAW-By cutworm /any other		
29.07.2021		4		-do-		
05.08.2021		3		-do-		
12.08.2021		0		-do-		
19.08.2021		0				
26.08.2021		0			No. of Chilo in tassel-FAW-Any other-	No. of FAW/cob borer sp. In tassel-Any other-
02.09.2021		0				Davis score of ear damage & the insect present in cob Plant No.1 Plant No.2 Plant No.3 Plant No.4 Plant No.5

#### ET16. Estimation of yield loss and economic threshold level for FAW

**Locations:** All locations where pesticide trials are conducted

**Prerequisite:** All observations are to be taken from same variety.

**Two types of data is required**

- 1. Yield of 20 plants of each Davis score-** Tag 20 plants of each Davis score at two timepoints, at V6 and VT. Tagging can be done from any plots belong to **any trial provided that the genotype is same**. Note that the chance of getting Davis1-4 is more on chemical pesticide trials and 5-9 in control lots. Record grain yield of individual plants under each Davis score (**Table1**).
- 2. Davis score and yield of entire plot-** Record Davis score two time only, at six leaf stage (V6) and tasseling stage (VT- when >50% of the tassels emerge out of leaf whorl). Score all plants from control, Chlorantraniliprole and Emamectin benzoate plots. Four replications each are needed, which can be selected from two trials i.e., chemical and bio-pesticide trials/ any other trials. There would be 90 plants/replication (6 rows of 3 m) Data to be send to PI: Raw data of individual plants.(**Table1**). Report name of cultivar, no. of rows, row length and spacing and total grain yield (kg/plot) of each plot.

**Note that we are reporting the above data from any 4 replication each from Chlorantraniliprole and Emamectin benzoate plots of pesticide/biopesticide trials where uniform treatments were applied.**

**Validation:** The formula developed can be validated for all the pesticide trials by using the Davis score data of 20 tagged plants that we are recording by default.

**Table1.Data table for yield of tagged plants**

	Yield (g)ofV6taggedplantNo.1-20						
Davis score	1	2	3	4	5	....	20
1							
2							
3							
4							
5							
6							
7							
8							
9							

	Yield (g)ofVTtaggedplantNo.1-20						
Davis score	1	2	3	4	5	....	20
1							
2							

3							
4							
5							
6							
7							
8							
9							

**Table2.DavisscoreofallplantsatV6stageand V Tstage**

Plots	V6 stage Davis score of individual plants (hypothetical)								
	Control R1	4	6	7	7	8	2	4	6
Control R2									
Control R3									
Control R4									
Emamectin benzoate5% SG R1									
Emamectin benzoate5% SG R2									
Emamectin benzoate5% SG R3									
Emamectinbenzoate5% SG R4									
Chlorantraniliprole 18.5% SC R1									
Chlorantraniliprole 18.5% SC R2									
Chlorantraniliprole 18.5% SC R3									
Chlorantraniliprole 18.5% SC R4									

Plots	VT stage Davis score of individual plants (hypothetical)								
	Control R1	2	3	3	3	1	3	4	4
Control R2									

Control R3									
Control R4									
Emamectin benzoate 5% S G R1									
Emamectin benzoate 5% SG R2									

Emamectin benzoate 5 % SG R3									
Emamectin benzoate 5 % SG R4									
Chlorantraniliprole18.5% SC R1									
Chlorantraniliprole18.5% SC R2									
Chlorantraniliprole18.5% SC R3									
Chlorantraniliprole18.5% SC R4									

**Table 3. Yield of plots from where the above data was recorded.**

<b>Name of cultivar: No. of rows and Row length: Spacing between rows and plants:</b>	<b>Grain yield (kg/plot)</b>
Control R1	
Control R2	
Control R3	
Control R4	
Emamectin benzoate 5 % SG R1	
Emamectin benzoate 5 % SG R2	
Emamectin benzoate 5 % SG R3	
Emamectin benzoate 5 % SG R4	
Chlorantraniliprole18.5% SC R1	
Chlorantraniliprole18.5% SC R2	
Chlorantraniliprole18.5% SC R3	
Chlorantraniliprole18.5% SC R4	

## **Rabi 2021**

### **ET 17: Evaluation of maize AICRP entries against Pink stem borer, *Sesamia inferens* under artificial infestation for AVT I & AVT II**

#### **Locations: Kolhapur, Hyderabad and Coimbatore**

Number of Entries: To be decided; Row length: 2.0 m, Replications: 2, Number of rows: 1 Spacing: 75×20cm/60×25cm, Date of Infestation: 12 days after germination; Release of 10-12 neonate larvae/plant; Observations: Leaf injury rating on 1-9 scale at 35-40 days after infestation (Reddy et al., 2003)

### **ET18: Evaluation of maize AICRP entries against *Spodoptera frugiperda* (J.E.Smith) under artificial infestation (AVT I and II) during Kharif and Rabi**

#### **Locations: Coimbatore, Hyderabad and Kolhapur**

Number of Entries: To be decided

Row length: 2.00 m; Replications: 2; Spacing: 75×20 cm/60×25 cm and Number of row: 1

Observations: Whorl feeding injury rating on 1-9 scale (modified Davis scale) at 4 and 8 weeks after germination

Ear damage rating at harvest on 1-9 scale Davis scale)

### **ET19: Evaluation of inbred lines against Spotted stem borer, *Chiloptellus*/Pink stem borer, *Sesamia inferens* under artificial infestation (1<sup>st</sup> Year)**

#### **Locations: Kolhapur and Hyderabad**

Number of Entries: 100, Design: Augmented; Row length: 2.0 m, Number of rows: 1,

Spacing: 75 × 20 cm/60 × 25 cm,

Date of Infestation: 12 days after germination; Release of 10-12 neonate larvae/plant;

Observations: Leaf injury rating on 1-9 scale at 35-40 days after infestation (Reddy et al 2003)

### **ET 20: Evaluation of inbred lines against *Spodoptera frugiperda* (J.E.Smith) under artificial infestation (1st year)**

#### **Locations: Coimbatore, Hyderabad and Kolhapur**

Number of Entries: 100, Design: Augmented

Row length: 2.0m; Spacing: 75×20cm/60 x 25 cm and Number of rows: 1

Observations: Whorl feeding injury rating on 1-9 scale (modified Davis scale) at 4 and 8 weeks after germination and ear damage rating at harvest on 1-9 scale (Davis scale)

## **Spring 2022**

### **ET 21: Evaluation of maize AICRP entries against *Atherigona sp.* under natural infestation for AVT I and II using fish meal technique.**

#### **Locations: Karnal and Ludhiana**

Number of Entries: to be decided by PI Breeding

Row length 2.0m, Number of rows: 1, Replications: 2

Method of Infestation: Natural (Fish meal technique) at the time of sowing

Data to be recorded: Number of dead hearts formed at 21 and 28 days after germination.

### **ET 22. Evaluation of inbred lines against shoot fly under natural infestation (Ludhiana)**

#### **Locations: Karnal and Ludhiana (1<sup>st</sup> Year)**

Entries: 100, Design: Augmented, Row length: 2.0m, Number of rows: 1,

Method of Infestation: Natural (Fish meal technique)

Data to be recorded: Eggs laid/plant, Number of dead hearts formed at 21 and 28 days after germination.

**Note: Along with your report, submit excel sheets of raw data for analysis.**

**Annexure**

**Leaf Injury ratings scale for spotted stem borer, *Chilo partellus* (Sarupetal. 1977)**

Rating	Description
1	Plants showing no infestation
2	1-2 leaves with pin holes
3	3-4 leaves with holes
4	1/3 leaves showing infestation
5	Half the number of the leaves with infestation
6	2/3 leaves with infestation symptoms and the holes becoming windows
7	Leaves with long window and plant grow this stunted
8	Almost all leaves displaying heavy infestation and plant grow this stunted
9	Dead heart formed

The resistant, moderately resistant and susceptible entries are defined by LIR 1-3, >3-6 and >6-9 respectively

**Leaf Injury rating scale for pink stem borer, *Sesamia inferens* (Reddy et al. 2003)**

Rating	Description
1.	Apparently healthy plant
2.	Plant with parallel, oval or oblong holes, slightly bigger than pin sized (2-3mm) on 1-2 Leaves
3.	Plant with more elongated holes (4-5mm or match stick head sized) or shot holes on 1-2 Leaves
4.	Plant with injury (oval holes, shot holes and slits of 1-4cm) in about 1/3 of total number of Leaves and midrib damage on 1-2 leaves
5.	Plants with about 50% leaf damage, oblong holes, shot holes, slits and streaks of 5-10cms And mid rib damage on leaves
6.	Plants with a variety of leaf injuries to about two third of total number of leaves (ragged appearance) or one or two holes or slits at the base of the stem (>10cms streaks are observed)
7.	Plants with every type of leaf injury and almost all the leaves damaged (ragged or crimped appearance), with tassel stalk boring or circular dark ring at the base of stem
8.	Plants with stunted growth in which all the leaves are damaged
9.	Plants with dead heart

The resistant, moderately resistant and susceptible entries are defined by LIR 1-3, >3-6 and >6-9 respectively.

**Ratings scale for screening of maize genotypes based on foliar damage (Modified from Davis and Williams, 1992)**

Score	Damage symptoms/Description	Response
1	No visible leaf feeding damage	Highly resistant
2	Few pin holes on 1-2 older leaves	Resistant
3	Several shot-hole injuries on a few leaves (<5 leaves) and small circular hole Damage to leaves	Resistant
4	Several shot-hole injuries on several leaves (6-8 leaves) or small lesions/pin holes, small circular lesions, and a few small elongated (rectangular-shaped) lesions of up to 1.3cm in length present on whorl and Furl leaves	Moderately Resistant
5	Elongated lesions (>2.5cm long) on 8-10 leaves, plus a few small- to mid-sized uniform to irregular-shaped holes (basement membrane consumed) Eaten from the whorl and/or furl leaves	Moderately Resistant
6	Several large elongated lesions present on several whorl and furl leaves and/or several large uniform to irregular-shaped holes eaten from furl and whorl Leaves	Susceptible

7	Many elongated lesions of all sizes present on several whorl and furl leaves Plus several large uniform to irregular-shaped holes eaten from the whorl and furl leaves	Susceptible
8	Many elongated lesions of all sizes present on most whorl and furl leaves plus many mid-to large-sized uniform to irregular-shaped holes eaten from the Whorl and furl leaves	Highly Susceptible
9	Whorl and furl leaves almost totally destroyed and plant dying as a result of Extensive foliar damage	Highly Susceptible

**Rating scale for ear damage caused by FAW where FAW is already present on plants (Davis and Williams, 1992)**

Score	Damage symptoms/Description	Response
1	No damage to the ear	Resistant
2	Damage to a few kernels (<5) or less than 5% damage to a near	Resistant
3	Damage to a few kernels (6-15) or less than 10% damage to a near	Resistant
4	Damage to 16-30 kernels or less than 15% damage to a near	Moderately Resistant
5	Damage to 31-50 kernels or less than 25% damage to a near	Moderately Resistant
6	Damage to 51-75 kernels or more than 35% but less than 50% Damage to a near	Susceptible
7	Damage to 76-100 kernels or more than 50% but less than 60% Damage to a near	Susceptible
8	Damage to >100 kernels or more than 60% but less than 100% Damage to a near	Susceptible
9	Almost 100% damage to a near	Susceptible

**PLAN OF WORK PLANT PATHOLOGY & NEMATOTOLOGY**  
(Kharif 2021 and Rabi 2021-22)

**MPT 1.** Disease screening of NIVT, AVT, QPM, and Rainfed (AVTs only) under artificially created epiphytotic (All centers) (Kharif 2021)

Entries in NIVT & AVT will be clubbed to constitute as Early, Medium, Late and whereas QPM Specialty corn (BC & SC) entries will also be included into one. If entries in one trail comes out to be unmanageable trials will spitted into two.

**Hot spot locations:**

S. No.	Zone	Disease	Locations
1.	NHZ (North Hill Zone)	TLB	Almora, Larnoo, Bajaura, Barapani (AVTs & Speciality corn), Imphal
		BLSB, BSR	Dhaulakuan
2.	NWPZ (North West Plain Zone)	MLB	Delhi, Karnal, Ludhiana
		BLSB	Delhi, Karnal, Pantnagar
		BSR	Pantnagar
		ChR	Ludhiana
3.	NEPZ (North East Plain Zone)	MLB	Dholi
		BLSB	Sabour
4.	PZ (Peninsular Zone)	TLB	Dharwad, Mandya, Rahuri
		BLSB	Peddapuram
		ChR	Coimbatore, Hyderabad
		SDM	Mandya
5.	CWZ (Central Western Zone)	FSR, CLS, RDM, MCN*	Udaipur

\* Udaipur centre will screen all the trials type except NIVT for cyst nematode with two replications for each entry

**Resistant and Susceptible Checks**

Resistant Checks				
Sr. No.	Genotype	Name of Company / Contributor	Name of Disease	Seed Quantity
1.	ADV 7022	Advanta Ltd.	MLB, TLB, BLSB, CLS, BSR, ChR, FSR, CR, SDM, RDM, PFSR	6 kg
2.	VAMH 12014	TNAU, Coimbatore	MLB, TLB, BLSB, CLS, BSR, ChR, FSR, CR, RDM	6 kg
Susceptible Checks				
1.	RCRMH 4-1 (Medium)	UAS, Raichur	MLB, BLSB, CLS, BSR, CR, SDM, RDM, MCN	6 kg
2.	Surya	MPUAT, Udaipur	MLB, TLB, ChR, SDM, RDM, CLS, FSR	6 kg
3.	Early Composite	Bajaura	TLB, BLSB, BSR	2kg
4.	Dhari Local	Almora	TLB	2 kg
5.	Buland	PAU Ludhiana	TLB, SDM	2 kg
6.	PMH-2	PAU Ludhiana	ChR	2 kg
7.	CM 202	VC Farm Mandya/WNC	TLB	2 kg
8.	CM 500	VC Farm Mandya/WNC	SDM, FSR	2 kg
9.	CM 600	Pantnagar/WNC	MLB, BLSB, ChR, BSR	2 kg

**MLB:** Maydis leaf blight; **TLB:**-Turcicum leaf blight; **BLSB:**-Banded leaf sheath blight; **ChR:**-Charcoal rot; **PR:**- Polysora rust; **FSR:**-Fusarium stalk rot; **BSR:**-Bacterial stalk rot; **SDM:** - Sorghum downy mildew; **RDM:** - Rajasthan downy mildew, **MCN:** - Maize cyst nematode

Observations: Record all the disease screening data with following details:

Season	:	<i>Kharif</i>	Replication	:	2
Date of Sowing	:		No. of Rows/ rep	:	1
Date of Inoculation	:		Row Length	:	2.0m
Name of Susceptible check	:		Date of Observation	:	
Name of Resistant Check	:		Date of Harvesting	:	

General observations to be taken care of while screening under artificially created disease epiphytotics:

- Follow uniform method of disease screening under sick plot/ artificial created disease epiphytotics as described in Technical Bulletin on “Mass Screening Techniques for resistance to maize diseases” available on IIMR and Krishi Portal websites. Grain culture technique for inoculum production should be uniformly followed for creation of TLB, MLB, CLS, BLSB epiphytotics by all hot spot locations.

**MPT 2.** Disease screening of maize inbred lines under artificially created epiphytotics

i. Inbred lines contributed from AICRPM centres and IIMR will be evaluated against target diseases at AICRP centres. Inbred advanced (fixed) lines are to be contributed for this study.

Locations: Dharwad (TLB), Mandya (SDM), Mandya (TLB)

ii. ICAR-CIMMYT trials: Following ICAR-CIMMYT trials (2021-22) would be conducted at centres mentioned against each trial:

Sr No.	AICRP-Centre	Diseases	Collaborator	#Entries	#Reps	Total rows
1	Ludhiana	BLSB	Dr Harleen Kaur	100	2	200
2	Larnoo	TLB	Dr Zahoor	100	2	200
3	Udaipur	FSR	Dr S S Sharma	100	2	200
4	Pantnagar	BSR	Dr R P Singh	100	2	200
5.	Mandya	TLB	Dr. Mallikarjuna	100	2	200
6.	Mandya	SDM	Dr Jadesha	100	2	200
7.	Hyderabad	PFSR	Dr. Mallaiah	100	2	200
8.	Peddapuram	BLSB	Mr. Bharat	100	2	200
9.	Dharwad ( <b>Rabi season</b> )	ChR	Dr. S.I. Harlapur	100	2	200

Replications-2, Row length-2 m

**MPT 3.** Assessment of avoidable yield losses due to major diseases of maize

These trials will be conducted at following locations using paired plot technique (LeClerc, 1973) with ten replications under sick plot/ artificially created epiphytotic.

**Locations:** Kalyani (TLB), Imphal (TLB)

Centre	:	Hybrid	:	Notified
Season	:			
Treatments	:	Plot size	:	5 Rows of 2 m each
Replications	:	Date of Observation	:	
Date of Sowing	:	Date of Harvesting	:	

Replication	Treatment	Disease Incidence (%)	PDI	Yield (q/ha)	Yield loss (%)
R1	Protected				
	Unprotected				
R2	Protected				
	Unprotected				
R10	Protected				

	Unprotected			
Mean				
Disease control (%)				
Avoidable yield losses (%)				
CD (5%)				
CV (%)				

Design: t-Test and Paired row technique, Most effective fungicides must be used

Note: Assessment of yield losses by paired plot technique the data should be analyzed, by 't' test and not by RBD. Follow 't' test statistical analysis. All centre which conducted multiple years will compile and send to PI well in advance before workshop or as and when requested.

#### MPT 4. Trap nursery trial for disease incidence

The trial will be conducted to find out the occurrence of disease and/or any new disease on a set of maize inbred lines (10 lines) susceptible to different diseases at various locations. A special care has to be taken in observing the incidence of viral diseases, if any.

**Locations:** Almora, Bajaura, Coimbatore, Delhi, Dharwad, Dhaulakuan, Dholi, Godhra, Hyderabad, Imphal, Karnal, Kalyani, Ludhiana, Mandya, Pantnagar, Peddapuram, Rahuri, Sabour, Udaipur (19 centres)

**Plot size:** 2 rows of 2.0 m length

Observations:

A. Disease score / incidence (%) of should be recorded in following format:

S. No.	Entry Name	Germination (%)	Disease score/ Incidence (%) (Natural condition)	Remarks
1.	CM 400			
2	CM 500			
3	CM 501			
4	CM 600			
5	BML 6			
6	BML 7			
7	Surya			
8	Early composite			
9	LM 14			
10	IIMR SBT POOL			

B. Weekly disease prevalence\* – Record weekly disease prevalence data of trap nursery of most susceptible lines for use in development of disease forecasting model in the following format:

Week	Entry Name	Disease name	Disease score/ Incidence (%) (Natural condition)	Remarks
1.	a			
	b			
	c			
2.	a			
	b			
	c			

\* Mean disease score and percent disease index (PDI) of foliar diseases should be given.

#### MPT 5. Disease survey and surveillance in different maize growing areas (All centres)

Survey and surveillance will be done in the mandated maize growing areas of the centre. During survey and surveillance of diseases, scoring should be done along with the incidence of disease in prescribed proforma.

**Locations:** Almora, Bajaura, Coimbatore, Delhi, Dharwad, Dhaulakuan, Dholi, Godhra, Hyderabad, Imphal, Kalyani, Karnal, Ludhiana, Mandya, Pantnagar, Peddapuram, Rahuri, Udaipur, Sabour (19 centres)

**Observations:**

- Mean disease score for calculating PDI should strictly be followed.
- Weather data of locations may be given with disease prevalence.
- Weather data should be recorded in following format and to give the correlation
- Include diseases scoring, disease severity and incidence as and when applied to a particular disease.

S. No.	Station Name	Month	Temperature (oC)		Rainfall of Month (mm)		R.H (%)		Sunshine hours
			Min	Max			Min	Max	

**Note: Every centre will notify disease wise free areas of their state.**

**MPT 6. Efficacy of new fungicides in control of maize diseases**

**Locations:** Udaipur (CLS, MLB, RDM), Karnal (MLB), Delhi (MLB), Kalyani (MLB), Pantnagar (MLB), Dharwad (TLB), Rahuri (TLB), Hyderabad (Chr), Imphal (Polysora rust)

Centre	:	Hybrid	:	*
Season	:	Design	:	RBD
Treatments	:	8	Plot size	: 6Rows of 2 m each
Replications	:	3	Date of Observation	:
Date of Sowing	:		Date of Harvesting	:

\* Surya (Udaipur), Punjab Sweet Corn-1 (Karnal), Punjab Sweet Corn-1 (Delhi), Kaveri 50- (Kalyani), PSM1-(Pantnagar), GH0727-(Dharwad)

T1	Kresoxim methyl 44.3%SC @ 0.10% spray at 3 days and 18 days after inoculation
T2	Zineb75% WP @ 0.20% spray at 3 days and 18 days after inoculation
T3	Thiram 75% WS only seed treatment @ 0.20%
T4	Azoxystrobin 18.2 w/w +Difenoconazole11.4% w/w SC@ 0.10% spray at 3 days and 18 days after inoculation
T5	*Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.20% spray at 3 days and 18 days after inoculation
T6	Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE @ 0.15% at 3 days and 18 days after inoculation
T7	Protected check (Mancozeb 75%WP @ 0.20% spray at 3 days and 18 days after inoculation)
T8	Untreated Control (Water spray)

\* **Include Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SCif available in market.**

**MPT 7. Evaluation of different modules for the management of MLB**

**Location:**Dholi

Centre	:	Hybrid	:	Rajendra Makka 1/2 (Dholi)
Season	:	Design	:	RBD
Treatments	:	6	Plot size	: 6Rows of 2 m each
Replications	:	4	Date of Observation	:
Date of Sowing	:		Date of Harvesting	:

Treatments	
T1	<b>Organic module:</b> Seed treatment with T.harziamum @ 10g/kg seed, foliar spray of Nimbicidine @ 5ml/lit of water @35 DAS and P.fluorescence@ 10g/lit at 50 DAS
T2	<b>Chemical module:</b> Seed treatment with Thiram 75WP @ 2g/kg seed, foliar application of Mancozeb 75WP @

	2.5g/litre of water @ 35 DAS followed by Azoxystrobin 18.2% + Difenconazole 11.4% (Amistar Top) @ 1 ml/litre of water at 50 days after sowing
T3	<b>IDM module:</b> Seed treatment with T. harzianum @ 10g/kg seed + Thiram 75WP @ 2g/kg seed, foliar application of Nimbicidine @ 5ml/litre @ 35 DAS, followed by Azoxystrobin 18.2% + Difenconazole 11.4% (Amistar Top) @ 1 ml/ litre of water at 40 days after sowing.
T4	<b>Protected check:</b> Foliar spray with Mancozeb 75 WP @ 2.5g/litre @ 35 and 50 DAS
T5	Unprotected organic check (inoculated) (Use FYM only)
T6	Unprotected inorganic check

#### MPT 8. Evaluation of different modules for the management of TLB

Treatments	
T1	<b>Organic module</b> - Seed treatment with Trichoderma harzianum@10g/kg of seed), foliar spray of Pseudomonas fluorescens (@ 10g/l of water) at 45 DAS & Foliar spray of cow urine (20%) at 60 DAS
T2	<b>Chemical module</b> - Seed treatment with Thiram @ 3g/kg of seed, foliar spray of Mancozeb 75WP @ 2.5g/l of water at 40 DAS, foliar spray of Azoxystrobin 18.2% + DAS Difenconazole 11.4% w/w SC (Amister Top 325 SC)1ml/l of water at 50 DAS
T3	<b>IDM module</b> - Seed treatment with Trichoderma harzianum @ 10g/kg of seed, foliar spray of Pseudomonas fluorescens @ 10g/l of water at 35 DAS, foliar spray of Azoxystrobin 18.2% + Difenconazole 11.4% w/w SC (Amister Top 325 SC) 1ml/l of water at 40 DAS, foliar spray of cow urine (20%) at 50 DAS
T4	Protected Check: Foliar spray with Mancozeb 75WP @ 2.5g/l at 35 and 50 DAS
T5	Unprotected Organic Check (inoculated) (Use FYM only)
T6	Unprotected Inorganic Check (inoculated)

#### Locations: Mandya

Centre	:	Hybrid	:	P 3502/5402 (Mandya)
Season	:	Design	:	RBD
Treatments	:	Plot size	:	6Rows of 3 meter each
Replications	:	Date of Observation	:	
Date of Sowing	:	Date of Harvesting	:	

#### MPT 9. Testing of *new molecule chemical for the management of maize cyst nematode*

##### Location: Udaipur

Centre	:	Hybrid	:	PEHM-2 or other susceptible check
Season	:	Design	:	RBD
Treatments	:	Plot size	:	6Rows of 3 meter each
Replications	:	Date of Observation	:	
Date of Sowing	:	Date of Harvesting	:	

Fluopyrum 34.48 % w/w SC 10 ml / kg seed

Fluensulfone 2 % w/w GR 5 kg / ha

Thiamethoxam 25 % WG 1% a.i. w/w

Carbofuran 3 G 1 kg a.i. /ha

Check

#### Treatments

**Udaipur centre will update new chemical available in markets and will conduct the experiment**

#### MPT 10. Disease screening of Rabi maize hybrids

Evaluation of maize hybrids of the coordinated trials of Rabi maize (NIVT & AVTs) against major diseases will be done under artificially created epiphytotics at following hot spot locations.

S. No.	Zone	Disease	Locations
1.	NWPZ (North West Plain Zone)	C.RUST	Karnal
		ChR	Ludhiana ( <i>Spring</i> )
2.	NEPZ (North East Plain Zone)	TLB	Dholi, Sabour, Kalyani
		MLB	Kalyani
3.	PZ (Peninsular Zone)	ChR	Coimbatore, Dharwad,

			Hyderabad, Rahuri
		TLB	Mandya, Peddapuram
		SDM	Mandya
5.	CWZ (Central Western Zone)	FSR	Udaipur

### Resistant and Susceptible Checks

Resistant Check				
1.	DKC 9165 (IM 8119) Late	Monsanto India Ltd.	TLB, ChR	2kg
2.	PM14205L (Late)	PHI Seeds Pvt. Ltd.	TLB, ChR	2kg
3.	BLH 102 (Medium)		TLB, ChR	2kg
4.	PM142096M (Medium)	PHI Seeds Pvt. Ltd.	TLB, ChR	2kg
5.	DMRH 1301 (Medium)	IIMR Ludhiana	TLB, ChR, SDM	2kg
6.	Bio9544 (Medium)	Bioseed Pvt Ltd.	TLB, ChR, SDM	2 kg
Susceptible Check				
7.	Buland (Medium)	PAU, Ludhiana	TLB, SDM	2kg
8.	PMH-2	PAU, Ludhiana	ChR	2kg
9.	MMH 15-9 (Medium)	TCA, Dholi	TLB, ChR, SDM	2kg
10.	31Y45	Pioneer	ChR (MS)	1kg

**MLB:-**Maydis leaf blight; **TLB:-**Turcicum leaf blight; **BSLB:-**Banded leaf sheath blight, **ChR:-**Charcoal rot; **CR:-**Common rust; **PR:-**Polysora rust; **FSR:-**Fusarium stalk rot **BSR:-**Bacterial stalk rot; **SDM:-** Sorghum downy mildew; **RDM:-** Rajasthan downy mildew

**Observation:** Record the disease screening data in following format:

Season	:	<i>Kharif</i>	Replication	:	2
Date of Sowing	:		No. of Rows/ rep	:	1
Date of Inoculation	:		Row Length	:	2.0m
Name of Susceptible check	:		Date of Observation	:	
Name of Resistant Check	:		Date of Harvesting	:	

### MPT11 Identification of racial pattern against TLB of Maize (*Kharif 2021 and rabi 2021-22*)

**Locations:** Mandya, Dharwad, Larnoo, Almora, Barapani, Kalyani, Bajaura, Rahuri, Imphal, Dholi, Sabour and Peddapuram (All hot spot centres according to season)

\*The centre will identify promising highly resistant inbred for TLB screened for at least two-three years and will multiply and will observe differential reaction on common lines.

At least Seven to eight promising inbred and two to three promising highly susceptible will be included.

The centre will also collect and maintain local isolates in their respective states as well as nearby adjacent state if TLB is observed so that maximum number of isolates differential reaction could be studied.

As Delhi centre has already experienced with MLB race/variability. The centre will be associated for MLB.

**Objective 1.** Identification of stable resistance sources

**Purpose-**To utilize stable sources in breeding program and to utilize in differential set development

**Objective 2.** Development of differential set against TLB of maize

**Purpose-**To identify racial patterns

**Objective 3.** Study of genetics of resistance in collaboration with breeders available at centre

**Purpose-** To study the disease resistance pattern

#### Special Note:

1. Use a common format for data observation including S.E., CD and CV (Management trials as well as survey and trap nursery).
2. Single replication data will be rejected directly.
3. The data which are observed for multiple year will be analyzed as in pool as well as for a particular year (All concerned centre will compile and send with proper analysis pattern)
4. After harvesting of every season send the management data within one month. Later on it won't be considered.

### Proceedings of VIC Meeting held through Video Conferencing

Variety Identification Committee (VIC) Meeting of AICRP on Maize was held on June 17, 2021 at 12:00 noon through Video Conferencing. The meeting was conducted under the chairmanship of Dr. T.R. Sharma, Deputy Director General (Crop Science), Indian Council of Agricultural Research, New Delhi. Director, ICAR-IIMR, Member Secretary and 11 members of the VIC including Chairman attended the meeting as detailed below:

1. Dr. T.R. Sharma, DDG (CS)	Chairman
2. Dr. Y.P. Singh, Assistant Director General (FFC)	Member
3. Dr. D.K. Yadav, Assistant Director General (Seeds)	Member
4. Dr. Sanjay Kumar, Director (IISR)	Member
5. Dr. S.K. Malhotra, Agri Commissioner, DACFW, GOI	Member
6. Dr. Rajesh Vashisht, Director of Agriculture, Govt. of Punjab	Member
7. Dr. Sanjeev Chhiller, Seed Certification Officer, Haryana state Seed Certification Agency, Panchkula	Member
8. Dr. R.S. Masali, Godrej Agrovel (Representative of crop-based processing/manufacturing industry)	Member
9. Dr. Brijendra Pal, Bioseeds (Representative of the private seed agency)	Member
10. Dr. N.K. Singh, Maize Breeder, GBPUA&T, Pantnagar	Member
11. Dr. R.B. Dubey, Maize Breeder, MPUA&T, Udaipur	Member
12. Dr. Sujay Rakshit, Director, Indian Institute of Maize Research	Member-Secretary

Dr. I.S. Solanki, Director of Research, BAU, Sabour could not attend the meeting. The meeting was also attended by the following resource persons from ICAR-Indian Institute of Maize Research:

1. Dr. J.C. Sekhar, PI, Entomology and Pathology, WNC, ICAR-IIMR, Hyderabad
2. Dr. Aditya Singh, PI, Agronomy, ICAR-IIMR, Ludhiana
3. Dr. S. B. Singh, PI, Field Corn, RMR&SPC, ICAR-IIMR, Begusarai
4. Dr. Ramesh Kumar, AICRP Nodal Officer & PI, QPM, ICAR-IIMR, Ludhiana
5. Dr. Chikkappa G. Karjagi, PI, Specialty Corn, Unit Office, ICAR-IIMR, New Delhi

A total of 28 entries have completed three years of testing during *rabi* 2019-20(8) and *kharif* 2020 (20). Out of these 17 identification proposals were received for consideration by the VIC. The proposals included three of *rabi* and 14 of *kharif* season. All the three proposals for *rabi* season were of long duration, whereas 14 proposals of *kharif* included long duration (3), medium duration (6), open pollinated variety (OPV) (1), biofortified EDVs derived through MAS enriched with Provitamin A (3), and an EDV of baby corn with male sterility trait (1). Out of the 17 proposals 5 were from public sector and 12 from private sector, which were submitted from 10 different organizations or institutes, 2 public sector and 8 private sector.

The VIC examined as per the variety identification guidelines, the consistency and yield superiority in multi-location, multi-year weighted mean yield data generated in NIVT, AVT-I and AVT-II stage of testing, three year data on reaction to major diseases generated in the respective trials of testing, two year data on reaction to major insect pests generated in AVT-I and AVT-II stage of testing and one-year data of agronomic evaluation for  $N \times G \times \text{spacing}$



Dr. Sujay Rakshit  
17/6/21

interaction generated at AVT-II stage of testing. Based on the consistency in superiority of the proposed entries over the best check in the respective zones, viz., Northern Hill Zone (NHZ or Z-I), North West Plain Zone (NWPZ or Zone-II), North East Plain Zone (NEPZ or Z-III), Peninsular Zone (PZ or Zone-IV) and Central West Zone (CWZ or Z-V) for which the entries were proposed, the following decisions were taken on each of the proposals with respect to identification of entries for release and notification:

#### **Kharif season long duration**

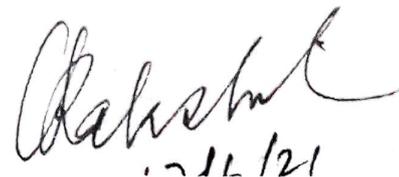
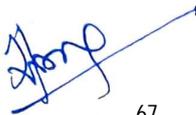
1. **ADV 7132 (ADV 732)**: The hybrid was proposed for NWPZ under long duration for *kharif* season. The hybrid was superior over the best check, hence it ***was identified and recommended*** for release in NWPZ.
2. **SYN 816514**: The hybrid was proposed for NWPZ under long duration for *kharif* season. Since the hybrid was not superior over the best check, it ***was not identified and not recommended*** for release.
3. **KMH 005**: The hybrid was proposed for NWPZ under long duration for *kharif* season. The entry was superior over the best check for yield in NWPZ. Hence it ***was identified and recommended*** for release in NWPZ.

#### **Kharif season medium maturity**

4. **DKC 8191**: The hybrid was proposed for NHZ under medium maturity for *kharif* season. Since the hybrid was not superior over the best check, it ***was not identified and not recommended*** for release.
5. **DKC 9190**: The hybrid was proposed for NHZ under medium maturity for *kharif* season. The entry was superior over the best check for yield in NHZ. Hence it ***was identified and recommended*** for release in NHZ.
6. **DKC 9194**: The hybrid was proposed for PZ under medium maturity for *kharif* season. The entry was superior over the best check in PZ. Hence it ***was identified and recommended*** for release in PZ.
7. **HT 18607**: The hybrid was proposed for PZ under medium maturity for *kharif* season. Since the hybrid was not superior over the best check, it ***was not identified and not recommended*** for release.
8. **JKMH 15303**: The hybrid was proposed for PZ under medium maturity for *kharif* season. Since the hybrid was not superior over the best check, it ***was not identified and not recommended*** for release.
9. **SYN 816604**: The hybrid was proposed for CWZ under medium maturity for *kharif* season. Since the hybrid was not superior over the best check, it ***was not identified and not recommended*** for release.

#### **Kharif season EDVs, biofortified with provitamin A**

10. **APQH1**: It is an EDV of HQPM 1 biofortified with provitamin A and was proposed for whole of India, viz., NHZ, NWPZ, NEPZ, PZ, and CWZ under biofortified EDV category for *kharif* season. Since the EDV was found superior over HQPM 1 in all the zones, i.e. NHZ (15.5%), NWPZ (14.5%), NEPZ (15.5%), PZ (10.9%), and CWZ (10.3%) and also it was biofortified with provitamin A, it ***was identified and recommended*** for release for whole of India.



12/11/21

11. **APH 1**: It is an EDV of APQH9, biofortified with provitamin A and was proposed for NHZ and NEPZ for *kharif* season. The EDV was superior over APQH9 for yield by 6.2% and 16.4% in NHZ and NEPZ, respectively, and also it is biofortified with provitamin A. Hence it ***was identified and recommended*** for release in NHZ and NEPZ.
12. **APQH 8**: It is an EDV of Pusa HM 8, biofortified with provitamin A and was proposed for PZ for *kharif* season. Since the EDV was inferior to Pusa HM 8 for yield (-6.6%), it ***was not identified and not recommended*** for release.

#### ***Kharif season OPV***

13. **L 315**: The composite or open pollinated variety (OPV) was proposed for NHZ for *kharif* season. The entry was superior over the best check for yield by 28.8% in NHZ. Hence it ***was identified and recommended*** for release in NHZ.

#### ***Kharif season EDVs of Baby Corn with male sterility***

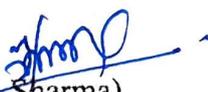
14. **ABSH 4-1**: It is an EDV of HM 4 with male sterility, and was proposed for NWPZ for *kharif* season. Since the EDV was found of comparable performance with HM 4 in NWPZ (3.8%) and also it is a male sterile version of HM 4, it ***was identified and recommended*** for release in NWPZ.

#### ***Rabi season long duration***

15. **PM 17201L (X35M019)**: The hybrid was proposed for NWPZ under long duration for *rabi* season. The entry was superior over the best check in NWPZ. Hence it ***was identified and recommended*** for release in NWPZ.
16. **PM 17205L (P 3526)**: The hybrid was proposed for NWPZ and NEPZ under long duration for *rabi* season. The entry was superior over the best check in NWPZ and NEPZ by 10% and 7%, respectively. Hence it ***was identified and recommended*** for release in NWPZ and NEPZ.
17. **Rasi 4118**: The hybrid was proposed for NEPZ and PZ under long duration for *rabi* season. The entry was promoted only for NEPZ only and found superior over the best check, hence it ***was identified and recommended*** for release in NEPZ.

Out of 17 proposals received for identification, 11 proposal were identified by VIC for further released and notification by CVRC.

The meeting ended with vote of thanks to the chair.

  
(T. R. Sharma)  
DDG (Crop Science)  
Chairman-VIC

  
(Sujay Rakshit)  
Director, ICAR-IIMR  
Member Secretary-VIC



# ICAR-Indian Institute of Maize Research PAU Campus, Ludhiana 141004



## 64<sup>th</sup> Annual Workshop of AICRP on Maize (in Virtual Mode)

### Day 1 : May 17, 2021 (Monday)

Meeting ID: 875 8455 4546 Pass code: 122697

9:00-9:30 Welcome: Dr. Sujay Rakshit, Director, ICAR-IIMR  
Introductory Dr. Y.P. Singh, ADG FFC, ICAR  
remarks:  
Opening remarks: Chairman and members of PAMC, AICRP on Maize

### 9:30-13:30 Session - I: Scientific audit of achievements, work plan of AICRP on maize centres during 2020-21 and implementation of QRT recommendations

(One consolidated presentation by centre In-charge as per template provided; each presentation shall be for each centre 8+2 min.)

Chairs: Dr. S.K. Vasal, World Food Laureate  
Dr. H.S. Gupta, Chairman, PAMC of AICRP on Maize  
Co-chairs: Dr. Y.P. Singh, ADG FFC, ICAR  
Dr. Sujay Rakshit, Director, ICAR-IIMR  
Experts: Dr. I.S. Singh, Member (Breeding), PAMC, AICRP on Maize  
Dr. R.N. Singh, Member (Agronomy), PAMC, AICRP on Maize  
Dr. P.N. Sharma, Member (Pathology), PAMC, AICRP on Maize  
Dr. Jella Satyanarayana, Member (Entomology), PAMC, AICRP on Maize

Rapporteurs: Drs. Yathish K.R. & Krishan Kumar

Srinagar, Kangra, Bajaura, Almora, Gossaigaon, Barapani, Imphal, Ludhiana, Karnal, Delhi, Pantnagar, Varanasi, Bahraich, Sabor, Dholi, Ranchi, Kalyani, Bhubaneswar

### 13:30-14:00 Lunch break

### 14:00 -17:30 Session - II: Scientific audit of achievements, work plan of AICRP on maize centres during 2020-21 and implementation of QRT recommendations ..... Continued

Rapporteurs Drs. Bhupender Kumar & B.S. Jat

Peddapuram, Hyderabad, Karimnagar, Coimbatore, Vagarai, Dharwad, Mandya, Kolhapur, Rahuri, Ambikapur, Chhindwara, Udaipur, Banswara, Godhra

17:30 -18:00 Discussion and remarks by Chairman & Members, PAMC, AICRP on Maize

### Day 2 : May 18, 2021 (Tuesday)

### 9:00-12:00 Session - III: Concurrent Session on Formulation of Work Plan (2021-22)

Plant Breeding Meeting ID: 875 8455 4546 Pass code: 122697

Chairs: Dr. S.K. Vasal, World Food Laureate  
Dr. H.S. Gupta, Chairman, PAMC of AICRP on Maize  
Co-chairs: Dr. I.S. Singh, Member (Breeding), PAMC, AICRP on Maize  
Dr. D.K. Yadava, ADG Seeds, ICAR  
Conveners: Drs. Sujay Rakshit, S.B. Singh, N. Sunil, Ramesh Kumar,

Chikkappa GK & Bhupender Kumar  
*Rapporteurs: Drs. A.K. Das, M.C. Dagla & Seema Sheoran*

**Agronomy & Outreach** Meeting ID: 831 7697 8919 Pass code: 384785

Chair: Dr. SK Chaudhary, DDG (NRM), ICAR  
Co-chairs: Dr. S. Bhaskar, ADG (Agronomy & AF), ICAR  
Dr. R.N. Singh, Member (Agronomy), PAMC, AICRP on Maize  
Conveners: Drs. A.K. Singh, PI (Agronomy) & S.L. Jat, PI (Outreach)  
*Rapporteurs: Drs. Seema Sepat, Romen Sharma & Priyajoy Kar*

**Plant Protection** Meeting ID: 870 3045 8654 Pass code: 384785

Chairs: Dr. P.N. Sharma, Member (Pathology), PAMC, AICRP on Maize  
Dr. Jella Satyanarayana, Member (Entomology), PAMC, AICRP on Maize  
Conveners: Drs. J.C. Sekhar, PI (Plant Protection)  
*Rapporteurs: Drs. S.B. Suby, Lakshmi P Soujanya & Sumit K Agarwal*

**12:00-13:30 Session IV: Discussion on Quality Breeding**

Meeting ID: 875 8455 4546 Pass code: 122697

Chair: Dr. S.K. Vasal, World Food Laureate  
Dr. H.S. Gupta, Chairman, PAMC of AICPR on Maize  
Co-chairs: Dr. Sujay Rakshit, Director, ICAR-IIMR  
Presenter: Dr. Firoz Hussain: Molecular Breeding for Quality Traits  
Dr. John Joel: Molecular Breeding for low phytic acid  
*Rapporteurs: Drs. Dharam Paul, Bharat Bhushan & Alla Singh*

**13:00-14:00 Lunch break**

**14:00-15:00 Session V: Presentation of Monitoring Reports**

Meeting ID: 875 8455 4546 Pass code: 122697

Chairs: Dr. K. Srinivas, ADG IP&TM, ICAR  
Presenter: Dr. Ramesh Kumar, Nodal Officer, AICRPM  
Members: All PIs  
*Rapporteurs: Drs. S.L. Jat & Yathish K.R.*

**15:00-16:00 Session VI: ICAR-CIMMYT/International Collaborative Research**

Meeting ID: 875 8455 4546 Pass code: 122697

Chair: Dr. J.P. Mishra, ADG IR, ICAR  
Presenter: Representative of CIMMYT  
*Rapporteurs: Drs. N. Sunil & Seema Sepat*

**16:00-17:30 Session VII: Finalization of Work Plan – Combined Session**

Meeting ID: 875 8455 4546 Pass code: 122697

Chairs: Dr. S.K. Vasal, World Food Laureate  
Dr. H.S. Gupta, Chairman, PAMC of AICPR on Maize  
Co-chairs: Dr. Y.P. Singh, ADG FFC, ICAR  
Dr. Sujay Rakshit, Director, ICAR-IIMR  
*Experts* Dr. I.S. Singh, Member (Breeding), PAMC, AICRP on Maize  
Dr. R.N. Singh, Member (Agronomy), PAMC, AICRP on Maize  
Dr. P.N. Sharma, Member (Pathology), PAMC, AICRP on Maize  
Dr. Jella Satyanarayana, Member (Entomology), PAMC, AICRP on Maize  
Presenters Respective PIs  
*Rapporteurs: Drs. Chikkappa G.K., Mamta Gupta & Priyajoy Kar*

**Day 3 : May 19, 2021 (Wednesday)**

**9:00-12:00 Session - VIII: PAMC Meeting with Director and PIs**

## Day 4 : June 17 (Thursday)

### 10:00-12:00 Session - IX: Panel discussion on "Prospect of Bt transgenic at BRL 1 or 2 to be tested for their efficacy against FAW"

Chairs: Dr. T.R. Sharma, DDG CS, ICAR  
Dr. H.S. Gupta, Chairman, PAMC of AICPR on Maize  
Conveners: Drs. Sujay Rakshit & J.C. Sekhar, ICAR-IIMR  
Panellist: Director (IARI), Director (NIPGR), Director (NBAIR), Director of Research (PAU), Director (GMP, CIMMYT), ADG FFC, ADG PP, Representatives from private stakeholders (Bayer crop science Bioseed, Corteva, Mahyco, Metahelix, Syngenta)  
*Rapporteurs: Drs. S.B. Suby, Lakshmi P. Soujanya & Pardeep Kumar*

### 12:00-13:00 Session - X: VIC Meeting

Chair: Dr. T.R. Sharma, DDG CS, ICAR  
Member Secretary: Dr. Sujay Rakshit, Director, ICAR-IIMR  
Participants: All members of VIC

### 13:00-14:30 Lunch break

### 14:30-17:00 Session - XI: Review of work during Kharif 2020 and Rabi 2019-20 and Work Plan 2021-22

Chairs: Dr. T.R. Sharma, DDG CS, ICAR  
Co-chair: Dr. Y.P. Singh, ADG FFC, ICAR  
Experts: Dr. H.S. Gupta, Chairman, PAMC of AICPR on Maize  
Dr. I.S. Singh, Member (Breeding), PAMC, AICRP on Maize  
Dr. R.N. Singh, Member (Agronomy), PAMC, AICRP on Maize  
Dr. P.N. Sharma, Member (Pathology), PAMC, AICRP on Maize  
Dr. Jella Satyanarayana, Member (Entomology), PAMC, AICRP on Maize  
*Rapporteurs: Drs. Pardeep Kumar, Romen Sharma & Seema Sheoran*  
Opening remarks: Dr. T.R. Sharma, DDG CS, ICAR  
Director's Report: Dr. Sujay Rakshit, ICAR-IIMR  
Presentation of discipline-wise reports and plan of work:  
Trials & Nurseries : Dr. N. Sunil  
Breeding (Field Corn) : Dr. S.B. Singh  
Breeding (QPM) : Dr. Ramesh Kumar  
Breeding (Specialty Corn): Dr. Chikkappa G.K.  
Crop Production : Dr. A.K. Singh  
Crop Protection : Dr. J.C. Sekhar  
BSP : Dr. Chikkappa G.K.  
Outreach programme : Dr. S.L. Jat  
Release of publications: Dr. T.R. Sharma, DDG CS, ICAR  
Felicitation of retiring scientists: Director and staff of ICAR-IIMR  
Remarks: Dr. H.S. Gupta, Chairman, PAMC of AICPR on Maize  
Closing remarks: Dr. T.R. Sharma, DDG CS, ICAR  
Vote of thanks: Dr. Ramesh Kumar, AICRP Nodal Officer