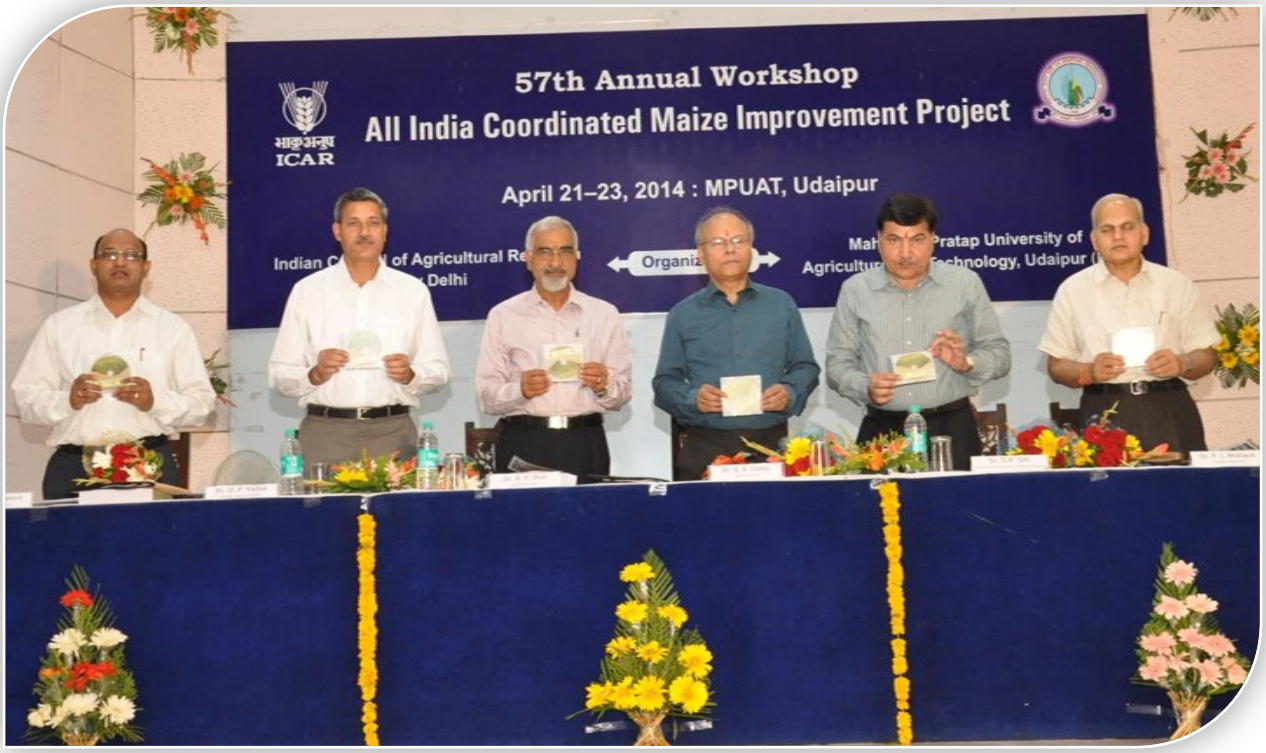
(***For office use only***)

Proceedings
57th Annual Maize Workshop
All India Coordinated Maize Improvement Project
held at
MPUAT, Udaipur
April 21-23, 2014



भाकृअनुप
ICAR

All India Coordinated Maize Improvement Project
Directorate of Maize Research
(Indian Council of Agricultural Research)
Pusa Campus, New Delhi 110 012
www.dmr.res.in

57th Annual Workshop

All India Coordinated Maize Improvement Project

(*Indian Council of Agricultural Research*)

Date: April 21 - 23, 2014 **Venue: MPUAT, Udaipur**

PROGRAMME

Day 1: April 21, 2014 (Monday)

0800 – 0900: Registration

***Session I*: Inaugural Session**

0900 – 1040

	Chief Guest	:	Dr. S.K. Datta, Dy. Director General (CS), ICAR
	Guest of Honour	:	Dr. R.P. Dua, ADG (FFC), ICAR
	Presiding Officer	:	Dr. O.P. Gill, Vice-Chancellor, MPUAT, Udaipur
	Rapporteurs	:	Drs. P. Kumar, V. Mahajan, K.S. Hooda, A.K. Singh
0900 - 0905	Welcome	:	Dr. P.L. Maliwal, Director of Research, MPUAT
0905 - 0910	Lighting of lamp	:	Chief Guest and Guest of Honour
0910 - 0925	Project Director's Review	:	Dr. O.P. Yadav, Director, DMR
0925 - 0935	Address by Guest of Honour	:	Dr. R.P. Dua, ADG (FFC), ICAR
0935- 0950	Presidential address		Dr. O.P. Gill, Vice-Chancellor, MPUAT, Udaipur
0950 - 1020	Address by Chief Guest		Dr. S.K. Datta, DDG (CS), ICAR
1020 - 1030	Felicitation		
1030 – 1040	Vote of Thanks		Dr. S. K. Sharma, Organizing Secretary & ADR, MPUAT, Udaipur

1040 – 1100 **<u>High tea</u>**

***Session II:* Review of work during *Kharif* 2013 and *Rabi* 2012-13**

1100 - 1300

Chairman:	:	Dr. S.K. Datta, DDG (CS), ICAR
Co Chairman	:	Dr. R.P. Dua, ADG (FFC), ICAR
Rapporteurs:	:	Drs. J.C. Sekhar, S.S. Sharma, S.L. Jat, Chikkappa G.K.

Discipline		**Speaker**
Breeding	:	Dr. Bhupender kumar
Agronomy	:	Dr. A.K. Singh
Entomology	:	Dr. P. Kumar
Pathology/ Nematology	:	Dr. K.S. Hooda

1300 – 1400 **<u>Lunch Break</u>**

***Session III*: Lead Lectures**

1400 –1630

Chairman	**:**	Dr. S.K. Datta, DDG (CS), ICAR
Co-chairman	**:**	Dr. R.P. Dua, ADG (FFC), ICAR
Rapporteurs	**:**	Drs. P. Yadav, Chikkappa G.K.
Speakers	**:**	1. Heterotic Grouping - A Breeding Tool in Corn Breeding - Dr. Bijendra Pal, Bioseed Ltd. 2. Virus diseases of maize in India – An Update - Dr. G.P. Rao, IARI 3. Maize current scenario and investment opportunities in India -Dr. Ranjit Kumar, NAARM, Hyderabad 4. Improving stover quality of maize – Dr. P.H. Zaidi, CIMMYT, ICRISAT Campus, Patancheru

1630- 1645 **Tea Break**

***Session IV*: Variety Identification Committee Meeting**

1645 – 1800

Chairman	:	Dr. R.P. Dua, ADG (FFC)
Member Secretary	:	Dr. O.P. Yadav, Project Director, DMR
Participants	:	All Members of Variety Identification Committee

---

Day 2: April 22, 2014 (Tuesday)

***Session V*:** Review of research results of individual AICRP centres for *Kharif* 2013 and *Rabi* 2012-13 and plan of work for *Kharif* 2014 and *Rabi* 2014- 15 (*Concurrent discipline-wise, centre-wise presentations of significant results and progress report*)

0900 – 1130

Concurrent session	**Chairperson**	**Co-chairman**	**Convener**	**Rapporteur/s**
Crop Improvement	Dr. O.P. Yadav Director, DMR	-	-	Drs. J. Kaul, Bhupender Kumar, R.B. Dubey, Pranjal Yadava
Crop Production	Dr. G.S. Chauhan, Director Resident Instruction, MPUAT	Dr. M.L. Jat, Agronomist, CIMMYT-India	Dr. A.K. Singh	Drs. Dilip Singh, S.L. Jat
Plant Pathology & Nematology	Dr. Anila Doshi, Prof. & Head, Pl. Pathology	Dr. A.U. Siddique Prof & Head, Nematology	Dr. K.S. Hooda	Drs. S.S. Sharma, Harleen Kaur
Entomology	Dr. O.P. Ameta, Prof and Head	-	Dr. P. Kumar	Drs. J.C. Sekhar, M.K. Mahla

1130 – 1145 **Tea Break**

***Session VI*: General session**

1145– 1300 General Discussion and monitoring reports

Chairman: : Dr. O.P. Yadav, Project Director, DMR

Rapporteurs: : Dr. J. Kaul, Ishwar Singh and Bhupender Kumar

1300 – 1400 **Lunch Break**

***Session VII*: ICAR-CIMMYT Collaboration**

1400-1500

Chairman: : Dr. R.P. Dua, ADG (FFC), ICAR

Co-chairman : Dr. O.P. Yadav, Project Director, DMR

Rapporteurs : Drs. C.M. Parihar, Chikkappa G.K.

Results of ICAR-CIMMYT collaborative research (2013)– Dr. P.H. Zaidi, CIMMYT

Planning ICAR-CIMMYT collaborative research (2014) - Dr. M.L Jat, CIMMYT
Dr. P.H. Zaidi, CIMMYT
Dr. Chikkappa G.K.

1500: 1515 **Tea Break**

***Session VIII*: FLDs, Training Programmes and Breeder Seed Production**

1515 – 1630

Chairman : Dr. A. K. Roy, Project Coordinator (Forage Crops), IGFRI, Jhansi

Co–Chairman : Dr. Dinesh Kumar, Principal Scientist, ICAR

Rapporteurs: : Drs. Amit Dadheech,

Speakers: : Drs. J. Kaul (Breeder Seed Production)
VK Yadav (FLDs and Training Programmes)

***Session IX*: Germplasm exchange, registration & seed issues**

1630 - 1700

Chairman : Dr. O.P. Yadav, Project Director, DMR

Rapporteurs : Drs. J. Kaul, Chikkappa G.K.

Speakers : Dr. J.C. Sekhar, DMR – Germplasm Exchange by DMR

Dr. B. Vivek, CIMMYT – Germplasm Exchange by CIMMYT

Dr. J Kaul, DMR – Registration of germplasm with NBPGR and PPVFRA

Dr. Ashok Kumar, NBPGR – Germplasm status in NBPGR in maize

Day 3: April 23, 2014 (Wednesday)

Session X: **Presentations of work plan 2014-15**

0900-1100

Chairman: : Dr. P.L. Maliwal

Rapporteurs: : Drs. J.C. Sekhar, S. S Sharma , S.L. Jat, Chikkappa, G.K., P. Rokadia

Speakers:

Dr. Bhupender kumar	:	Breeding
Dr. A.K. Singh	:	Agronomy
Dr. P. Kumar	:	Entomology
Dr. K.S. Hooda	:	Pathology/ Nematology

1100 – 1115 **Tea Break**

***Session X*: Plenary Session**

1115 – 1300

Chairman: : Dr. P.L. Maliwal

Rapporteurs: : Drs. J.C. Sekhar, S. S Sharma, S.L. Jat, Chikkappa, G.K.

Speakers:

Dr. Bhupender kumar	:	Breeding
Dr. A.K. Singh	:	Agronomy
Dr. P. Kumar	:	Entomology
Dr. K.S. Hooda	:	Pathology/Nematology

Vote of Thanks Dr. S.K. Sharma, Organizing Secretary

1300 – 1400 **Lunch Break**

1400 - 1630 Field Visit

Session I

Inaugural Session

Invocation	
Lighting of lamp	Chief Guest and other dignitaries
Welcome	Dr. P.L. Maliwal, Director of Research, MPUAT
Project Director's Review	Dr. O.P. Yadav, Project Director, DMR
Address by guest of honour	Dr. R.P. Dua, ADG, ICAR
Presidential address	Dr. O.P. Gill, Vice-Chancellor, MPUAT, Udaipur
Felicitation	Dr. S.K. Datta, Dy. Director General (CS), ICAR
Address by Chief Guest	Dr. S.K. Datta, Dy. Director General (CS), ICAR
Vote of Thanks	Dr. S.K. Sharma, Organizing Secretary & ADR, MPUAT, Udaipur

57th Annual Maize Workshop was inaugurated by lighting the lamp by Dr. S.K. Datta, DDG, ICAR; Dr. O.P. Gill, Vice Chancellor, MPUAP, Udaipur; R.P. Dua, ADG, ICAR; Dr. O.P. Yadav, Project Director, DMR; P.L. Mailwal, Director Research, MPUAT, Udaipur and S.K. Sharma, Organizing Secretary, 57th Annual Maize Workshop.

Dr. Maliwal in his welcome address highlighted the importance of maize and pearl millet in Rajasthan. He emphasised that maize is the second most important crop in Rajasthan which is being cultivated on 1 m ha area, out of which 80% of area is under dry land agriculture. The productivity of maize is around 1.5 t/ha which is quite low as compared to national average productivity of maize (2.5 t/ha). The major reasons for low productivity are poor seed replacement rate, which is less than 50 % and poor technology adoption etc.

Dr. O.P. Yadav, Project Director, DMR presented Director's report in which he highlighted the increased maize production in India in the recent past. In his report he briefed about research highlights *viz.,* cultivars released, germplasm registered under NBPGR, new cultivars protected under PPVFRA and breeding materials supplied to different research centres and technology transfer *viz.*, FLDs and breeder seed production.

Dr. R.P. Dua, ADG, ICAR highlighted the importance of diversification of maize, increasing seed replacement rate through SCH, expanding area under hybrid seed production, breeding dual purpose maize and policy intervention in MSP for QPM can bring substantial change in the maize production and productivity in the country. CD of Annual Progress Report and four publications were released.

Dr. O.P. Gill, Vice-Chancellor, MPUAT in his presidential address highlighted the growing demand of maize viz-a-*viz* disparity in maize yield across different states/districts of India. He also emphasised on future challenges like climate change, weather uncertainty, drought and salinity.

Dr. S.K. Datta, DDG, ICAR compared Indian maize scenario with that of USA, China, Brazil and Argentina. He also compared yield differences in maize in India across different states. He also stressed on diversification of maize germplasm and public private partnership along with importance of GM technology to enhance maize yield.

The AICRP centre of TNAU, Coimbatore and Bio Seed Pvt. Ltd., Hyderabad and Nuziveedu Seeds Pvt. Ltd., Hyderabad were facilitated for their significant contribution in maize improvement. The maize scientists superannuating before next annual maize workshop were also felicitated.

Session II

Review of work during *Kharif* 2013 and *Rabi* 2012-13

Chairman	Co-Chairman	Rapporteur/s
Dr. S.K. Datta, DDG, ICAR	Dr. R.P. Dua, ADG, ICAR	Drs. J.C. Sekhar, S.S. Sharma, S.L.Jhat, Chikkappa G.K.

Breeding

Dr. Bhupender Kumar presented the work undertaken during *Kharif* 2013 and *rabi* 2013-14. During 2013-2014, under All India Co-ordinated Research Project on Maize, 16 multi location yield trials in *kharif* and 10 in *rabi* were conducted with the success percentage of 65.92 to 100%. Total of 288 and 122 entries were tested in *kharif* and *rabi* seasons respectively. Of 253 test entries, which were evaluated in *kharif* 2013 IVT (185), AVT-I (46) and Specialty corns (22) trials, 79 were promoted from IVT to AVT I; 12 from AVT I to AVT II and 21 in specialty corns trials. Similarly, of 107 test entries, which were evaluated in *rabi* 2012-13 IVT (76), AVT-I (26) and Specialty corns (5) trials, 37 were promoted from IVT to AVT I; 14 from AVT I to AVT II and 1 in specialty corns trials. The success percent of trials during *kharif* season was 65.9 to 91.2%, where as it was 76.1 to 100% during *rabi*. The percentage of entries promoted during *kharif* and *rabi* were 44.2 and 48.6% respectively. More than 4000 germplasm lines were maintained, out of which 651 elite lines were distributed to 22 Public Sector Research Institute. During 2013, 17 cultivars include 15 single cross hybrids (SCH) and 2 composites were released and notified. Among them, 14 SCHs were released at the national level and 3 at state level. During the reporting period, 2 lines viz., DMRQPM 102 and MCM11/01 were registered with NBPGR. In addition, 3 hybrids and 1 composite were also protected under PPVFR Act 2001. Breeder seed (66.33 quintals) of parental lines of 19 different hybrids and composites were produced.

Several issues were discussed with respect to conduct of trials, criteria for promotion of entries etc. After detailed deliberations following points emerged unanimously:

- With reference to check, there should be unambiguity w.r.t best performing check or best performing recommended check for the specific zone.
- In case of speciality corn, the observations to be taken and stage of recording observations on quality traits were finalized.
- Observations have to be recorded on all 3 replications (not on 2 replications).
- There is no need to record days to 75% dry husk in sweet corn and baby corn as they were harvested at immature crop and green cob stage respectively.

Agronomy

Salient findings of total seven trials conducted during *kharif* 2013 at 22 locations were presented by Dr. A.K. Singh. The results were presented on crop performance and economics of the nutrient application. During *kharif* 2013, the major focus of agronomic research areas were tillage and crop establishment, nutrient management especially site specific nutrient management (SSNM), quantification of nutrient requirement of different released promising maize

hybrids, development of suitable intercrop and planting system under rainfed conditions, optimization of sowing time and weed management in maize and maize based cropping systems under different agro-ecologies. In *rabi* 2012-13, a total of four trials on different agronomic aspects were conducted at 13 locations in various agro-ecologies. The results of *rabi* trials were mainly focused on genotypic response to nutrient levels, tillage management, weed management and fertigation of nitrogen with drip irrigation in sweet corn.

Entomology

Dr. Pradyumn Kumar, PI (Entomology) presented the results of 6 trials conducted during last *Kharif*. Seventy hybrids were evaluated against *C. partellus* during *kharif* under artificial infestation. In advanced trial conducted at 5 locations, 4 hybrids out of 23 lines tested were least susceptible (<3.0 LIR). Spraying at 15 days old crop is more effective against *C. partellus*. Natural parasitisation of *Trichogramma* on *C. partellus* is very low at different locations whereas *Cotesia* parasitisation was high at Kolhapur. Crop loss assessment model was validated at 21 locations. Loss due to *C. partellus* was 16.73%. During *rabi* 2012-13, 53 hybrids were evaluated against *C. partellus* at Kohapur Centre and 6 hybrids out of them recorded LIR <3.0. Twenty seven lines out of 212 lines screened recorded LIR <3.0 at Kolhapur and 13 lines recorded LIR <3.0 at Hyderabad against *Sesamia*.

Pathology

Dr. K.S. Hooda, PI (Pathology) presented ongoing activities in pathology and Nematology programme. He presented the results of 10 trials and reported the promising hybrids from these trials from disease resistance point of view. Occurrence of disease in trap nursery trial was also presented. The disease incidence was low to moderate as reported in survey and surveillance of AICRP in maize and disease distribution map was updated. He has also reported the follow up action of QRT recommendations. Guidelines for uniform method of inoculation for screening the germplasm were also finalized. Project Director cited the TLB flared up in Banswara region and therefore felt the need of thorough survey of all diseases in the country. Dr. Bijender Pal from Bioseeds Pvt Ltd, Hyderabad also emphasised on the emerging trend of TLB in the country.

Session III

Lead lectures

Chairman	Co-chairman	Speakers	Rapporteurs
Dr. S.K. Datta, DDG	Dr. R.P. Dua Dr. OP Yadav	Dr. Bijendra Pal, Bioseeds Pvt Ltd Dr. G.P. Rao, IARI, New Delhi Dr. Ranjit Kumar, NAARM,Hyderabad Dr. P.H.Zaidi, CIMMYT	Drs. P. Yadav, Chikkappa G.K.

In this session, there were four lead lectures by eminent scientists working on different aspects of maize. The first presentation was by Dr. Bijendra Pal, Bioseeds Pvt Ltd, Hyderabad on 'Heterotic Grouping - A Breeding Tool in Corn Breeding'. The salient points were as follows:

- Heterotic grouping is very popular in USA and China and it has tremendous scope for the Indian maize breeding programme as well.
- It can help in predicting the performance of F_1 combinations.
- Genomic regions for heterosis are not known; therefore molecular genetic diversity is of limited use in delineating the heterotic groups.
- Combining ability should be the major factor in defining heterotic groups.

Dr. G.P. Rao, Indian Agricultural Research Institute, New Delhi spoke on 'Virus diseases of maize in India – An Update'. He has given a comprehensive update on various cereal viruses that are relevant to maize. Most of these viruses are presently not causing very high yield losses in maize, but we should be vigilant in their incidence on maize in the country. Some of the important maize viruses are: Maize dwarf mosaic virus, maize stripe virus, maize mosaic virus, cucumber mosaic virus, maize bushy stunt virus etc.

Dr. Ranjit Kumar, NAARM, Hyderabad deliberated on 'Maize current scenario and investment opportunities in India'. The major highlights of the talk were as follows:

- The productivity improvement in maize between 1990 and 2000 in India was only 177 kg/ha/year. This is far below than many neighbouring Asian countries like, Pakistan (292 kg/ha/year), China (434 kg/ha/year), Bangladesh (461 kg/ha/year), and Indonesia (325 kg/ha/year).
- There is approximately 21 lakh tonn requirement of improved maize seed per year. Actual availability is far less than this requirement.
- The present utilization pattern of maize in India is 49% in poultry sector, 17% industry, 10% livestock, 10% food, 10% export, 3% wastage and 1% seed.
- By 2020, the share of maize for human consumption might further come down to 6-7% and for poultry it might be around 54%.
- By 2020, India's maize productivity and production is expected to be 3.17 t/ha and 28.45 million t respectively, against the domestic demand for 26 million t.
- India is expected to be a major maize exporter and maize would be like today's basmati rice.

Session IV

Variety Identification Committee Meeting

Chairman	:	Dr. R.P. Dua, ADG (FFC), ICAR
Member Secretary	:	Dr. O.P. Yadav, Project Director, DMR

Proceedings of VIC meeting held at the 57th Annual Maize workshop

During the 57th Annual Maize Workshop, the Variety Identification Committed (VIC) meeting was convened under the chairmanship of Dr. R.P. Dua, Asstt. Director General (FFC), ICAR, New Delhi in the committee room of MPUA&T, Udaipur at 4.30 P.M on April 21, 2014.

Following were present during the meeting:

1. Dr. R.P. Dua: Asstt.Director General (FFC), ICAR, New Delhi: Chairman
2. Dr. O.P. Yadav: Project Director, DMR, New Delhi : Member Secretary
3. Dr. SainDass: NSC, New Delhi : Member
4. Dr. P.L. Maliwal: Director Research, MPUA&T, Udaipur: Member
5. Dr. Sunil Mathur: Project Manager, RSSC Ltd., Udaipur: Member
6. Dr. R.K. Jaroli: Deputy Director Agril. (Ext.), Udaipur: Member
7. Dr.V.G. Makne Consultant VRDC, KSSC. Ltd., Dharwad: Member
8. Dr. M.R. Suddarshan: Principal Scientist, Maize Research Centre, ARI, Hyderabad: Member
9. Sh. Vivek V. Thakare: Senior Breeder Maharashtra State Seed Corporation Ltd., (Mahabeej), Akola, (M.S): Member
10. Dr. J.P. Shahi: Prof. cum Sr. Maize Breeder, BHU, Varanasi: Member
11. Mr.Satya Pal Singh: Shakti Vardhak Hybrid Seeds, Hisar: Member

Resource Persons:

1. Dr.Pradyumn Kumar : PI Entomology, DMR, New Delhi
2. Dr.K.S. Hooda: PI Pathology, DMR, New Delhi
3. Dr. Aditya Kumar Singh:PI Agronomy, DMR, New Delhi
4. Dr.Jyoti Kaul: PS Breeding, DMR, New Delhi

The committee discussed in depth a total of 33 proposals of maize hybrids received from differentinstitutions. These included22 for kharif and 11 for rabi season. Based on the performance of proposed hybrid in comparison to checks and qualifying hybrids and suitability for cultivation in different agro-ecological zones of the country,following recommendations emerged:

Kharif season:

Late maturity:

1. **P 3580 (X35 A 180)**: The hybrid was proposed for zones 1,3, 4 and 5.Based on its performance, the committee recommended it for the states of zone 4 viz.,Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra under late maturity group. The company is required to submit information on package of practices and source germplasm at the time of release and notification.

2. **Pro385**: The hybrid was proposed for zones 1, and 4. Based on its consistent superiority over best check, the committee recommended it for

the states of zone 4 viz.,Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra under late maturity group. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

3. **MCH 45**: The hybrid was proposed for zone 1 under late maturity group.The committee found its performance to be inconsistent over the years of testing and hence not recommended.

4. **MCH 46**: The hybrid was proposed for zones 1 and 4. It exhibited yield superiority over best check in all three years of testing. Based on its performance, the committee recommended it for the states of zone 1, and 4, viz. J&K, Himachal Pradesh, Uttarakhand, North East hills, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh under late maturity group. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

5. **HTMH 5106:**The hybrid was proposed for zones 1, and 4.The committee found qualifying hybrids in zone 1 and 4 superior to the proposed hybrid. Hence, it was not identified.

6. **HTMH 5402**:The hybrid was proposed for zone 1. However, the committee found qualifying hybrids superior in yield than the proposed hybrid in the relevant zone. The performance of the proposed hybrid was also inconsistent over years. Hence, it was not identified.

7. **CMH 08-381**: The hybrid was proposed for zones 3 and 4. It displayed yield superiority over best check as well as possessed special attributes such as high starch (76.42%), high protein (10.57%) and high beta-carotein (0.47 mg/100g) with moderate level of fat (4.56%) and crude fibre (1.43%). Hence, recommended for the states, viz. eastern UP, Bihar, Jharkhand, Odisha, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh. The centre is required to submit colour photographs of the parental lines of the hybrid at the time of release and notification.

8. **CMH 08-381(G)**:The hybrid was proposed for zone 3. However, the hybrid showed inconsistent performance over the years of testing against the checks.Hence it was not recommended.

9. **CP 333**:The proposed hybrid showed yield superiority over best check as well as the qualifying hybrids in zone 5, hence identified for the states of Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh under late maturity

group. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

10. **CMH 09-464**: The hybrid was proposed for zone 3 under late maturity group. It exhibited special attributes such as high starch (76.52%), high protein (11.51%) and high beta-carotein (0.48 mg/100g) with moderate level of fat (4.52%) and crude fibre (1.44%) and stay green trait. The hybrid also displayed resistance to Maydis Leaf Blight, Curvularia Leaf Spot, Turcicum Leaf Blight, Post Flowering Stalk Rot and Rajasthan Downy Mildew, hence identified for the states of eastern Uttar Pradesh, Bihar, Jharkhand and Odisha. The centre is required to submit colour photographs of the hybrid and parental lines at the time of release and notification.

11. **GK 3103**:The hybrid was proposed for zone 1 under late maturity group. It was found to have inconsistent performance in comparison to checks and qualifying entries over the years hence not recommended.

Medium maturity:

12. **Pro 383**: The hybrid was proposed for zone 4. Based on its yield superiority over best check and other checks, it was recommended for the states, viz. Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh under medium maturity Group.The Company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

13. **EHL161708**: The hybrid was proposed for zone 1 and based on its yield performance as well as moderate resistance to Maydis Leaf Blight and Turcicum Leaf Blight, the committee recommended it for the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand and North East hills under medium maturity group. The centre is required to submit package of practices of the hybrid and parental lines at the time of release and notification.

14. **JH 31470:** The hybrid was proposed for zone 4 under medium maturity group. However, it displayed inconsistent performance against the checks over the years of testing. Hence, it was not approved.

15. **EH 1974**: The hybrid was proposed for zone 5. The hybrid showed yield superiority over the checks and also displayed resistant reaction to Fusarium Stalk Rot and moderate resistance to Curvularia Leaf Spot and Rajasthan Downy Mildew. Based on its performance, the committee recommended it for the states of Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh under medium maturity group. The centre is required to

submit package of practices of the hybrid and colour photographs of the parental lines of the hybrid at the time of release and notification.

Early maturity:

16. **EHL 162508**: The hybrid was proposed for zone 1. Based on its consistent performance, the committee recommended it for the states of zones 1 and 5 viz., Jammu & Kashmir, Himachal Pradesh, Uttarakhand, North East hills, Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh under early maturity group. The centre is required to submit its package of practices of the hybrid and colour photographs of the parental lines at the time of release and notification. Since, this is an inter-institutional hybrid with female parent from CCSHAU, Karnal, hence, the breeders of this center must be included as developers in release and notification proposal.

17. **KNMH 4010141**: The hybrid was proposed for zone 4. It showed consistent yield superiority and moderate resistant reaction to Maydis Leaf Bligh, Turcicum Leaf Blight, Post Flowering Stalk Rot and Curvularia Leaf Spot in zone 4.Based on its consistent performance against the checks, the committee recommended for zone 4 i.e. the states of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh under early maturity group. The centre is required to submit colour photographs of the parental lines and the hybrid and package of practices at the time of release and notification.

18. **FH 3548**: The hybrid was proposed for zone 4. The proposed hybrid FH3548 showed high yield superiority over the best check in zone 4 under early maturity group, hence identified for the states of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh. The centre is required to submit colour photographs of the parental lines and the hybrid and package of practices at the time of release and notification.

19. **DASMH 501**: The hybrid was proposed for zones 1, 4 and 5. The hybrid showed consistently high yield superiority over the checks. Based on its performance, the committee recommended it for the states of J&K, Himachal Pradesh, Uttarakhand, North East hills, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh under early maturity group. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

20. **Bisco 2238**: The hybrid was proposed for zones 1 and 4. Based on its superior performance in yield over the checks, the committee recommended it for the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, North East hills, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh under early maturity group. The company is required to

submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

Extra-early maturity:

21. **FH 3554**: The hybrid was proposed for zone 5. Based on its consistent performance over the best checks and moderate resistance to Maydis Leaf Blight, Fusarium Stalk Rot, Rajasthan Downy Mildew, and Curvularia Leaf Spot, the committee recommended it for the states of zones 1 and 5 viz., Jammu & Kashmir, Himachal Pradesh, Uttarakhand, North East hills, Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh under extra-early maturity group. The centre is required to submit colour photographs of the parental lines and the hybrid and package of practices at the time of release and notification.

22. **FH 3556**: The hybrid was proposed for zones 1, 3 and 4.Based on its performance, the committee recommended it for the states of Jammu & Kashmir, Himachal Pradesh,Uttarakhand, North East hills, East Uttar Pradesh, Bihar, Jharkhand, Odisha, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh under extra- early maturity. The centre is required to submit colour photographs of the parental lines and the hybrid and package of practices at the time of release and notification.

Rabi season:

Late maturity

23. **CMH-08-282**: The hybrid was proposed for zone 4 under season extension. Based on its yield superiority over the checks, the committee recommended it for the states of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in rabi. The centre is required to submit colour photographs of the parental lines and the hybrid and package of practices at the time of release and notification.

24. **CMH-08-287**: The hybrid was proposed for zone 4 under season extension. Based on its consistent performance, the committee recommended it for the states of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in rabi. The centre is required to submit colour photographs of the parental lines and the hybrid and package of practices at the time of release and notification.

25. **KMH-25K45 (2700)**:The hybrid was proposed for zones 2, 3, 4 and 5. Based on its consistent performance, the committee recommended for the states of zones 2, 4 and 5 viz.,Punjab, Haryana, Delhi, Western Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh, Rajasthan, Gujarat, Chattisgarh and Madhya Pradesh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

26. **Bisco New 704**: The hybrid was proposed for zone 5 (under season extension). The committee found the hybrid superior in zone 4 over the checks. Based on its superior performance, the committee recommended it for the states of zone 4 viz., Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in Rabi.The Company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

27. **Bisco X 5129**:The hybrid was proposed for zones 4 and 5. Based on his performance over the best check and other checks, it was recommended for the states of zone 4 i.e. Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

28. **Bisco X 9**:The hybrid was proposed for zone 4. The proposed hybrid was found inferior to qualifying hybrid Bisco X 5129. Hence, not recommended for release.

29. **NMH 713**: The hybrid was proposed for zone 4. Based on his performance against the checks, the committee approved it for states of zones 3 and 4 viz., Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

30. **NMH 731**: The hybrid was proposed for zone 4 under season extension. The hybrid displayed high yield superiority over best check in zone 4. Based on its performance, the committee recommended it for the states of zone 4, viz., Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

31. **RJ 2020**: The hybrid was proposed for zone 5. Based on its performance, the committee recommended it for the states of Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

Medium maturity:

32. **NMH 1242**: The hybrid was proposed for zones 3, 4 and 5 under season extension. Based on its performance, the committee recommended it for the states of zone 2, 4 and 5 viz., Punjab, Haryana, Delhi, Western Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh, Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

33. **Bio-151**: The hybrid was proposed for zones 2 and 4 under season extension. Based on its performance, the committee recommended it for the states of zones 4 and 5 viz., Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh in rabi. The company is required to submit information on package of practices and source germplasm along with colour photographs of parental lines and hybrid at the time of release and notification.

Dr. O.P. Yadav
Member Secretary

डा. ओम प्रकाश यादव/Dr. O.P. Yadav
परियोजना निदेशक/Project Director
मक्का अनुसंधान निदेशालय/Directorate of Maize Research
पूसा परिसर, नई दिल्ली-12/Pusa Campus, New Delhi-12

Dr. R.P. Dua
Chairman

Session V

Review of research results of individual AICMIP centres for *Kharif* 2013 and *Rabi* 2012-13 and plan of work for *Kharif* 2014 and *Rabi* 2014-15

(*Concurrent discipline-wise, centre-wise presentations of significant results and progress report*)

Concurrent session (Crop Improvement)

Chairman	Rapporteurs
Dr. O.P. Yadav, Director, DMR	Drs. J. Kaul, Bhupender Kumar, R.B. Dubey, Pranjal Yadava

The progress of maize breeding related work in different AICRP centres was presented and reviewed. The findings were presented by the following centres.

S. No	Name of the centre	Scientist
1.	Almora Crop Improvement Division, VPKAS Almora–263601, Uttarakhand	Not attended
2.	Ambikapur RMD College of Agriculture and Research Station, Ajirma-497001 Chattisgarh	
3.	Arabhavi Agriculture Research Station, Arbhavi-591306, Karnataka	Dr. Mruthunjaya C. Wali Sr. Breeder & I/c
4.	Bajaura CSKHPKV, HAREC, Bajaura, Distt. Kullu – 175 125, Himachal Pradesh	Dr. S.K. Guleria Breeder
5.	Bahraich Crop Research Station, NDUA&T, Bahraich-271801, Uttar Pradesh	Not presented
6.	Barapani ICAR Research Complex for NEH Region, Umaim, Meghalaya	Not presented
7.	Banswara Agricultural Research Station, Borwat Farm, Dahot Road Banswara-327001, Rajasthan	Dr. P Rokadia
8.	Bhubaneswar Department of Plant Breeding & Genetic , College of Agriculture, OUAT Bhubaneswar-751003,Odisha	Sri Digbijaya Swain Breeder & I/c
9.	Chhindwara JNKVV, Zonal Agriculture Research Station, Chhindwara-480001 Madhya Pradesh	Not Attended
10.	Coimbatore Department of Millets, Centre for Plant Breeding & Genetics, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu	Dr. G.Nallathambi Breeder & I/c
11.	Delhi Indian Agriculture Research Institute Pusa, New Delhi - 110012	Dr. Firoz Hussain Sr. Scientist
12.	Dholi Tirhut College of Agriculture, Dholi, Bihar	Not Attended

S. No	Name of the centre	Scientist
13.	Godhra Main Maize Research Station, Anand Agricultural University, Godhra, Panchmahals-389 001, Gujarat	Dr. S.M. Khanorkar Sr. Breeder & I/c
14.	Gossaigaon Regional Agricultural Research Station, AAU, Gossaigaon, Telipara Dist. Kokrajhar-783360, Assam	Not presented
15.	Hyderabad Maize Research Centre, ARI, ANGRAU, Rajendra Nagar Hyderabad - 500 030, Andhra Pradesh	Dr. T. Pradeep Pr. Scientist
16.	Jhabua Zonal Agricultural Research Station, RVSKVV, Jhabua, Madhya Pradesh	No Breeder Post
17.	Kangra Shivalik Agricultural Research and Extension Centre, Kangra-176001 CSKHPKV, Himachal Pradesh	Dr. Uttam Chandel Asst. Breeder
18.	Kanpur Department of genetics and Plant Breeding, C. S. Azad University of Ag. & Tech., Kanpur-208002, Uttar Pradesh	Not attended
19.	Karimnagar Agricultural Research Station, Karimnagar, ANGRAU-505 001 Andhra Pradesh	Plant breeder
20.	Karnal CCS HAU RRS Uchani, Karnal-132001, Haryana	Dr. M.C. Kamboj Asst. Breeder
21.	Kolhapur Maharashtra Shahu Agricultural School Campus, Line Bazar Kasba-Bawada, Kolhapur-4166003, Maharashtra	Prof. S.R. Kulkarni Breeder & I/c
22.	Ludhiana Maize Section, Deptt. of Plant Breeding, Genetics & Biotech, P.A. U. Ludhiana-141004, Punjab	Dr. Jasbir Singh Chawla Senior Maize Breeder
23.	Mandya Zonal Agricultural Research Station, V.C. Farm, Mandya, Karnataka	Dr. Puttaramanaik Breeder
24.	Pantnagar (Uttarakhand) Department of Plant Pathology, College of Agriculture, G. B. Pant University of Agriculture & Technology, Pantnagar-263145, Uttrakhand	Dr. S.S. Verma Sr. Breeder
25.	Ranchi Dept. of Plant Breeding & Genetics, BAU, Kanke, Ranchi-834 006 Jharkhand	Dr. (Ms.) M. Chakraborty Asst. Breeder
26.	Srinagar KD Research Station, S.K.U.A.&T., Post Box.905, Srinagar-190001, J&K	Dr Zahoor Ahmed Dar Sr. Scientist
27.	Udhampur Maize Research Centre (AICRP), SKUA & T-J, Sansoo, Behind 71 Sub Area Officers Mess, Via P.O. Garhi, Udhampur, J&K	Dr. R.S. Sudan Breeder
28.	Udaipur MPUA&T, RCA, Udaipur-313001, Rajasthan	Dr. R.B. Dubey Breeder & I/c
29.	Vagarai Maize Research Station, Tamil Nadu Agricultural University Vagarai-624613, Tamil Nadu	Dr. Ganeshan
30.	Varanasi Institute of Agricultural Sciences, Banaras Hindu University Varanasi-221005, Uttar Pradesh	Dr. J.P. Shahi Prof. cum Sr. Breeder

Following points emerged in the discussions:

- The rejection rate of the trials due to poor management by come centres is a serious concern and therefore, experiments need to be executed with better planning and commitment to overcome this problem.
- The AICRP centres should make an effort to designate a permanent fixed piece of land to be used as sick plot for disease screening nurseries. More such nurseries are needed at different AICRP centres.
- The participants from Srinagar centre informed the house that the year 2014 has been declared as the Year of Maize by Govt. of Jammu and Kashmir, underlining the increasing importance of maize in the state.
- Whenever any new germplasm collection is made, it has to be submitted to NBPGR immediately with intimation to DMR. The number of seeds required to be submitted to NBPGR, i.e. 4000 seeds was considered by the house on the higher side.
- It was decided that every centre is required to submit Annual Report of respective AICRP centres to DMR.
- Some centres only receive germplasm material from DMR, but do not generate any new material. All centres should also concentrate on generating new material.
- The Bhubaneswar centre resolved to make at last 100 crosses in the coming year.
- While presenting the work on conversion of germplasm through MAS for higher β-carotene content, the representative of the Delhi centre informed that the kernel colour variation in maize is not correlated with β-carotene. Existing ICAR policy for MAS derived cultivars would be applied in AICRP-Maize. The yield of converted cultivar would be compared with its original cultivar.
- Yield would continue to be the main criteria in promotion of entries in AICRP trials. Any other trait, viz. water-logging tolerance etc, shall be considered as bonus only and such genotypes shall be evaluated along with the general trials. The specific water-logging trial, as requested by the Delhi centre shall be conducted as a Zonal trial by the Pantnagar centre.
- The house discussed whether Karimnagar centre could be merged with Hyderabad centre, keeping all the positions unchanged. However, no decision was taken in this regard during the workshop. It was resolved that from the next year, AICRP centres located in one state shall have to report on coordination between intra-state centres. Specifically, crosses developed at two centres should be evaluated at each other's location.
- The Coimbatore centre should strengthen germplasm/lines registration work with NBPGR.
- The Project Director, DMR was requested by Godhra centre to send a letter to the Vice-Chancellor for filling 2 technical positions.

- It was decided by the house to shift Ambikapur centre from Zone 5 to Zone 3.
- It was also requested to standardize the naming system of the germplasm.
- The coding system of locations in zone I reporting data one season later should be different than coding in other locations in the zone.
- As a major outcome of initiative taken by DMR, the AICRP maize network was expanded to 60 centres from the existing 30 centres by including more number of cooperating and voluntary centres from SAUs.

Technical programme for 2014-15

- In the kharif 2013, total of 288 test entries were evaluated in 16 different breeding trials of various maturity group and types of corns
- Of 288 entries, 266 were in normal and 22 were in specialty corns which include QPM (6), sweet corn (8), baby corn (3) and popcorn (5).
- Total of 253 test entries [IVT (185), AVTI (46), Specialty corns trials (22)] were available for promotion from their current evaluation stage to next stage of testing, of which 112 were promoted.
- Entries (Listed below) were promoted based on yield superiority over the best check (5% in late and specialty corns and 10% in medium, early and extra early), days to maturity (75% dry husking) and days to 50% silking together.
- Technical programme for year 2014-15 was presented, discussed and the following work plan was approved.

Entries in different trials during *Kharif* 2014

Trials	Zone	Entry Name
IVT		New entries will be received from different centres
AVT-I		
Late	ZONE-I	No trial will be conducted in this zone
	ZONE-II	X35D601, VNR-31834
	ZONE-III	HTMH-5108, IM8562, IM8539, Siri4527, IM8554, HTMH-5202, Super GA-105, HTMH-5404, BB 032, VNR-31355, DKC9133, JH12247, PRO-391, VNR-31834, X35D612, DAS-MH-104, RMH-972, KMH-2811
	ZONE IV	IM8539, IM8562, X35D601, RMH-972, HTMH-5108
	ZONE V	IM8562, IM8554, IM8539, X35D601, DKC9133, Siri4527, IM8556, PRO-392, HTMH-5202, Super GA-105, Janahit, ASMH-777, DAS-MH-105, CP-999
Medium	ZONE-I	LG-3282
	ZONE-II	IM8478, JKMH-4545, X35D620, DAS-MH-304, IM8581, X35D602, IM 7501, CMH 10-547, IM 7519, X35D603, FCH-11231, S-6750, TH-38
	ZONE-III	DAS-MH-305, IM8478, Kuber Shakthi, S-6750, CMH 11-582, IM8479
	ZONE IV	IM8478, HTMH-5402, X35D602, JKMH-4545, X35D603, FCH-11231, LG-3282

Trials	Zone	Entry Name
	ZONE V	IM8478, KDMH-2705, JKMH-4545, SAFAL X-2, IM8581, IM8479, KNMH-4010131, HTMH-5402, IM 7501, DAS-MH-305, LG-3282, KMH-5951, EH-2240, CMH 11-617, CMH 10-547, PRMH-2177, BH 41150, X35D620, X35D602, EH-2205, EHL-3412
Early	ZONE-I	DMH-63, FH-3669, Bio 9720, LG-3181, FH-3664, JH 31610, MEH-1-12-13, AH-1261, GWH-0712
	ZONE-II	CMH 11-595, CMH 11-579, CMH 11-629, CMH 11-626, CMH 11-611, DMH-63
	ZONE-III	CMH 11-629, B-52, CMH 11-579, CMH 11-626
	ZONE IV	NMH-1258, B-52, FH-3669, MEH-1-12-13, EH-2214, DMH-63, EH-2233, FH-3664, LG-3181, HKH 341, AH-1261, BH 411305
	ZONE V	CMH 11-595, CMH 11-579, CMH 11-626, FH-3669, CMH 11-629, KNMH-4301, CMH 11-611, EH-2233, JH 31613, B-52, MEH-1-12-13, NMH-1258, EH-2214, FH-3664, Bio 9720, DMH-63, BH 411305
Extra Early	ZONE-I & II	No test entry available
	ZONE-III	FH-3641, AH-1212
	ZONE IV	KH-7502
	ZONE V	FH-3641, KH-7502, AH-1212
AVT-II		
Late	ZONE-I & II	No test entry available
	ZONE-III	P3491(X35B391)
	ZONE IV	LTH-22, P3491(X35B391), NMH-1265, Geo Premium Diamond
	ZONE V	No test entry available
Medium	ZONE-I, III & IV	No test entry available
	ZONE-II	IJ8533, X35B403, Rasi-3033
	ZONE V	IJ8533
Early	ZONE-I	FH-3626, FH-3605, EH-2212
	ZONE-II	No test entry available
	ZONE-III	FH-3605
	ZONE IV	FH-3605, KMH-7021
	ZONE V	CMH-10-531
Extra Early	In all zones	No test entry available
QPM	Across zones	JH(QPM)3, EHQ 63, MMHQPM6, EHQ64, VEHQ-11-1 + New Entries for QPM-I
BC	Across zones	CMH-11-659, CMH-11-658, Vivek Hybrid-27 + New Entries for BC-I
SC	Across zones	ADVSW-2, ADVSW-1, KSCH-333, FSCH-41, KSCH-222, FSCH-18, Bajaura Sweet Corn, Bisco Madhu + New Entries for SC-I

Trials	Zone	Entry Name
PC	Across zones	KDPC-2, Bajaura Popcorn, VL Popcorn-2, BPCH 27, BPC-3 + New Entries for PC-I

Trials allotments to different locations during *Kharif* 2014

	Location		Initial Varietal Trial					Advance Varietal Trial I					Advance Varietal Trial II					Specialty Corns			
SNo	**Zone-I**	**State**	**L**	**M**	**E**	**EE**		**L**	**M**	**E**	**EE**		**L**	**M**	**E**	**EE**		**QPM**	**SC**	**PC**	**BC**
1	Almora	UK		*	*	*			*	*					*			*	*	*	*
2	Bajaura	HP		*	*	*			*	*					*			*	*	*	*
3	Srinagar	J&K		*	*	*			*	*					*						
4	Udhampur	J&K		*	*	*			*	*					*						
5	Kangra	HP		*	*	*			*	*					*			*	*	*	*
6	Bertin (HP)	HP							*	*					*						
7	Dhaulakuan	HP							*	*					*						
8	Barapani	MEG		*	*	*			*	*					*			*			
9	Gossaiogaon	AS		*	*	*			*	*					*						
10	Poonch	J&K							*	*					*						
11	Rajouri	J&K							*	*					*						
	Total			7	7	7			11	11					11			4	3	3	3
	ZONE-II																				
12	Ludhiana	PB	*	*	*	*		*	*	*				*				*	*	*	*
13	Karnal	HR	*	*	*	*		*	*	*				*				*	*	*	*
14	Kanpur	UP	*	*	*	*		*	*	*				*				*	*	*	*
15	Pantnagar	UK	*	*	*	*		*	*	*				*				*	*	*	*
16	Delhi	DE	*	*	*	*		*	*	*				*				*	*	*	*
17	Hisar	HR						*	*	*				*							
18	Aligarh	UP						*	*	*				*							
19	Jhansi	UP						*	*	*				*							
20	Gurdaspur	PB						*	*	*				*							
21	Kapurthala	PB						*	*	*				*							
	Total		5	5	5	5		10	10	10				10				5	5	5	5
	ZONE-III																				
22	Dholi	BH	*	*	*	*		*	*	*	*		*		*			*	*	*	*
23	Ranchi	JKH	*	*	*	*		*	*	*	*		*		*			*	*	*	*
24	Bhubaneswar	OD	*	*	*	*		*	*	*	*		*		*			*	*	*	*
25	Varanasi	UP	*	*	*	*		*	*	*	*		*		*			*	*	*	*
26	Bahraich	UP	*	*	*	*		*	*	*	*		*		*			*	*	*	*
27	Midnapur	WB						*	*	*	*		*		*						

	Location		Initial Varietal Trial					Advance Varietal Trial I					Advance Varietal Trial II					Specialty Corns			
28	Campus of BHU	UP						*	*	*	*		*		*						
29	Koraput	OD						*	*	*	*		*		*						
30	RRS Madhopur	BH						*	*	*	*		*		*						
31	Chhapra	BH						*	*	*	*		*		*						
	Total		5	5	5	5		10	10	10	10		10		10			5	5	5	5
	ZONE-IV																				
32	Hyderabad	AP	*	*	*	*		*	*	*	*		*		*			*	*	*	*
33	Sehgal Fou	AP						*	*	*	*		*		*						
34	Karimnagar	AP	*	*	*	*		*	*	*	*		*		*			*	*	*	*
35	VRDC KSSC-Dharwad	KR						*	*	*	*		*		*						
36	Dharwad	KR						*	*	*	*		*		*						
37	Kolhapur	MH	*	*	*	*		*	*	*	*		*		*			*	*	*	*
38	Arbhavi	KR	*	*	*	*		*	*	*	*		*		*			*	*	*	*
39	Mandya,	KR	*	*	*	*		*	*	*	*		*		*			*	*	*	*
40	Vagarai	TN	*	*	*	*		*	*	*	*		*		*						
41	Coimbatore	TN	*	*	*	*		*	*	*	*		*		*			*	*	*	*
42	ARS Devihosur	KR						*	*	*	*		*		*						
43	Almel	KR						*	*	*	*		*		*						
44	ARS Belavatagi	KR						*	*	*	*		*		*						
45	Dhule	MH						*	*	*	*		*		*						
46	Parbhani	MH						*	*	*	*		*		*						
47	Niphad, Nasik	MH						*	*	*	*		*		*						
	Total		7	7	7	7		16	16	16	16		16		16			6	6	6	6
	ZONE-V																				
48	Udaipur	RJ	*	*	*	*		*	*	*	*			*	*			*	*	*	*
49	Banswara	RJ	*	*	*	*		*	*	*	*			*	*			*	*	*	*
50	Chindwara	MP	*	*	*	*		*	*	*	*			*	*			*	*	*	*
51	Ambikapur	CHG	*	*	*	*		*	*	*	*			*	*			*	*	*	*
52	Godhra	GUJ	*	*	*	*		*	*	*	*			*	*			*	*	*	*
53	Jabhua	MP	*	*	*	*		*	*	*	*			*	*						
54	Bhiloda	GUJ						*	*	*	*			*	*						
55	AAR	G						*	*	*	*			*	*						

	Location		Initial Varietal Trial					Advance Varietal Trial I					Advance Varietal Trial II					Specialty Corns			
	Dahod	UJ																			
56	Raipur	CHG						*	*	*	*			*	*						
57	Jagadalpur	CHG						*	*	*	*			*	*						
58	RARS Ujjain	MP						*	*	*	*			*	*						
59	ZARS, Indore	MP						*	*	*	*			*	*						
60	ARS, Kota	RJ						*	*	*	*			*	*						
	Total		6	6	6	6		13	13	13	13			13	13			5	5	5	5
	Grand total		23	30	30	30		49	60	60	39		26	23	50			25	24	24	24

Note: * trial allotted, trials not allotted, L = Late maturity, M = Medium maturity, E = Early maturity, EE = Extra early maturity, SC = Sweet corn, QPM = Quality Protein Maize, BC = Baby corn, PC = Popcorn

Quantity of seed of check variety required for constitution of *Kharif* 2015 and *Rabi* 2015-16 trials

S.No.	Check Name	Maturity Group	Centre	Quantity seed (Kgs)
1	PMH 1	Late	Ludhiana	40
2	PMH 3	Late	Ludhiana	40
3	HM 11	Late	Karnal	40
4	SeedTech2324	Late	BISCO	40
5	Bio 9681	Late	Bio Seed	40
6	PMH 4	Medium	Ludhiana	40
7	Bio 9637	Medium	Bio Seed	40
8	HM 8	Medium	Karnal	40
9	HM 9	Medium	Karnal	40
10	HM 10	Medium	Karnal	40
11	HM 12	Medium	Karnal	40
12	Prakash	Early	Ludhiana	40
13	JH 3459	Early	Ludhiana	40
14	PMH 5	Early	Ludhiana	40
15	Vivek QPM 9	Extra Early	Almora	40
16	Vivek Hybrid 9	Extra Early	Almora	40
17	Vivek Hybrid 21	Extra Early	Almora	40
18	Vivek Hybrid 43	Extra Early	Almora	40

S.No.	Check Name	Maturity Group	Centre	Quantity seed (Kgs)
19	HQPM 1	QPM	Karnal	30
20	HQPM 4	QPM	Karnal	30
21	HQPM 5	QPM	Karnal	30
22	HQPM 7	QPM	Karnal	30
23	HM 4	Baby corn	Karnal	30
24	HSC 1	Sweet corn	Karnal	20
25	Madhuri	Sweet corn	Hyderabad	20
26	Priya	Sweet corn	Hyderabad	20
27	WOSC	Sweet corn	Hyderabad	20
28	VL Amber	Popcorn	Almora	20
Normal Maize-*Rabi* 2015-16				
1	SeedTech 2324	Late	BISCO	25
2	Bio 9681	Late	Bio Seed	25
3	Buland	Late	Ludhiana	25
4	Bio 9637	Medium	Bio Seed	25
5	HM 10	Medium	Karnal	25
6	Prakash	Early	Ludhiana	25
7	JH 3459	Early	Ludhiana	25
Specialty Corns -*Rabi* 2015-16				
8	HQPM 1	QPM	Karnal	20
9	HQPM 4	QPM	Karnal	20
10	HQPM 5	QPM	Karnal	20
11	HQPM 7	QPM	Karnal	20

In addition to this, the seed of latest notified hybrids can be contributed for check consideration in IVT

Quantity of seed of test entries required in each trial for *kharif* 2014

S.N.	Trial	Year of testing	Seed quantity (Kg)	Mode of conduct
1	Initial Varietal Trial (IVT)	First	4 Kg/Entry	Across the zones
2	Advance Varietal Trial-I (AVT-I)	Second	4.5 Kg/Entry/Zone	Zone specific

3	Advance Varietal Trial-II(AVT-II)	Third	6 Kg/Entry/Zone	Zone specific
4	Baby corn	I, II, III	7 Kg/ Entry	Across the zones
5	QPM	I, II, III	6.5 Kg/ Entry	Across the zones
6	Sweet corn	I, II, III	3.5 Kg/ Entry	Across the zones
7	Popcorn	I, II, III	3.5 Kg/ Entry	Across the zones
8	National Maize Demonstration-Hybrids	I	0.5 Kg/Hybrids	New Delhi
9	National Maize Demonstration-Inbreds	I	0.2 Kg/Hybrids	New Delhi

Quantity of seed of test entries required in each trial for *Rabi* 2014-15

S.N.	Trial	Year of testing	Seed quantity (Kg)	Mode of conduct
1	Initial Varietal Trial (IVT)	First	3.5 Kg/Entry	Across the zones
2	Advance Varietal Trial-I (AVT-I)	Second	3 Kg/Entry/Zone	Zone specific
3	Advance Varietal Trial-II(AVT-II)	Third	4 Kg/Entry/Zone	Zone specific
5	QPM	I, II, III	6 Kg/ Entry	Across the zones

- Seed of entries should reach the office of the Project Director, Directorate of Maize Research, Pusa Campus, New Delhi-110012, **latest by 15th May 2014 for *kharif* and by 10th October 2014 for *rabi* trials**
- The Private Sector must submit the testing fee of *Rs. 60,000 + 12.36% (service* tax)/entry/trial/year in the form of DD in favor of Project Director (Maize), Directorate of Maize Research, Pusa Campus, New Delhi, payable at New Delhi. **Entries without fee and pedigree of hybrids will not be accepted.** Seeds of each entry should be double-packed separately in cloth bag**.**
- The seed submitted for testing in AICMIP must be un-treated.
- The breeders must give full details (trial name, maturity, zone etc.) of their hybrids submitted for testing under AICMIP. All breeders must confirm delivery of their entries at DMR.

Trials conductance

Initial varietal Trials (IVT-I) (Across the zones) • No. of rows – 2 (net) • Row length – 4m (net) • Spacing- 75cm x 25cm Rainfed, 60cm X 20 cm in Irrigated • Replications – 3 • Fertilizer – As per recommendations	**Advance varietal Trials-II (AVT-II) or (AVT I+II) (Zone specific)** • No. of rows – 6 (net) • Row length – 4m (net) • Spacing- 75cm x 25cm - Rainfed, 60cm X 20 cm in Irrigated • Replications – 3 • Fertilizer – As per recommendations
Advance varietal Trials-I (Zone specific) • No. of rows – 4 (net) • Row length – 4m (net) • Spacing- 75cm x 25cm - Rainfed, 60cm X 20 cm in Irrigated • Replications – 3 • Fertilizer – As per recommendations	**QPM/SC/PC-I-II-III (Across the zone)** • No. of rows – 4 (net) • Row length – 4m (net) • Spacing- 75cm x 25cm - Rainfed, 60cm X 20 cm in Irrigated • Replications – 3 • Fertilizer – As per recommendations
Baby corn trials (BC-I-II-II) (Across the zone) • No. of rows – 4 (net), • Row length – 4m (net), • Spacing- 60cm X 15cm, • Replications – 3, • Fertilizer – As per recommendations	

- AVT-I trials will be clubbed with AVT-II wherever the number of entries available are less and will be allotted to new volunteer centers beside the regular centres. Different trials will be planted with the following recommendation:

Recording of observations:

Traits recorded in specialty corn particularly sweet corn and baby corn were highlighted and there was recommendation for removing the following observations from sweet corn trial

1. Days to maturity (75% dry husk) in Replication-3
2. Cob weight at maturity (Kg/plot)-Replication-3
3. Fresh five cobs weight with husk and without husk
4. Shelling percentage
5. Sugar content (%) - On dry weight basis-calculated from selfed cob used for measuring sweetness.

In baby corn the following traits are recommended to remove from the observation list:

1. Days to maturity (75% dry husk) in Replication-3
2. Fresh cob weight at maturity (Kg/plot)-Replication-3
3. Moisture percentage-(Replication-3)

4. Shelling percentage

There was consensus with respect to recording observations on all three replications and the observations will be recorded till green cob harvest in sweet corn and baby corn harvest in baby corn trial. No replication will be continued till maturity in both sweet corn and baby corn trials.

Observations to be recorded in initial and advance trials: **Normal Maize**

1. Days to 50% anthesis - Rounded to 0 decimals
2. Days to 50% silking - Rounded to 0 decimals
3. Plant height (cm) - Rounded to 0 decimal
4. Ear height/ placement (cm) - Rounded to 0 decimal
5. Days to maturity – 75% dry husk/appearance of black layer
6. Plant population at harvest (No./Plot)
7. Cobs count at harvest (No./plot)
8. Fresh cobs weight at harvest (Kg/plot)
9. Grain Moisture at the time of harvesting (%)
10. Shelling percentage (%)

Observations to be recorded in initial and advance trials: **Quality Protein Maize (QPM)**

1. Days to 50% anthesis - Rounded to 0 decimals
2. Days to 50% silking - Rounded to 0 decimals
3. Plant Height (cm) - Rounded to 0 decimal
4. Ear height/ placement (cm) - Rounded to 0 decimal
5. Days to maturity – 75% dry husk/appearance of black layer
6. Plant population at harvest (No./Plot)
7. Cobs count at harvest (No./plot)
8. Fresh cobs weight at harvest (Kg/plot)
9. Grain Moisture at the time of harvest (%) - should be recorded from two replications
10. Shelling percentage (%) - recorded in two replications
11. Lysine and Tryptophan (%) – recorded in the selfed cobs from two replications

Observations to be recorded in initial and advance trials: **Popcorn**

1. Days to 50% anthesis - Rounded to 0 decimals
2. Days to 50% silking - Rounded to 0 decimals
3. Plant Height (cm) - Rounded to 0 decimal
4. Ear height/placement (cm) - Rounded to 0 decimal
5. Days to maturity – 75% dry husk/appearance of black layer
6. Plant population at harvest (No./Plot)
7. Cobs count at harvest (No./plot)
8. Fresh cobs weight at harvest (Kg/plot)
9. Grain Moisture at the time of harvesting (%) - recorded from two replications
10. Shelling percentage (%) - recorded from two replications
11. Popping volume and percentage - recorded from selfed cobs

Observations to be recorded in initial and advance trials: **Sweet corn**

1. Days to 50% anthesis - Rounded to 0 decimals

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

Observations to be recorded in initial and advance trials: **Baby corn**

1. Days to 50% silking - Rounded to 0 decimal
2. Plant Height (cm) - Rounded to 0 decimal
3. Plant population per plot
4. Baby corn height/placement (cm) top most baby corn - Rounded to 0 decimal
5. Date of harvest of un-pollinated baby corn and number of baby corn from each harvest (No./plot)
6. Fresh weight of baby corn per plot with husk (Kg) - Rounded to 0 decimal
7. Fresh weight of baby corn per plot without husk (Kg) - Rounded to 0 decimal
8. Length of baby corn (cm) - Rounded to 0 decimal
9. Diameter of baby corn (cm)

Session V
Concurrent Session (Crop Production)

Chairman	Co-chairman	Convener	Rapporteurs
Dr. G.S. Chauhan, Dean, Resident Instruction, MPUAT, Udaipur	Dr. M.L. Jat, Senior Cropping Systems Agronomist, CIMMYT, New Delhi	Dr. A.K. Singh, PI Agronomy, DMR, New Delhi	Drs. Dilip Singh, S.L. Jat

At the outset, Dr. A.K. Singh welcomed the chairman and co-chairman of the session. Chairman invited all the agronomists to present salient findings for the *rabi* 2012-13 and *kharif* 2013. Co-chairman Dr. M.L. Jat in his remarks emphasized that agronomic management is very critical to bridge the gaps between attainable and potential yields hence more emphasis is required for development of location-specific crop production practices. The meeting was attended by 27 Natural Resource Management scientists. The findings were presented by the following centres:

S. No	Name of the centre	Scientist
1.	JNKKV, ZARS, Chhindwara	Dr. V.K. Paradkar
2.	K.D. Farm, SKAUAST, Srinagar	Dr. Bashi Ahamad Alie
3.	MPUAT, Udaipur	Dr. Dilip Singh
4.	ARS, Arbhavi, Belgaum, Karnataka	Dr. S.S. Hallikeri
5.	AAU, MMRS, Godhra	Prof. K.H Patel
6.	Maize Research Station, TNAU, Vagarai	Dr. R. Karthikeyan
7.	Maize Research Centre, ARI, ANGRAU, Hyderabad	Dr. (Ms.) D. Sreelatha
8.	Agricultural Research Station, ANGRAU, Karimnagar	Dr. (Ms.) G. Manju Latha
9.	College of Agriculture, OUAT, Bhubaneswar	Ms. Pramila Naik
10.	College of Agriculture, GBPUAT, Pantnagar	Dr. Amit Bhatnagar and Dr. Veer Singh
11.	PAU, Ludhiana	Dr. Mahesh Kumar
12.	CCS HAU Regional Research Station, Uchani, Karnal	Dr. Mehar Chand
13.	CRS NDUAT, Bahraich	Dr. M.V. Singh
14.	ARS, MPUAT, Banswara	Dr. Hargilas
15.	RMD College of Agriculture and Research Station, Ambikapur	Dr. S.K. Sinha
16.	Dept. of Plant Breeding & Genetics, BAU, Kanke, Ranchi	Dr. C.S. Singh
17.	Shivalik Agricultural Research and Extension Centre, Kangra	Dr. Anil Kumar
18.	IARI, New Delhi	Dr. Vijay Pooniya
19.	VPKAS, Almora	Not presented
20.	CSKHPKV, HAREC, Bajaura	Not presented
21.	RAU, Dholi	Not presented
22.	AAU, Gossaigaon	Not presented
23.	RVSKVV, Jhabua	Not presented
24.	CSAUAT, Kanpur	Not presented
25.	MPKV, Kolhapur	Not presented

S. No	Name of the centre	Scientist
26.	SKUAST-J, Udhampur	Not presented
27.	BHU, Varanasi	Not presented

After presentation following points have emerged:

1. Detailed production economics needs to be worked out and submitted for each trial to DMR (Action: All AICRP scientists)
2. The previous crop and its nutrient management practices must be provided along with data of each trial (Action: All AICRP scientists)
3. Residue of which preceding crop used in experimentation must be mentioned with data (Action: All AICRP scientists)
4. The experiment sites in tillage based experiment must not be rotated at any cost. Otherwise it will attract rejection of data (Action: All AICRP scientists)
5. DMR will clearly indicate the stages of maize for split application of nitrogen (Action: PI Agronomy)
6. A sample of at least 20 farmers must be taken into consideration to collect the data for farmers fertilizer practice and same should be send to DMR (Action: All AICRP scientists)
7. Full pdf file of each SSNM trial calculation must be prepared and same should be sent to DMR before commencement of sowing season (Action: All AICRP scientists)
8. Almora centre is not conducting the allotted trial/s as well as the agronomist of the centre is not attending the workshop since last three years. Director, VPKAS may be requested for regular participation of agronomist in workshop (Action: Almora centre in-charge).
9. The need was felt to centrally analyze the soil health of the nutrient management and tillage experiments for which DMR will finalize sampling protocol and same will be sent to the centres for sending their samples to DMR (Action: PI Agronomy)
10. The group felt there is a need to conduct the weed management trials with post emergence molecules but due to non-availability of such new molecules in the market it was decided that this trial will be formulated after registration of post emergence herbicide for maize in the India (Action: PI Agronomy)

The group thoroughly discussed the achievements made in last year to make some recommendations out of the experiments conducted and concluded. It was decided that consistent results of the two year multi-locations experiments must go to farmer's field as technologies. In this regard, the group came out with three following recommendations:

- Drip irrigation at 100% pan evaporation (PE) and 200 kg/ha N fertigation produced 23 t/ha of green cob (Sweet corn) with B:C ratio of 2.60 which is recommended for sweet corn production in peninsular region during *rabi* season.
- Glyphosate @ 1.0 kg/ha as pre-plant application followed by 2,4-D Sodium salt @ 0.4 kg/ha at 25-30 DAS gives grain yield of 7512 kg/ha with less weed index (8.77) and higher weed control efficiency (59.2%) and benefit:cost of 3.56 in zero-till maize under rice-maize system in peninsular India.

- Nutrient expert based site-specific nutrient management (SSNM) increases *kharif* maize yield to the tune of 200 to 2060 kg/ha which may be opted for higher yield over existing fertilization practices.

After this the group discussed the trial-wise work plan for the *kharif* 2014 and *rabi* 2014-15. The group made many suggestions in the conduct of the experiments and approved them unanimously in 7 ongoing experiments. In view of requirement of agronomic practices for pre-release genotypes, the group suggested for inclusion of the planting density for the first time in such experiments along with nutrient levels. As per the prevailing production systems and issues for their sustainable production, three more research trials were formulated to conduct in coming season. The data to be recorded in all trials were thoroughly discussed and finalized for each experiment. In all, ten trials were formulated for *kharif* 2014 and *rabi* 2014-15 as follows:

Trials to be continued during 2013-14

1. Performance of pre-release genotypes under varying nutrients levels
2. Effect of planting systems and intercropping with and without residue retention under rain-fed conditions
3. Nutrient management in maize-wheat-green gram cropping system under different tillage practices
4. Nutrient management in rice-maize cropping system under different tillage practices
5. Nutrient management in maize-chickpea/mustard cropping system under different tillage practices
6. Nutrient requirement of maize genotypes under different cropping systems
7. Water management in spring maize

New Trials formulated

1. Effect of planting density and nutrient management practices on the performance of hybrids in *kharif* season
2. Effect of planting density and nutrient management practices on the performance of hybrids in *rabi* season
3. Optimization of nutrient and plant geometry management in zero-till *rabi* maize

This session was attended by the following scientists:

S. No.	Name of the scientist	Centre
1.	Dr. V.K. Paradkar	JNKKV, ZARS, Chhindwara
2.	Dr. Bashi Ahamad Alie	K.D. Farm, SKAUAST, Kashmir
3.	Dr. Dilip Singh	MPUAT, Udaipur
4.	Dr. S.S. Hallikeri	ARS, Arbhavi, Belgaum
5.	Prof. K.H Patel	AAU, MMRS, Godhra
6.	Dr. R. Karthikeyan	Maize Research Station, TNAU, Vagarai
7.	Dr. (Ms.) D. Sreelatha	Maize Research Centre, ARI, ANGRAU, Hyderabad
8.	Dr. (Ms.) G. Manju Latha	Agricultural Research Station, ANGRAU, Karimnagar
9.	Ms. Pramila Naik	College of Agriculture, OUAT, Bhubaneswar

S. No.	Name of the scientist	Centre
10.	Dr. Partha Mukherjee	Economic Botanist Section III, Midnapore, West Bengal
11.	Dr. S.K. Adak	Economic Botanist Section III, Midnapore, West Bengal
12.	Dr. Amit Bhatnagar	College of Agriculture, GBPUAT, Pantnagar
13.	Dr. Veer Singh	College of Agriculture, GBPUAT, Pantnagar
14.	Dr. Mahesh Kumar	PAU, Ludhiana
15.	Dr. Mehar Chand	CCS HAU Regional Research Station, Uchani, Karnal
16.	Dr. M.V. Singh	CRS NDUAT, Bahraich
17.	Dr. Hargilas	ARS, MPUAT, Borwat Farm, Dahot Road, Banswara
18.	Dr. S.K. Sinha	RMD College of Agriculture and Research Station, Ambikapur
19.	Dr. C.S. Singh	Dept. of Plant Breeding & Genetics, BAU, Kanke, Ranchi
20.	Dr. Anil Kumar	Shivalik Agricultural Research and Extension Centre, Kangra
21.	Dr. Kaushik Majumdar	IPNI, Gurgaon
22.	Dr. M.L. Jat	CIMMYT, New Delhi
23.	Dr. R.K. Jat	BISA, Bihar
24.	Dr. Vijay Pooniya	IARI, New Delhi
25.	Dr. A.K. Singh	DMR, New Delhi
26.	Dr. C.M. Parihar	DMR, New Delhi
27.	Dr. S.L. Jat	DMR, New Delhi

The session was ended with vote of the thanks to chair and all the scientists by Dr. D. Sreelatha.

Technical programme for 2014-15

MAT 1. Performance of pre-release genotypes under varying planting density and nutrient levels

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

a) Performance of pre-release extra early maturity genotypes under varying planting density and nutrient levels in Zone IV:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (3)+checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Arbhavi, Kolhapur, Karimnagar, Hyderabad, Vagarai

b) Performance of pre-release extra early maturity genotypes under varying planting density and nutrients levels in Zone V:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (3) +checks
Design: Split-split plot

Replications: 3
Plot size: 15 m^2

Locations: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur

c) Performance of pre-release early maturity genotypes under varying planting density and nutrients levels in Zone I:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (3) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Almora, Bajaura, Kangra, Udhampur, Srinagar, Gossaigaon

d) Performance of pre-release early maturity genotypes under varying planting density and nutrients levels in Zone III:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (1) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Bahraich, Midnapore, Varanasi, Bhubaneswar, Ranchi, Dholi

e) Performance of pre-release early maturity genotypes under varying planting density and nutrients levels in Zone IV:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (2) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Arbhavi, Kolhapur, Karimnagar, Hyderabad, Vagarai

f) Performance of pre-release early maturity genotypes under varying planting density and nutrients levels in Zone V:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (1) +checks
Design: Split-split plot
Replications: 3
Plot size:

Locations: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur

g) Performance of pre-release medium maturity genotypes under varying planting density and nutrients levels in Zone III:

Main-plot:Nutrient Levels (2) 200:65:80, 250:80:100 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (3) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Bahraich, Midnapore, Varanasi, Bhubneshwar, Ranchi, Dholi

h) Performance of pre-release medium maturity genotypes under varying planting density and nutrients levels in Zone V:

Main-plot: Nutrient Levels(2) 200:65:80, 250:80:100 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (1) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur

i) Performance of pre-release late maturity genotypes under varying planting density and nutrients levels in Zone III:

Main-plot: Nutrient Levels (2) 200:65:80, 250:80:100 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (1) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Arbhavi, Kolhapur, Midnapore, Karimnagar, Hyderabad, Vagarai

j) Performance of pre-release late maturity genotypes under varying planting density and nutrients levels in Zone IV:

Main-plot:Nutrient Levels (2) 200:65:80, 250:80:100 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (4) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur

Note: Nitrogen to be applied in three equal splits in all MAT 1(a to j) at basal, knee high and tasseling stage.

Observations to be recorded in MAT 1(a to j):

1. Plant height (cm) at harvest
2. Plant population (thousands/ha) at harvest
3. Number of cobs/ha
4. Barrenness in maize (%)
5. Days to 50% silking
6. Days to maturity
7. Test weight (1000-seed weight)
8. Grain yield (kg/ha)
9. Stover yield (kg/ha)
10. Insect-pest and disease incidence, if any
11. Net return and B:C ratio

k) Performance of pre-release popcorn genotypes under varying planting density and nutrients levels in Zone I:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (2) +checks
Design: Split-split plot

Replications: 3
Plot size: 15 m^2

Locations: Almora, Bajaura, Kangra, Udhampur, Srinagar, Gossaigaon

l) Performance of pre-release popcorn genotypes under varying planting density and nutrients levels in Zone III:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (2) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Bahraich, Varanasi, Midnapore, Bhubaneswar, Ranchi, Dholi, Gossaigaon

m) Performance of pre-release popcorn genotypes under varying planting density and nutrients levels in Zone IV:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (2) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Arbhavi, Kolhapur, Karimnagar, Hyderabad, Vagarai

n) Performance of pre release popcorn genotypes under varying planting density and nutrients levels in Zone V:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (1) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur

Note: Nitrogen to be applied in three equal splits in all MAT 1(k to n) at basal, knee high and tasseling stage.

Observations to be recorded in MAT 1 pop corn (k to n):

1. Plant height (cm) at harvest
2. Plant population (thousands/ha) at harvest
3. Number of cobs/ha
4. Barrenness in maize (%)
5. Days to 50% silking
6. Days to maturity
7. Popping (%)
8. Test weight (1000-seed weight)
9. Grain yield (kg/ha)
10. Stover yield (kg/ha)
11. Insect-pest and disease incidence, if any
12. Net returns and B:C ratio

o) Performance of pre-release sweet corn genotypes under varying planting density and nutrients levels in Zone I, II, IV & V:

Main-plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub-plot: Density (2) Normal, high
Sub-sub plot: Genotypes (5) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations:

Zone I: Almora, Bajaura, Kangra, Udhampur, Srinagar
Zone II: Delhi, Kanpur, Ludhiana, Karnal, Pantnagar
Zone IV: Arbhavi, Kolhapur, Karimnagar, Hyderabad, Vagarai
Zone V: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur
Note: Nitrogen to be applied in three equal splits in MAT 1(o) at basal, knee high and tasseling stage.

Observations to be recorded in MAT 1 sweet corn (o):

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

p) Performance of pre-release baby corn genotypes under varying planting density and nutrients levels in Zone II, III, IV & V:

Main plot: Nutrient Levels (2) 150:50:60, 200:60:80 ($N:P_2O_5:K_2O$ kg/ha)
Sub plot: Density (2) Normal, high
Sub- Sub plot: Genotypes (1) +checks
Design: Split-split plot
Replications: 3
Plot size: 15 m^2

Locations:

Zone II: Delhi, Kanpur, Ludhiana, Karnal, Pantnagar

Zone III: Bahraich, Varanasi, Bhubaneswar, Ranchi, Dholi, Gossaigaon

Zone IV: Arbhavi, Kolhapur, Karimnagar, Hyderabad, Vagarai

Zone V: Ambikapur, Chhindwara, Jhabua, Godhra, Banswara, Udaipur

Note: Nitrogen to be applied in three equal splits in MAT 1(p) at basal, knee high and tasseling stage.

Observations to be recorded in MAT 1 babycorn (p):

1. Plant height (cm) at harvest
2. Number of plants/ha at harvest
3. Days to first picking
4. Number of pickings
5. Baby corn yield with husk
6. Baby corn yield without husk (kg/ha)
7. Green fodder yield (kg/ha)

8. Insect-pest and disease incidence, if any
9. Net returns and B:C ratio

MAT 2. Effect of planting systems and intercropping with and without residue retention under rainfed condition

Objective: To find out suitable intercrops in different planting system with maize for higher profit under rainfed conditions

Treatments detail

A. Planting systems (Main-plots)
   1. Uniform row at 67 cm
   2. Paired row at 84:50 cm
B. Intercrops (Sub-plots)
   1. Soybean
   2. Black gram
C. Residue level(Sub-sub plots)
   1. No residue
   2. Residue retention as a mulch@ 5 t/ha

Design: Split-split plot
Replications: three
Sub-sub plot size: 15 m^2
Locations: Udaipur, Banswara, Ranchi, Ambikapur (Soybean & Urdbean), Bhubaneswar (Cowpea & Groundnut), Srinagar (cowpea & mungbean), Vagarai (Urdbean and mungbean)

Observations to be recorded:

1. Plant population (thousands/ha) at harvest
2. Plant height (cm) of maize and intercrop at harvest
3. Days to reproductive stage of each crop
4. Days to maturity of each crop
5. Yield attributes and yield of maize and inter crops
6. Maize equivalents of intercrop and cropping system
7. Stover yield of maize and inter crop
8. Net returns and B: C ratio
9. Moisture use efficiency
10. Insect-pest and disease incidence, if any
11. N, P and K uptake by all crops

MAT 3: Nutrient management in maize-wheat-greengram cropping system under different tillage practices

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

Tillage practices (Main-plots)	**Nutrient management (Sub-plots)**
1. Zero till 2. Conventional Till 3.Permanent bed	1.RDF 2.SSNM based on nutrient expert 3.Farmer's fertilizer practice

Design: Split Plot Replications: three Main-plot size: 150 m^2
Locations: Almora, Udaipur, Pantnagar, Delhi, Dholi, Karnal, Banswara

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 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, if any
12. Initial and final (after completion of one year cropping sequence) physical and chemical parameters of soil

MAT 4: Nutrient management in rice-maize cropping system under different tillage practices

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

Tillage practices (Main-plots)	**Nutrient management (Sub-plots)**
1. Zero till 2. Conventional Till 3.Permanent bed	1.RDF 2.SSNM based on nutrient expert 3.Farmer's fertilizer practice

Design: Split Plot Replications: three Main-plot size: 150 m^2

Locations: Dholi, Hyderabad

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, if any
12. Initial and final (after completion of one year cropping sequence) physical and chemical parameters of soil

MAT 5: Nutrient management in maize based rainfed cropping systems under different tillage practices

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

Tillage practices (Main-plots)	**Nutrient management (Sub-plots)**
1. Zero till 2. Conventional Till 3.Permanent bed	1.RDF 2.SSNM based on nutrient expert 3.Farmer's fertilizer practice

Design: Split Plot Replications: three Main-plot size: 150 m^2

Locations: Maize-chickpea cropping system-Banswara, Delhi

Maize-mustard cropping system-Srinagar, Chhindwara, Delhi

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, if any
11. Initial and final (after completion of one year cropping sequence) physical and chemical parameters of soil

MAT 6: Nutrient management for maize genotypes under different cropping systems

Objectives: 1. To find out SSNM practices for yield maximization of hybrids

2. To estimate the interaction of nutrient management with hybrids

Hybrids (Main-plots)	**Nutrient management (Sub-plots)**
Five recommended hybrids of the region	1.RDF 2.SSNM based on nutrient expert 3.Farmer's fertilizer practice

Design: Split Plot Replications: three Sub-plot size: 15 m^2

Locations:

Maize-wheat: Bajaura, Jhabua, Udaipur, Banswara, Ranchi, Ludhiana, Karnal, Delhi, Pantnagar
Maize-chickpea: Kanpur, Bahraich
Maize-mustard: Chhindwara, Ambikapur, Srinagar, Kangra
Rice-maize: Hyderabad
Maize alone: Karimnagar, Arbhavi

Observations to be recorded:

1. Plant population in maize and mungbean/chickpea /mustard at harvest (thousands/ha)
2. Effective tillers of wheat and rice per m^2
3. Plant height (cm) 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 (kg/ha)
9. Net returns and B: C ratio
10. N, P and K uptake by all crops
11. Initial and final (after completion of one year cropping sequence) physical and chemical parameters of soil.

MAT 7: Water management in spring maize (ICAR-CIMMYT collaborative project)

Objective: To standardize the effective water management practices for spring maize in northern India

Irrigation practices (Main-plot)

1. Continuous furrow irrigation (45kPascal SMP)
2. Alternate furrow irrigation (45kPascal SMP)
3. Drip irrigation (45 k Pascal SMP)
4. Continuous furrow irrigation (60kPascal SMP)
5. Alternate furrow irrigation (60kPascal SMP)
6. Drip irrigation (60 k Pascal SMP)
7. Irrigation at critical stages

Mulching (Sub-plot)

1. No mulch
2. With mulch

Design: Split plot Replications: 3 Sub-plot size: 15 m^2

Location: Ludhiana

Observations to be recorded:

1. Plant population (thousands/ha) at harvest
2. Yield attributes and yield
3. Consumptive use and water use efficiency
4. Stover (kg/ha)
5. Amount of water applied and water saving
6. Net returns and B: C ratio

MAT 8: Effect of planting density and nutrient management practices on the performance of hybrids in kharif season

Objective: To study the genotype x planting density x nutrient interactions for achieving higher yield in hybrid maize during kharif season

Locations	**Cropping system**	**Main-plot (Hybrids:2)**	**Sub-plot (Density:2)**	**Sub-sub plot (Nutrient mangement:3)**
Zone I (Almora, Bajaura, Srinagar, Kangra, Gossaingaon)	Maize – Wheat/ Maize-mustard	Early/ medium maturity	60 x 20 cm^2 60 x 15 cm^2	RDF STCR SSNM
Zone II (Delhi, Ludhiana, Karnal, Kanpur, Pantnagar)	Maize – Wheat	Full maturity	67 x 20 cm^2 67 x 15 cm^2 (75 x 20 cm^2 75 x 15 cm^2)*	RDF STCR SSNM
Zone III (Dholi, Ambikapur, Bahraich, Bhubaneswar, Varanasi, Ranchi)	Maize – Wheat/ Maize-mustard	Medium maturity	60 x 20 cm^2 50 x 20 cm^2	RDF STCR SSNM

Locations	Cropping system	Main-plot (Hybrids:2)	Sub-plot (Density:2)	Sub-sub plot (Nutrient mangement:3)
Zone IV (Arbhavi, Hyderabad, Kolhapur, Karimnagar)	Maize alone	Full maturity	60 x 20 cm^2 50 x 20 cm^2	RDF STCR SSNM 150%RDF[#]
Zone V(Udaipur, Chhindwara, Banswara, Godhara)	Maize – Wheat/ Maize-Chickpea/ Maize-mustard	Early/ medium maturity	60 x 20 cm^2 50 x 20 cm^2	RDF STCR SSNM

Note: *For Karnal centre; [#]For Hyderabad centre only.

Design: Split-split plot Replications: 3 Sub-sub plot size: 15 m^2

***Note*:** Select the hybrids from local market having maximum area at farmers field and mention their names

Observation to be recorded:

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

MAT 9: Effect of planting density and nutrient management practices on the performance of hybrids in rabi season

Objective: To study the genotype x planting density x nutrient interactions for achieving higher yield in hybrid maize during rabi season

Locations	Cropping system	Main-plot (Hybrids:2)	Sub-plot (Density:2)	Sub-sub plot (Nutrient mangement:3)
Zone III (Dholi, Bahraich)	Rice- Maize	Full maturity	60 x 20 cm^2 50 x 20 cm^2	RDF STCR SSNM
Zone IV (Karimnagar, Vagarai)	Pulse-maize/ Maize alone	Full maturity	60 x 20 cm^2 50 x 20 cm^2	RDF STCR SSNM
Zone V (Banswara)	Soybean-maize	Full maturity	60 x 20 cm^2 50 x 20 cm^2	RDF STCR SSNM

Design: Split-split plot Replications: 3 Sub-sub plot size: 15 m^2

***Note*:** Select the hybrids from local market having maximum area at farmers field and mention their names

Observation to be recorded:

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

MAT 10: Optimization of nutrient and plant geometry management in rice-zero-till *rabi* maize system

Objective: Optimization of geometry and fertilization practices in ZT maize

Main-plot: Method of nutrient application

1. Farmer practice
2. Improved practice

Sub-plot: Nutrient management

1. Farmers practice
2. STCR
3. RDF

Sub-sub plot: Planting density

1. 60 x 20 cm^2
2. 50 x 20 cm^2
3. 45 x 20 cm^2

Design: Split-split plot Replications: 3 Sub-sub plot size: 15 m^2

Location: Hyderabad

Observations to be recorded:

1. Plant population (thousands/ha) in maize
2. Barrenness in maize (%)
3. Effective tillers of rice per square meter
4. Plant height (cm) at harvest of all crops
5. Yield attributes and yield of all crops
6. Days to reproductive stage of each crop
7. Days to maturity of each crop
8. System productivity
9. Stover/straw yields of all crops (kg/ha)
10. Net returns and B: C ratio
11. N, P and K uptake by all crops

12. Initial and final (after completion of one year cropping sequence) physical and chemical parameters of soil.

MAT 11: Long-term trial on integrated nutrient management in maize-wheat cropping system

Objective: To explore the possibilities of organic maize production

Treatments:

1. Unmanured control
2. 100% RDF
3. 75% RDF
4. 50% RDF
5. FYM 10 t/ha + Azotobacter
6. Maize + cowpea with FYM 10 t/ha + Azotobacter
7. 100% RDF + 5 t/ha FYM
8. 50% RDF + 5 t/ha FYM
9. 100% RDF + 5 kg/ha Zinc

Note: the trial must be conducted on fixed plots where no synthetic chemical must be used for treatment 5 and 6 in view of organic maize-wheat production.

Design: RBD

Location: Pantnagar

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

Concurrent Session V (Plant Pathology & Nematology)

Chairperson	Co-Chairman	Convener	Rapporteurs
Prof. Anila Doshi, HOD, Plant Pathology, MPUAT, Udaipur	Prof. A.U. Siddiqui, HOD, Nematology, MPUAT, Udaipur	Dr. K.S. Hooda, DMR, New Delhi	Dr. S.S. Sharma, Dr. (Mrs) Harleen Kaur

The group meeting of Maize Pathology and Nematology was held at 2.00 PM at Committee Hall of Directorate of Research, MPUAT, Udaipur to undertake the review of research results of *kharif 2013*/*rabi* 2012-13 and formulation of technical programme of *kharif 2014*/*rabi* 2014-15. At the outset, Dr. K.S. Hooda welcomed the chairman Prof. Anila Doshi and Co-Chairman Prof. A.U. Siddiqui and requested them to take up the review of research achievements of maize pathology.

The findings were presented by the following centres:

Sr. No.	Centre	Presented by/ not presented	Sr. No.	Centre	Presented/ not presented
1.	Mandya	Dr. T.A. Sreerama Shetty	9.	Udaipur, (Pathology)	Dr. S.S. Sharma
2.	IARI	Dr. Robin Gogoi	10.	ANGRAU	Dr. R. Ranga Reddy
3.	Arabhavi	Dr. V.R. Kulkarni	11.	Ludhiana	Dr. Harleen Kaur
4.	Karnal	Dr. Vinod Kumar	12.	Coimbatore	Dr. P. Renuka Devi
5.	Bajaura	Dr. Rakesh Devlash	13.	Bhubneshwar	Ms. P. Behera
6.	Dhaulakuan	Dr. Ashwani Kumar	14.	Medinapur	Dr. C.K. Bhunia
7.	Udaipur (Nematology)	Dr. B.L. Baheti	15.	Dholi	Not presented
8.	Almora	Not presented	16.	Pantnagar	Not presented

All the centres from 5 zones conducted experiments and reported results. A total of 321 entries in 10 trials at 15 locations were evaluated against 11 major diseases (MLB, TLB, BLSB, SDM, BSDM, RDM, CLS, PFSR,Common rust, BSR and cyst nematode)under artificially created epiphytotics. A total of 481 inbred lines were evaluated at hot spot locations in the country. Disease occurrence in trap nursery was reported from 11 centres (Dholi, Karnal, Mandya, Udaipur, Pantnagar, Delhi, Hyderabad, Ludhiana, Coimbatore, Arabhavi and Almora). No new disease appeared and intensity of other diseases was low to severe. Yield loss trials were conducted by Dhaulakuan (MLB), Almora (TLB), Delhi (BLSB), Pantnagar (BLSB), Hyderabad (charcoal rot) and Ludhiana (charcoal rot). To know the disease status during the crop season, disease surveys were conducted at farmers fields in Himachal Pradesh (Zone I), Karnataka (Zone IV), Udaipur (Zone V) and Uttarakhand (Zone I). As a follow up of QRT recommendations, studies on molecular diversity among the isolates of *Peronosclerospora sorghi;* and nematode management and their interaction with PFSR, termite and stem borer were undertaken by Mandya and Udaipur centres respectively.

The chairperson appreciated the achievements made by scientists of representative centres. There was no representation from newly joined ICAR

voluntary centre *viz.*; Barapani. Project Director also participated in the meeting and advised the Group to give a new direction to Maize Pathology Program. He put forward the idea of developing sick plot of soil borne diseases at every hot spot location for rigorous screening of material against different diseases. The scientists of the centres have expressed the financial constraint of doing extensive survey of maize growing areas of the state. He has agreed to provide a contingency of Rs. 15000/- for meeting the POL expenses for conducting disease survey and surveillance.

Based on the critical review, the following observations emerged out of hectic discussion during the group meeting. The group also discussed and formulated the Technical Programme for *kharif 2014*/*rabi* 2014-15.

A. Technical observations

1. A total of 42 genotypes out of 198 tested in IVT trial were resistant to 2 or more than 2 diseases.
2. A total of 35 genotypes out of 92 tested in AVT I and AVT II trials were resistant to 2 or more than two diseases.
3. Eight genotypes of specialty corn *viz*; EHQ-64, JH (QPM)3, HQPM 1, Bajaura Sweet Corn, Bisco Madhu, WOSC, CMH 11-658, Vivek Hybrid -27 out of 31 tested were having multiple disease resistance. Three hybrids *viz*; EHQ-64, HQPM 5 and CMH 11-659 were also having moderate resistance to cyst nematode also.
4. Out of 321 total hybrid tested, 15 hybrids *viz.* IM8539, BH 41036, JH 12003, SAFAL X-2, CMH 10-488, BH 41150, JH 31600(JH 31627), KNMH-4010131, FH-3669, CMH 11-629, S 6668, CP 333, EH-1974, CMH 10-531and K-75 were moderately resistant to cyst nematode (*Heteroderazeae).*
5. A total of 64 inbred lines out of 481 evaluated exhibited multiple disease resistance (MDR) which can be utilized as potential donors for multiple resistance in maize hybrids.
6. Performance of the previous years' resistant inbred lines should be evaluated to know the stability of resistance.
7. Pathogen(s) of every disease should clearly be spelt out **(Action: Coimbatore**)
8. In case of complex disease like PFSR (FSR, CR and late wilt), score of each individual disease be mentioned. There is no need to take average of individual scores to decide the reaction of complex disease. Disease reaction of complex disease should only be based upon reaction of individual disease (**Action: DMR, Ludhiana, Hyderabad, Udaipur**).
9. Every center including Midnapur (voluntary centre) should compulsorily carry out survey and surveillance of maize diseases (both major and minor diseases including viral ones) during the season and should present the data in workshop. During survey and surveillance the disease scoring should be done along with the incidence of disease. A contingent amount of maximum Rs. 15000/- would be reimbursed by DMR against POL expenditure incurred on this activity (**Action: All Centres**).

10. All pathologists should invariably include susceptible check (s) in all disease screening trials (hybrids/ lines) at every 10throw and mention its name with range of disease score (**Action: All Centres).**

11. Group discussed whether disease screening of breeding material against soil borne diseases (PFSRs, BLSB, BSR, BSDM, cyst nematode) should be done under artificially inoculated epiphytotics or sick plot created epiphytotics. There was consensus over the fact that sick plot screening is best and most accepted method of disease screening because of its natural diseased simulated condition and unbiased to both host and pathogen. In tooth pick inoculation of PFSR pathogens, the pathogens are being extra facilitated and the very first line of host defense is broken due to puncturing with jabber. Moreover, wounding provides avenues for attack of borers and secondary invaders, thus making the host vulnerable to other biotic stress like insect pests. Sick plot screening gives natural opportunity to both host and pathogen for survival. Similarly, in case of BLSB, primary inoculum (sclerotia or diseased plant parts) cannot jump to 2nd or 3rd sheath from soil level where inoculum is inserted in leaf sheath for creating artificial disease pressure. Therefore, group recommended the initiation of sick plot development at all hot spot locations of soil borne diseases with immediate effect from this very *Kharif* 2014 season for screening against soil borne diseases (PFSRs, BLSB, BSDM, BSR, cyst nematode). This can be developed by fixing the plot with monocropping of maize throughout the year and simultaneously amending the plot with lab multiplied inoculum of pathogen. Adding of lab multiplied inoculum should be continued till susceptible lines express a susceptible reaction [>4.5 score on 1-5 rating scale in case of BLSB, BSDM; >8.0 on 1-9 rating scale in case of PFSR; >50.0% disease incidence in case of BSR; >9 cyst/plant in maize cyst disease). In this regard, Project Director was requested to enforce the workshop decision at all the relevant centres [(**Action: Medinapur (BLSB); Pantnagar (BLSB, BSR); Delhi (BLSB); Dhaulakuan (BLSB, BSR); Udaipur (BLSB, FSR); Hyderabad (charcoal rot), Ludhiana (charcoal rot)].**

12. There should be separate nursery area for SDM inoculum maintenance (**Action: Coimbatore**)

13. Chairman felt that in addition to studies on host plant resistance, studies on management of diseases (consisting of individual components viz.; botanicals, bioagents and newer chemicals) should also be initiated from this *kharif* 2014 so as to develop IDM in maize during ensuing years. This will provide other options of managing maize diseases in otherwise high yielding corn hybrids. (**Action: Almora, Karnal, Ludhiana, Delhi, Dhaulakuan, Bubhaneshwar, Bajaura, Godhra, Pantnagar, Arbhavi, Hyderabad, Udaipur, Coimbatore, Mandya)**

B. Other observations:

1. Centres should conduct all the allotted trials and report the data as per technical program. (**Action: All Centres)**

2. Registration of resistant lines on 3 years of testing should be taken up by the breeder/ developer of the line of concerned centre. List is already sent by PI (Pathology) for follow up action. The progress would be reviewed in next Annual Maize Workshop 2015. **(Action: concerned Centres)**
3. To ensure availability of sufficient seeds of check varieties for conducting trials, multiplication of check variety may be taken up in association with breeder.
4. The identified resistant inbreds should be maintained and provided to breeder for their utilization in resistant breeding. The report on their utilization would be reviewed in next Annual Maize Workshop 2015.
5. Newly joined scientists need exposure training in disease screening techniques. The desiring scientists would contact pathologists of desired centre for taking hands-on experience in these techniques during *kharif* 2014 (**Action: Midnapure, Coimbatore, Bhubeneshwar, Karnal centres**)
6. Guidelines for uniform method of scoring the disease intensity (Annexure I) should be followed. (**Action: All centres**)
7. Presentations should be in the uniform format as provided by PI (Pathology) so that quick compilations and conclusions can be drawn. (**Action: All centres**)
8. Keep vigilant about incidence of viral disease(s) and report immediately to Dr. G.P. Rao (Cell. No. 9839293383/ 9711763384), Principal Scientist (Maize Virology), Division of Plant Pathology, IARI, New Delhi 12 (**Action: All Centres**).
9. Data of concluded AICRP (Maize Pathology) experiments should be jointly published with prior permission of Project Director, DMR in prescribed proforma developed by DMR. (**Actions: Pantnagar, Udaipur, Hyderabad, Delhi)**
10. A contingency of Rs. 20,000/- per experiment for Midnapur centre, a voluntary centre under Government of West Bengal should be given at par with those of SAUs. (**Action: DMR**)
11. Activities like symposia, seminar, training, awards, recognitions, any new disease record should be sent with photographs to Project Director for publication in DMR News Letter.
12. Owing to hike in wages and prices of consumables, there is need to enhance contingency of centres.
13. All the centres/co-operators will send one copy of the data of all disciplines in soft as well as in hard copy in prescribed format to PI latest by **15th December 2014 positively**. It may please be noted that data received after this date will not be included in the compilation of Annual Progress Report of AICRP on Maize.

Technical programme for 2014-15

Maize pathological trials to be conducted at various coordinating/cooperating centres during *Kharif* 2014 and *Rabi* 2014-15

A. *Kharif* 2014

MPT 1 – 9: Disease screening of IVT, AVT and specialty corn hybrids of all maturity groups (Tr no. 61-64; 75-78; Specialty Corn): Evaluation of maize hybrids of the coordinated trials (IVT, AVT I, AVT II and specialty corn) consisting of four maturity groups against major diseases will be done under artificially/ sick plot created epiphyotics at following hot spot locations.

Hot spot locations:

i. **Maydis leaf blight (MLB)**: Dholi, Karnal, Ludhiana, Delhi; Susceptible check (SC): CML 186, CM 600, CM 119, Local check
ii. **Turcicum leaf blight (TLB)**: Bajaura, Almora, Mandya, Arbhavi, Barapani; SC: Dhari, 219J, CM 202, Local check
iii. **Banded leaf and sheath blight (BLSB)**: Midnapur, Pantnagar, Dhaulakuan, Delhi, Bhubaneswar, Udaipur, Karnal; SC: CM 600, CM 501, Hishell, Local check
iv. **Sorghum downy mildew (SDM)**: Mandya, Coimbatore; SC: CM 500, Local check
v. **Rajasthan downy mildew (RDM)**: Udaipur; SC: Surya
vi. **Curvularia leaf spot (CLS)**: Udaipur, SC: Surya
vii. **Bacterial stalk rot (BSR)**: Pantnagar, Dhaulakuan; SC: CM 600, DAC 7074, Local check
viii. **Fusarium stalk rot (FSR):** Udaipur; SC: Surya, CM 500
ix. **Charcoal rot (CR):** Ludhiana, Hyderabad, Arabhavi (*rabi*); SC: CM 600, 30V92, HQPM-1, CM 501, Hishell
x. **Common rust:** Arbhavi; SC: Local check
xi. **Polysora rust:** Mandya; SC: Local check, CM 202, 219 J

Observations:

- Follow uniform method of disease screening under sick plot/ artificially created epiphytotics. If need be use Mckinney (1923) formula for calculating Percent Disease Index (PDI) [PDI = (Sum of individual ratings)/ (No. of leaves examined) ×100/ (Maximum disease rating)] mentioned in Annexure I.
- Mean score of foliar diseases should be recorded by making average of scores of each plant in a row.
- Use susceptible and resistant checks at every 10^{th} row.
- Meteorological data of the centers during crop growth period should be provided along with the disease reaction data.
- Pathogen(s) of every disease should clearly be spelt out.
- In case of complex disease like PFSR (FSR, CR and late wilt), score of each individual disease be mentioned.

MPT 10: Screening of maize hybrids against cyst nematode (*Heterodera zeae*)

All the hybrids of IVT, AVT I, AVT II and Specialty corn will be screened against cyst nematode under sick plot condition.

Hot spot: Udaipur; SC: Local check

MPT 11: Disease screening of station maize hybrids against major diseases

Hot spots: Dhaulakuan, Mandya, Ludhiana and Bajaura

MPT 12: Screening of inbred lines against major diseases of maize

All the inbred lines of normal and QPM will be screened at following hot spot locations.

i. **Maydis leaf blight (MLB):** Dholi, Karnal, Ludhiana, Delhi; SC: CML 186, CM 600
ii. **Turcicum leaf blight (TLB)**: Bajaura, Almora, Mandya, Arbhavi; SC: Dhari, 219J
iii. **Fusarium stalk rot (FSR):** Udaipur; SC: Surya
iv. **Charcoal rot (CR):** Delhi (DMR), Ludhiana, Hyderabad; SC: CM 600, 30 V92,CM 501, Hishell
v. **Banded leaf and sheath blight (BLSB):** Midnapur, Bhubneshwar, Pantnagar, Dhaulakuan, Delhi
vi. **Sorghum downy mildew (SDM):** Mandya, Coimbatore; SC: CM 500, Local
vii. **Rajasthan downy mildew (RDM):** Udaipur; SC: Surya
viii. **Brown stripe downy mildew (BSDM):** Dhaulakuan; Local check
ix. **Bacterial stalk rot (BSR)**: Pantnagar, Dhaulakuan; SC: DAC 7074, Local check
x. **Curvularia leaf spot (CLS):** Udaipur, Dhaulakuan; SC: Surya; Local check
xi. **Common rust:** Arbhavi; SC: Local check
xii. **Polysora rust:** Mandya; SC: Local check

Observations: As mentioned under screening trials of hybrids.

MPT 13: Assessment of avoidable yield losses due to major diseases of maize

Trials on yield losses due to major diseases of maize will be conducted at following locations using paired plot technique with nine replications under sick plot/ artificially created epiphytotics.

Centres: Dhaulakuan, Almora and Ludhiana

MPT 14: Trap nursery trial for disease incidence

Trap nursery trial will be conducted to find out the occurrence of any new disease on a set of maize inbred lines (10-12 lines) susceptible to diseases at various locations. A special care has to be taken in observing the incidence of viral diseases, if any.

Centers: Dholi, Karnal, Mandya, Udaipur, Pantnagar, Delhi, Hyderabad, Ludhiana, Coimbatore, Arabhavi, Bajaura, Barapani, Bhubaneshwar, Dhaulakaun and Almora

Observations:

- For soil borne diseases (PFSRs, BLSB, BSDM, SDM, RDM, cyst nematode), exact value of percent incidence should be mentioned. Additionally, percent incidence should also be reflected in terms of mean disease score of foliar diseases and percent disease index (PDI) as mentioned in Annexure I.

- For foliar diseases (MLB, TLB, CLS, rusts and viral diseases), scoring should be made in standard rating scale (Annexure I).
- Pathogen(s) of every disease should clearly be spelt out.

MPT 15: Survey and surveillance of maize diseases

During survey & surveillance of diseases, scoring should be done along with the incidence of disease in prescribed proforma.

Centres: All centers

Note:

- Survey should be undertaken in association with other scientists wherever possible.
- Mean disease score and procedure given for calculating PDI should strictly be followed.
- Date of the appearance of disease and period of its rapid spread should be mentioned.
- Previous crops to be recorded before maize cropping.
- Probable yield loss due to disease in the affected location should also be mentioned based on survey and monitoring.
- Pathogen of every disease should clearly be spelt out. Name and abbreviated form of diseases as given in Annexure I should uniformly be followed.
- Plant protection measures used by farmers to be recorded.
- In case of viral diseases, vector population around the field and weather factors to be recorded.

MPT 16: Performance of the previous years' resistant inbred lines

S.N	Centre	Disease(s)
1.	Almora	TLB
2.	Arbhavi	TLB, CR
3.	Bajaura	TLB
4.	Bhubneshwar	BLSB
5.	Coimbatore	SDM
6.	Delhi	MLB,BLSB
7.	DMR	CR
8.	Dhaulakuan	MLB, BLSB, BSDM, BSR
9.	Dholi	MLB, TLB
10.	Hyderabad	CR
11.	Karnal	MLB, BLSB, C.rust
12.	Ludhiana	MLB, CR
13.	Mandya	TLB, SDM, P.rust
14.	Midnapur	BLSB
15.	Pantnagar	BLSB, BSDM, BSR
16.	Udaipur	RDM, CLS, FSR

MPT 17: Development of integrated management module for major diseases of maize

Objective: Identification of promising components for management of fungal and bacterial diseases:

<u>Experiment 1</u>: Efficacy of fungicides on incidence of maydis leaf blight under field condition

Centre: Karnal

Treatments:

1. Propiconazole @ 0.1 %
2. Hexaconazole @ 0.1%
3. Carbendazim @ 0.1%
4. Mancozeb @ 0.2%
5. Carbendazim 12 WP + Mancozeb 63 WP @ 0.3%
6. Untreated check (water spray)

<u>Experiment 2</u>: Efficacy of botanicals/bioagents on incidence of maydis leaf blight under field condition

Centre: Karnal

Treatments:

1. Azadirachtin 3000ppm @ 0.3%
2. *R. serpentine* leaves (Sarpgandaha) @10%
3. *A. marmelos* leaves (Bel Pathar) @25 %
4. *TH-3* @ 0.5% as seed treatment, bioagent-fortified FYM (1:50) and spray @ 0.5%
5. *TV-3* @ 0.5% as seed treatment, bioagent-fortified FYM (1:50) and spray@ 0.5%
6. Untreated check (water sprays)

<u>Experiment 3</u>: Efficacy of newer fungicides on incidence of banded leaf and sheath blight

Centres: Almora, Karnal, Ludhiana, Delhi, Dhaulakuan, Bubhaneshwar, Bajaura, Godhra, Pantnagar

Treatments:

1. Difenconazole @ 0.1 %
2. Hexaconazole @ 0.1%
3. Carbendazim @ 0.1%
4. Validamycin @ 0.1%
5. Tebuconazole @ 0.05%
6. Trifloxystrobin 25% + Tebuconazole 50% @ 0.05%
7. Azoxystrobin @ 0.05%
8. Pencycuron @ 0.1%
9. Untreated check (water spray)

<u>Experiment 4</u>: Efficacy of newer fungicides on incidence of common rust under field condition

Centres: Karnal, Arbhavi

Treatments:

1. Difenconazole @ 0.1 %

2. Hexaconazole @ 0.1%
3. Tebuconazole @ 0.05%
4. Propiconazole @ 0.1%
5. Trifloxystrobin 25% + Tebuconazole 50% @ 0.05%
6. Azoxystrobin @ 0.05%
7. Untreated check (water spray)

<u>Experiment 5</u>: Management of PFSR with bioagents, fungicide and potash

Centres: Hyderabad (charcoal rot), Ludhiana (charcoal rot), Arbhavi (charcoal rot), Udaipur (fusarium stalk rot)

Treatments:

1. *TH -3* @ 0.5% as seed treatment, bioagent-fortified FYM (1:50) and spray@ 0.5%
2. *Pseudomonas fluorescens @ 0.5%* as seed treatment, bioagent-fortified FYM (1:50) and spray@ 0.5%
3. Local strains of fungal antagonists @ 0.5% as seed treatment, bioagent-fortified FYM (1:50) and spray@ 0.5%
4. Spraying of muriate of potash @ 1-2% at 30 days after planting
5. Propiconazole @ 0.1% spray at 40 DAS
6. Double dose of muriate of potash at 45 DAS
7. Untreated check (water spray)

Note: Incubate bioagent fortified FYM under moist condition at least for 10 days before sowing and apply at recommended rate.

<u>Experiment 6</u>: Management of downy mildews (SDM and RDM) with bioagents and fungicides

Centres: Coimbatore (SDM), Mandya (SDM), Udaipur (RDM)

Treatments:

1. *Bacillus amyloliquefaciens* @10g/kg as seed treatment, bioagent-fortified FYM (1:50) and spray @ 1.0%
2. *TH-3* @ 0.5% as seed treatment, bioagent-fortified FYM (1:50) and spray @ 0.5%
3. *TV-3 (Trichoderma viride)* @ 0.5% as seed treatment, bioagent-fortified FYM (1:50) and spray @ 0.5%
4. Fosetyl-al @ 0.2% seed treatment and spray @ 0.2%
5. Azoxystrobin @ 0.2% seed treatment and spray @ 0.15%
6. Metalaxyl+mancozeb @ 0.25% seed treatment and spray @ 0.25%
7. Metalaxyl @ 0.25% seed treatment and spray @ 0.25%

8. Untreated check (water spray)

Note: Incubate bioagent fortified FYM under moist condition at least for 10 days before sowing and apply at recommended rate.

Experiment 7: Identification of nematode management components against maize cyst nematode (*Heterodera zeae)* on maize.

Centre: Udaipur

Treatments:

1. Soil amendment with Neem leaves powder @ 1 q/ha as row application
2. Soil amendment with Neem leaves powder @ 2 q/ha as row application
3. Soil amendment with Aak leaves powder @ 1 q/ha as row application
4. Soil amendment with Aak leaves powder @ 2 q/ha as row application
5. Soil amendment with Lantana leaves powder @ 1 q/ha as row application
6. Soil amendment with Lantana leaves powder @ 2 q/ha as row application
7. Soil amendment with Neem cake @ 2 q/ha as row application
8. Untreated check

Observations:

- Initial nematode population / 100 cc soil
- Cyst / 5 g root
- Cyst/100 cc soil
- Final nematode population/100 cc soil
- Yield/plot

MPT 18: Molecular diversity among the isolates of *Peronosclerospora sorghi* causing SDM in maize

The study will continue as per technical program of last year.

MPT 19: Interaction of nematodes with disease, termite and insect

Centre: Udaipur

Experiment 1: Interaction of maize cyst nematode (*Heteodera zeae) with* PFSR pathogen (*Fusarium verticilloides)* and stem borer (*Chilo partellus)* on maize

Treatments:

1. Nematode + PFSR fungi
2. Nematode + Stem borer

3. Nematode + PFSR fungi + Stem borer
4. Nematode alone

Observations:

- Initial nematode population / 100 cc soil
- Cyst / 5 g root
- Cyst/100 cc soil
- Final nematode population/100 cc soil
- Leaf injury of *Chilo*
- Disease Rating Scale of PFSR

Experiment 2: Studies on interaction of maize cyst nematode (*Heteodera zeae)* with termite on maize in infested field.

Treatments:

1. Nematode + Termite
2. Nematode alone

Observations:

- Initial nematode population / 100 cc soil
- Cyst/100 cc soil
- Final nematode population/100 cc soil

B. *Rabi* 2014-15

MPT 1: Disease screening of hybrids against diseases of *rabi* maize

Evaluation of maize hybrids of the coordinated trials of *rabi* maize against major diseases will be done under artificially/ sick plot created epiphyotics at following hot spot locations.

Hot spot locations:

i. **Turcicum leaf blight (TLB)**: Mandya, Dholi; SC: Dhari, 219J, CM 202, Local check

ii. **Charcoal rot (CR):** Arabhavi, Hyderabad, Ludhiana; SC: CM 600, 30V92, HQPM-1, CM 501, Hishell

iii. **Common rust:** Karnal; SC: Local check

iv. **Sorghum downy mildew (SDM)**: Mandya; SC: CM 500, Local check

MPT 2: Disease screening of inbred lines against diseases of *rabi* maize

i. **Turcicum leaf blight (TLB)**: Mandya, Dholi (*rabi*); SC: Dhari, 219J, CM 202, Local check

ii. **Charcoal rot (CR):** Arabhavi, Hyderabad, Ludhiana; SC: CM 600, 30V92, HQPM-1, CM 501, Hishell

i. **Sorghum downy mildew (SDM)**: Mandya; SC: CM 500, Local check

The following scientists attended the meeting:

1. Dr. O.P. Yadav, Director, DMR, New Delhi
2. Prof. Anila Doshi, HOD, Dept. of Plant Pathology, MPUAT, Udaipur

3. Prof A.U. Siddiqui, HOD, Dept. of Nematology, MPUAT, Udaipur
4. Dr. Robin Gogoi, Pr. Scientist (Plant Pathology), IARI, N. Delhi
5. Dr. K.T. Pandurangegowda, Dean, COA, UAS, Mandya, KN
6. Dr. T.A. Sreerama Shetty, Maize Pathologist, , Mandya, KN
7. Dr. V.R. Kulkarni, Asstt. Maize Pathologist, ARS, Arabhavi, KN
8. Dr. Vinod Kumar, Maize Pathologist, CCS HAU, RRS, Karnal, HRY
9. Dr. Rakesh Devlash, Maize Pathologist, HAREC, HPKVV, Bajaura, HP
10. Dr. Ashwani Kumar, Maize Pathologist, HPKVV, Dhaulakuan, HP
11. Dr. B.L. Baheti, Maize Nematologist, MPUAT, Udaipur, Raj.
12. Dr. S.S. Sharma, Maize Pathologist, MPUAT, Udaipur, Raj.
13. Dr. R. Ranga Reddy, Pr. Scientist, MRC, ARI, ANGRAU, Hyderabad
14. Dr. Harleen Kaur, Asstt. Plant Pathologist, PAU, Ludhiana, Punjab
15. Dr. N. Mallkarjuna, Maize Pathologist, ZARS, V.C. Farm, Mandya, KN
16. Dr. P. Renukadevi, Asstt. Professor (Pl. Path.), TNAU, Coimbatore, TN
17. Dr. K.S. Hooda, Pr. Scientist, DMR, New Delhi
18. Ms. P. Behera, Jr. Scientist, OUAT, Odisha
19. Dr. Sudha Nair, Scientist, CIMMYT, Hyderabad, AP
20. Dr. C.K. Bhunia, O/o Economic Botanist III, Pashim Medinapur, W.B.
21. Dr. Ram Swarup Chaudhary, Asstt. Professor, MPUAT, Udaipur
22. Dr. (Ms.) Roshan Chaudhary, Asstt. Professor, MPUAT, Udaipur

Annexure I

Guidelines for Uniform Method of Disease Assessment in Maize Under Artificially/ Sick Plot Created Epiphytotics

The screening techniques and rating of the disease intensities for uniform assessment of maize diseases are given below:

1. Turcicum leaf blight (TLB) and maydis leaf blight (MLB)

Sorghum grains soaked in water in a conical flask, autoclaved twice, seeded with fungus under aseptic condition are kept for incubation at 25-27^{0}C. The flasks are shaken once in 2-3 days to facilitate uniform growth on grains. After 10 days the material is ready for inoculation. Prepare a fine powder of impregnated sorghum grains after shade drying. Put a pinch of this powder in the leaf whorl of 30-35 days old plant. Maintain adequate moisture for longer period to permit spore germination with the help of sprayer. Disease can also be created by spraying the spore suspension prepared from the pure culture of fungi or placing a pinch of leaf meal (prepared by grinding dried diseased leaves collected from the previous season) into whorl of each plant at 30-35 centimeter plant height with spray of 10-12 ml of water in whorl in case of dry weather. Second inoculation can be followed if the symptoms do not appear even after a week of first inoculation. Data can be recorded on 30-35 days after inoculation following rating scale of Payak and Sharma[#] (1983) mentioned below:

Rating scale	Disease severity (%)	PDI*	Disease reaction
1.0	Very slight to slight infection, one or two to few scattered lesions on lower leaves	20.0	Resistant (Score: ≤ 2.0) (PDI: ≤ 40.0)
2.0	Light infection, moderate number of lesions on lower leaves only	40.0	
3.0	Moderate infection, abundant lesions on lower leaves, few on middle leaves	60.0	Moderately resistant (Score: 2.1 – 3.0) (PDI: 40.1 – 60.0)
4.0	Heavy infections abundant on lower and middle leaves, extending to upper leaves	80.0	Moderately susceptible (Score: 3.1 – 4.0) (PDI: 60.1 – 80.0)
5.0	Very heavy infection, lesions abundant on almost all leaves plants prematurely dry or killed by the disease.	100.0	Susceptible (Score: ≥4.1) (PDI: ≥ 80.0)

*Percent disease index (PDI)

2. Banded leaf and sheath blight (BLSB)

Soak barley grains in water for 24 hours and dispense 40g in 250 ml Erlenmeyer flask after removing excess water; autoclave at a pressure of

1.05 kg/sq. cm for 30 minutes. Homogenize 2-3 days old growth of pathogen taken from potato dextrose agar in sterile water and seed 5 ml in each flask. Incubate at 27°C for 10 days. Inoculations should be made during the rainy season on 30-45 days old plants with grain culture (2-4 grains) inserted between stalk and sheath at second or third level from soil. Grains placed at junction of sheath and leaf can also create optimum disease level and do not fall away with strong wind or heavy rain. Disease is recorded 45 days after inoculation on basis of following rating scale of Payak and Sharma[#](1983).

Rating scale	Disease severity (%)	PDI*	Disease reaction
1.0	Disease on one leaf sheath only; few small, non-coalescent lesions present	20.0	Resistant (Score: ≤ 2.0) (PDI ≤ 40.0)
1.5	Disease on two sheaths: lesions large and coalescent	30.0	
2.0	Disease up to four sheaths; lesions many and always coalescent	40.0	
2.5	As in disease rating symptoms of 2.0 + rind discolored with small lesions	50.0	Moderately resistant (Score: 2.1 - 3.0) (PDI 40.1 - 60.0)
3.0	Disease on all sheaths except two internodes below the ear	60.0	
3.5	Disease up to one internode below ear shoot; rind discoloration on many internodes with large depressed lesions	70.0	Moderately susceptible (Score: 3.1 - 4.0) (PDI 60.1 - 80.0)
4.0	Disease up to the internode bearing the ear shoot but shank not affected	80.0	
4.5	Disease on the ear; husk leaves show bleaching, bands and caking among themselves as also silk fibres; abundant fungal growth between and on kernels; kernel formation normal except being lusterless; ear size less than normal; some plants prematurely dead	90.0	Susceptible (Score: ≥ 4.0) (≥ 80.0)
5.0	In addition to disease rating symptoms of 4.5, shrinkage of stalk; reduced ear dimensions, wet rot and disorganization of ear; kernel formation absent or	100.0	

	rudimentary; prematurely dead plants common; abundant sclerotial production on husk leaves, kernels, ear tips and stalk fibres		

*Percent disease index (PDI)

3. Brown stripe downy mildew (BSDM)

Artificial epiphytotic conditions can be created by placing the powdered infected maize leaves containing spores collected during the last season containing oospores in furrows just before planting. This inoculum could also be prepared by collecting infected leaves supposed to be full of oospores from early plantings of maize of the same season, drying leaves and making powder out of the debris. Inoculum should be placed in furrows in such a manner that seeds were in proximity of inoculum.

Artificial epiphytotic condition could also be created by putting 2-3 cm pieces of freshly infected leaves containing sporangia of the fungus in the whorls of seedlings. This should be done during cloudy weather in the evening between 5 and 7 P.M. at 17, 24 and 30 days after planting. In experimental plots, where disease occurs year after year, only this method is adequate for creating epidemics. In areas of low disease incidence, both the methods of inoculation can be combined to obtain better results. Disease rating of individual maize varieties can be done by evaluation all plants of the row (s) using 1-5 rating scale of Payak and Sharma[#] (1983) as described below:

Rating scale	Disease severity (%)	PDI*	Disease reaction
1.0	Very slight infection, one or two to few scattered lesions on lower leaves	20.0	Resistant (Score: ≤ 2.0) (PDI: ≤ 40.0)
2.0	Light infection, a few scattered to moderate number of stripes on lower leaves	40.0	
3.0	Moderate infection, abundant stripes on lower leaves and few on middle leaves	60.0	Moderately resistant (Score: 2.1 - 3.0) (PDI: 40.1 - 60 .0)
4.0	Heavy infection, stripes abundant on lower and middle leaves extending to upper leaves	80.0	Moderately susceptible (Score: 3.1 - 4.0) (PDI: 60.1 - 80 .0)
5.0	Very heavy infection, stripes abundant on all leaves. No cob formation. Plants may be killed prematurely.	100.0	Susceptible (Score: ≥ 4.0) (PDI: ≥ 80 .0)

*Percent disease index (PDI)

4. Curvularia leaf spot (CLS)

Mass multiplication of culture is done on half cooked sorghum grains and after evaporating excess moisture from surface, the grains are filled in 500 ml conical

flasks and plugged properly. These are autoclaved for two hours at 15 lbs pressure and inoculated when cooled down at room temperature with pure culture of *Curvularialunata*. After completion of mycelial growth which may take 15-20 days at temperature around 25-27 degree C, these grains are washed in RO water to get conidial suspension of $5X10^4$ conidia per ml. A bucket full of suspension is enough for spray inoculation of two 480 meter strip. The washed grains are spread in a tray to get again mass of conidia. After two days gap, one more spray inoculation is done as per previous method, but this time conidial suspension should be half of the previous one.

At least three observations are made and third observation at 80-85 DAS would be final based on leaf area covered by spots caused by pathogen. Observations are recorded using 1-5 rating scale as described below:

Rating scale	**Disease severity (%)**	**Disease reaction**
1.0	1-20 % area of leaf infected	Resistant (Score: ≤ 2.0) (Severity: ≤ 40.0)
2.0	21-40 % area of leaf infected	
3.0	41-60 % area of leaf infected	Moderately resistant (Score: 2.1 - 3.0) (Severity: 40.1 - 60 .0)
4.0	61-80 % area of leaf infected	Moderately susceptible (Score: 3.1 - 4.0) (Severity: 60.1 - 80 .0)
5.0	81-100 % area of leaf infected	Susceptible (Score: ≥ 4.0) (Severity: ≥ 80 .0)

5. Common rust (C. rust) and Polysora rust (P. rust)

The rust is an obligate parasite and thus, it is very difficult to grow it on artificial media under laboratory condition. Though, for some specific purposes small amount of inoculum can be grown under laboratory condition on detached leaf culture. But, this meager amount of culture obtained by such method is not sufficient to be utilized for large scale screening trials under field conditions. Therefore, naturally infected leaves showing large number of uredopustules may be collected from different places so that all the prevalent races in the areas may be utilized for screening the materials against the prevalent rust fungus.

The infected leaves thus collected should be macerated thoroughly in between two palms of the hands dipped under a bucket of water until the water gets sufficiently coloured. The uredospores can also be collected on a butter paper by tapping the severely infected leaves with fingers and then stored in glass vial or glass tube which can be sealed easily under a flame. The uredospores, thus obtained may be kept for longer period in the freezer at lower temperature i.e. 5-7°C and can also be easily carried to some distant places for inoculation purposes.

For inoculating the plants in a field use of a knapsack sprayer is very useful. The spore suspension should be sprayed over the plants during the second half of the day when the sun becomes mild. While spraying inoculum, the nozzle of the sprayer should be kept over whorl of the plant and all the leaves may be

sprayed thoroughly. The spore suspension must be stirred continuously during spraying as the light spores aggregate together on the upper surface of the water.

Repeating the inoculation two to three times gives a good result. In addition 2-4 lines of susceptible varieties grown as border rows around the screening plots also help to spread the disease. Disease rating is done as per scale devised by Payak and Sharma[#] (1983).

Rating scale	Disease severity (%)	PDI*	Disease reaction
1.0	Very slight to slight infection, one or two to few scattered pustules on lower leaves only.	20.0	Resistant (Score: ≤ 1.0) (PDI: ≤ 20.0)
2.0	Moderate number of pustules on lower leaves only (light infection)	40.0	Moderately resistant (Score: 1.1 - 2.0) (PDI: 20.1 - 40.0)
3.0	Abundant pustules on lower leaves; few on middle leaves (moderate infection)	60.0	Moderately susceptible (Score: 2.1 - 3.0) (PDI: 40.1 - 60.0)
4.0	Abundant pustules on lower and middle leaves; extending to upper leaves (heavy infection)	80.0	Susceptible (Score: 3.1 - 4.0) (PDI: 60.1 - 80.0)
5.0	Abundant pustules on all leaves, plant may dry prematurely or killed by the disease (very heavy infection)	100.0	Highly susceptible (Score: ≥ 4.0) (PDI: ≥ 80.0)

*Percent disease index (PDI)

6. Sorghum downy mildew (SDM)

- Screening through direct inoculation with conidia:

    - *Collection and maintenance of inoculum*: Sorghum plants showing systemic infection of downy mildew from the farmer's fields in and are collected during morning hours, preserved in polythene bags and brought to the laboratory. Conidiophores and conidia from the white bloom found on the lower surface of the leaves are washed with a fine jet of distilled water and conidial suspension is collected from the sorghum leaves. The seedlings of susceptible cultivar are spray inoculated at 2 leaf stage (6-7 days old) with the conidial suspension collected from the sorghum leaves. The inoculation of the seedlings is continued till the plants reached 15 days and systemic symptoms are seen. The inoculum from these plants is multiplied by spray inoculating to the fortnightly sowings of maize. The infected plants are maintained in the plot throughout the experimental period. Artificial inoculation technique developed by Lal and Singh (1984) is followed to induce the disease incidence by spraying conidial suspension between 2.30 a.m. and 4.00 a.m.

- *Evaluation of maize genotypes under artificial inoculation:* Maize genotypes are evaluated against sorghum downy mildew by artificial inoculation. Artificial inoculation is done when the plants are at two leaves stage as described by Lal and Singh (1984). Diseased plants from which inoculum required to be drawn is sprayed with water at 6.00 PM so that leaves would have a thin film of water for good sporulation. By 2.00 AM, the inoculation crew assembles in the field with cleaned sprayers, torches and buckets. By 2.30 AM the diseased leaves with good sporulation are searched and washed in the water at the rate of 15 leaves per litre of water collected in the buckets. This operation is completed by 3.00 AM. Then the collected spore suspension in different buckets is thoroughly mixed and made upto 25 litres. The 25 litres of conidial inoculum is collected from 375 diseased leaves. The inoculation is completed by 4.00 AM with hand compression sprayer. Between 6.00 AM and at 6.00 PM water spray is given to the inoculated plot to create the required humidity artificially. With this method 100 percent disease incidence was created.

- *Spreader row technique*: Spreader rows are sown 15-20 days prior to the sowing of the entries in 2.5 meter bands with a row spacing of 60 cm and plant to plant spacing of 30 cm. each band consisting of four rows surrounding on all the four directions. For this, highly susceptible variety will be used. Inoculation of these spreader rows is done by following the above artificial inoculation procedure. Test entries were sown as mentioned above.

  Per cent disease incidence is recorded 35 days after sowing and the entries are classified according to their disease reaction as described by Lal and Singh (1984).

Disease incidence (%)	**Disease reaction**
≤ 10	Resistant
10.1 – 25.0	Moderately resistant
25.1 – 50.0	Moderately susceptible
≥ 50.0	Susceptible

7. Rajasthan Downy Mildew (RDM)

Downy mildew nurseryis required for artificial inoculation purposes. Susceptible maize cultivar is grown in cage house and the plants are inoculated at seedling stage by placing bits of downy mildew infected grasses *Heteropogoncontortus* and *H. melanocarpus.* Humidity around 90% is maintained in the cage house. Chlorotic symptoms along with light green color extends up to upper green portion are typical symptoms. During midnight hours a layer of conidia can be seen. These plants serve as source of inoculum for artificial inoculation.

Since the pathogenis of nocturnal nature and produces conidia during 12:00 to 6 AM, hence the freshly harvested conidia are collected in distilled water or RO water. Before collecting conidia the leaves can be washed before an hour so as to get fresh viable conidia. For screening the test entries, susceptible entries should be planted before 15 days and should be inoculated first. Since this

pathogen does not form oospores on maize, hence sick plot technique does not work. The conidial suspension of harvested conidia is filled in dropping bottle to put drops of inoculum at seedling stage (6-7 days old) in the whorl (a cup like structure of upper leaf) during 3-5 AM. This should be done for 4-5 days regularly to avoid any escape. After 15-20 days symptoms become visible.

The observation is recorded as percent infected plants in a row out of total plants. At least three observations are taken at 30, 50 and 80 DAS. The last observation is considered as final, but number of plants is considered as of first observation. This is because some plants die and disappear due to infection. The entries are classified according to their disease reaction as described by Lal and Singh (1984) for SDM.

8. Post flowering stalk rots (Charcoal rot, Fusarium stalk rot and Late wilt)

Screening for resistance against these diseases can is easily be donein sick plots. However, artificial inoculation is necessary where such plots are not available. For this purpose the fungal material should be isolated from the infected stalks, cultured and multiplied in the laboratory as described below.

Small bits cut from the infected stalks should be surface sterilized with 0.1 per cent mercuric chloride solution for one minute followed by washing in sterile distilled water. Finally a single bit is to be aseptically transferred to sterilized potato dextrose agar days at 26±2°C for getting the fungal hyphae to come out from the infected bits. Finally, the fungal hyphae is to be aseptically transferred to culture tubes containing the sterile PDA medium and to be incubated for about 10 days to get the stock culture of the pathogen to be used for increase of the inoculum in the laboratory for field inoculation.

Among various methods of field inoculation, the toothpick inoculation is followed for these diseases under the co-ordinatedprogrammes. Round bamboo toothpicks about 6.5 cm long are boiled three times (about 1 hour each time) in tap water to remove toxic substances. After each boiling these are thoroughly washed in fresh water and dried in the sun. When these are thoroughly dry, they are loosely packed in bundles and put into the glass jars/ bottles and enough potato dextrose broth (one- third length of toothpicks) is added to thoroughly moisten the toothpicks plus some quantity in the bottom of the jars. The jars with the toothpicks are autoclaved immediately after the broth is added. Later the sterilized toothpicks are inoculated with the culture of the pathogen aseptically. The growth of the fungus covers the toothpicks and inoculum is ready for use in about 10 days.

Inoculations should be made just after flowering stage of plants. For inoculating plants, the lower internode (second/third) above soil level is opened with a jabber and the toothpick is inserted into the hole. The jabber is made by driving a nail of the diameter of the toothpick into a wooden handle. The head of the nail is ground off to a point and to the desired length (2cm). The round toothpicks effectively seal the hole in the stalk and prevent drying. The measurement is based on the proportion of disease present in the inoculated internodes and its subsequent spread. For scoring disease severity of PFSR, 1-9 rating scale of Payak and Sharma[#] (1983) is followed:

Rating scale	Disease severity (%)	PDI*	Disease reaction
1.0	Healthy or trace/slight discolouration at the site of inoculation.	11.11	Resistant (Score: ≤ 3.0) (PDI: ≤33.33)
2.0	Up to 50% of the inoculated internode is discoloured	22.22	
3.0	51-75% of the inoculated internode is discoloured	33.33	
4.0	76-100% of the inoculated internode is discoloured	44.44	Moderately resistant (Score: 3.1- 5.0) (PDI: 33.34 - 55.55)
5.0	Less than 50% discolouration of the adjacent internode	55.55	
6.0	More than 50% discolouration of the adjacent internode	66.66	Moderately susceptible (Score: 5.1 - 7.0) (PDI: 55.56 - 77.77)
7.0	Discolouration of three internodes	77.77	
8.0	Discolouration of four internodes	88.88	Susceptible (Score: ≥ 7.0) (PDI: ≥ 77.77)
9.0	Discolouration of five or more internodes and premature death of plant	99.99	

*Percent disease index (PDI)

9. Bacterial stalk rot (Pre-flowering stalk rot)

A virulent isolate of *Erwinachrysanthemi* corn pathotype should be selected for inoculation. To maintain the virulence of the bacterium, it should be inoculated on healthy plants and then reisolated every year before mass inoculation. In order to isolate a virulent strain, the inoculated plants showing characteristic symptoms of the disease are selected. A small piece of rotten internode is immediately dipped into mercuric chloride solution (1:1000) for 5 seconds and passed through three changes of sterile water. The piece is then cut into two halves with sterilized blade, put into little sterile water and then teased apart with sterile needle. The small quantities of resulting suspension are then removed with a flamed wireloop and streaked out on well dried nutrient agar plates, the aim being to separate the cells so that they produce individual colonies. The characteristic colonies are identified after 2 days of incubation at 30°C and used for subculturing. The culture is used for testing the pathogenicity. The cultures which induce the typical symptoms of the disease within 48 hours of inoculation are used for mass inoculation. The inoculum is increased for mass inoculation on nutrient broth for 48 hours at 30°C. The inoculum was diluted 10 times with sterile water to maintain a concentration of approximate $1X10^{7-9}$ bacteria/ml.

The inoculation may be carried out when the crop is at the pre-silking stage or until flowering has reached 75%. To inoculate the plants a diagonal hole is made in the middle of second internode from the ground to the pith. One milliliter of bacterial suspension is injected into the plant through the hole by a hypodermic syringe. If necessary, a second inoculation may be done one week later in the third internode from the ground**.** Percent disease incidence is recorded 15 days after sowing and the entries are classified according to their disease reaction as described by Lal and Singh (1984) for SDM.

10. Maize cyst nematode (*HeteroderaZeae)*

Plant parasitic nematodes are responsible to causes 10.2% losses o maize. Though, large number of plant parasitic nematodes attacks on maize but maize cyst nematode (*Heteroderazeae*) is considered as most important and therefore, screeningtrials are carried out under artificially inoculated conditions in permanent plots to find out source of resistance against maize cyst nematode (*Heteroderazeae*)*.* The observations on nematode infestation are recorded after 45 days of germination. The varieties/hybrids/ lines are categorized on the basis of cyst/plant as mentioned below:

S. No.	Number of cyst/plant	Category
1	0 - 4 cyst/plant	Resistant
2	Above 4 - 9 cyst/plant	Moderately Resistant
3	Above 9 cyst/plant	Susceptible

*** Calculation of Percent Disease Index (PDI) of Foliar Diseases of Maize**

Percent disease index (PDI) is calculated using the following formula of Mckinney (1923).

Percent disease index (PDI) =

On the basis of PDI, the inbred lines/ varieties/ hybrids can be classified as resistant (R), moderately resistant (MR), moderately susceptible (MS) and susceptible (S). The test inbred lines/ varieties/ hybrids with resistant reaction are considered acceptable for a breeding programme whereas test inbred lines/ varieties/ hybrids with moderately resistant are acceptable when lines with resistant reaction are not available.

M.M. Payak and R.C. Sharma. Disease rating scales in maize in India. *In:Techniques of Scoring for Resistance to Important Diseases of Maize*. All India Coordinated Maize Improvement Project, Indian Agriculture Research Institute, New Delhi, 1983, pp. 1-4.

Concurrent Session V (Entomology)

Concurrent Session (Entomology) Date: 22.04.2014 Time: 02:30 AM

Concurrent Session	Chairman	Convener	Rapporteur
Entomology	Dr. OP Ameta Professor and Head, Entomology	Dr. Pradyumn Kumar Principal Investigator, Entomology	Dr. J.C. Sekhar, Dr. Manoj kumar Mahla

The Entomologists presented the work done at their respective Centers. The work was reviewed and discussed. The Principal Investigator then discussed the plan of work with members of all the centers for next year.

S. No.	Name of the Centre	Scientist
1	DMR, Delhi	Pradyumn Kumar
2	ANGRAU, Hyderabad	Lava Kumar Reddy
3	PAU, Ludhiana	Jawala Jindal
4	MPKU, Rahuri Kolhapur	Sushant Mahadik
5	MPUAT, Udaipur	-(Not presented)
6	RAU, Dholi	-(Entomologist did not come)
7	HAU, Karnal	-(There is no Entomologist)

RECOMMENDATIONS

- Crop loss due to *C. partellus* can be easily estimated by using newly developed formula.
- One insecticide spray should be done between 15 to 20 DAG for the management of *Chilo partellus.*
- DMR E63 (INGR14014) resistant to pink borer, *Sesamia inferens* is now available for breeding.

PLAN OF WORK
Kharif 2014

ET 1: Evaluation of maize AICRP trials entries against *Chilo partellus* under artificial infestation for AVT I and II

ET 2 a. Evaluation of inbred lines against *Chilo partellus* under artificial infestation (3rd year screening 20 lines + 2 checks, 3 replications)

Data Recording (Experiment 1 and 2)

LIR (1-9 scale) has to be recorded 25 days after infestation.

Use the guidelines given below to minimize errors during data analysis.

If there are 12 plants per row the LIR has to be recorded as given below

Situation1: Ideal Situation

2 1 1 1 1 2 3 3 3 4 2 2 – take all the values to derive mean

5 4 6 6 7 7 7 5 5 5 7 8 – take all the values to derive mean

Situation 2: Data with variability

1 2 3 2 3 3 5 4 **9** 6 3 **9** – Remove **9** to derive mean, as 9 may be an aberration (case of resistant germplasm)

8 8 7 6 5 7 **1** 9 **2** 8 9 7 – Remove **1** & **2** to derive mean, as 1 and 2 may be aberrations (case of susceptibility)

Situation 3: Highly variable data (experimental error)

1 2 3 4 5 6 7 8 9 3 5 1 – send the data as such

ET 2 b. Evaluation of inbred lines against Sorghum shootfly under natural infestation

Row length: 2.5 m each

No. of seeds to be sown per row: 16 (retain 12 seedlings)

Observations:
Total number of eggs on each plant
Total number of dead hearts
*Continue observation till no further increase in dead hearts…..

Germ plasm	Total No. of plants	DAG							
		3		5		7		*	
		Eggs	**Dead Hearts**	**Eggs**	**Dead Hearts**	**Eggs**	**Dead Hearts**	**Eggs**	**Dead Hearts**

- ET 3: Identification of cob borer complex and level of infestation
- ET 5: Evaluation of biocontrol agents , egg and larval parasitoids
- ET 6. Evaluation of insecticides against *C. partellus*

Insecticide	*Dose*
Chlorantaniliprole 20 SC	*0.3 ml/lit*
Chlorantaniliprole 20 SC	*0.4 ml/lit*
Flubendiamide480 SC	*0.1 ml/lit*
Flubendiamide480 SC	*0.2 ml/lit*
Novaluron 10 EC	*0.75ml/lit*
Novaluron 10 EC	*1 ml/lit*
Deltamethrin 2.8 EC	*0.4 ml/lit*
Control	

Germplasm to be used : HQPM 1
No. of rows : 4 rows of 3m
Number of rows/ treatment : 4 (thus each plot comprise of 4 rows; central two rows will be treated and border rows will act as buffer. It is advisable to separate each plot by leaving a row blank)
Seeds to be sown : 16 (12 seedlings will be maintained)
Total no. of plots : 8 (treatments) * 2 (subtreatments)*3 (replications): 48

1.

Rabi 2014-15

ET 7: Evaluation of maize AICRP Trials entries against *Chilo partellus and S. inferens* under artificial infestation for AVT I and II (Kolhapur & Hyderabad)
Experimental layout for both 7 and 8
Row length : 3m each
For each germplasm, there are two packets. Use one packet for replication R1 and the other for R2. Please send the data for each replication against the respective code.
No. of seeds to be sown per row: 16 (retain 12 seedlings)
No. of eggs to be released: 10-12 eggs/plant
Plant-age for infestation : 14-16 DAG
Note: The packets of resistant and susceptible check are also arranged in the seed packets as per the layout.
Data Recording

- LIR (1-9 scale) has to be recorded 25 days after infestation.
- Use the guidelines given below to minimize errors during data analysis.

If there are 12 plants per row the LIR has to be recorded as given below
Situation 1: Ideal Situation
2 1 1 1 1 2 3 3 3 4 2 2 – take all the values to derive mean

5 4 6 6 7 7 7 5 5 5 7 8 – take all the values to derive mean
Situation 2: Data with variability
1 2 3 2 3 3 5 4 **9** 6 3 **9** – Remove **9** to derive mean, as 9 may be an aberration (case of resistant germplasm)
8 8 7 6 5 7 **1** 9 **2** 8 9 7 – Remove **1** & **2** to derive mean, as 1 and 2 may be aberrations (case of susceptibility)
Situation 3: Highly variable data (experimental error)
1 2 3 4 5 6 7 8 9 3 5 1 – send the data as such

ET 8. Evaluation of inbred lines against *Chilo partellus and S. inferens* under artificial infestation (Kolhapur & Hyderabad) (3rd year testing replicated trial)
ET.9 LIR vs yield relationship for *S. inferens.* (Hyderabad)

Experiment layout
Germplasm : HQPM1, DHM 117 and Basi Local
No. of rows to be sown for each germplasm: 50
No. of plants/row: 12
No. of eggs to be released per plant: 10-12, 6-8, 3-5 eggs at 10-12 DAG
Data Recording

- Observe LIR (1-9 scale) 25 days after infestation.
- Tag at least 15 plants of each LIR.
- Harvest and pool the cobs of each LIR in respective labeled bags.
- Record the grain yield (at 14% moisture level) of individual cob after sun drying the cobs.

LIR	Cob no.	Grain weight (g)	Moisture (%)	Weight at 14% moisture (g)
1	1			
	2			
	⋮			
	15			
2	1			
	⋮			
	15			
⋮				
9	1-15			

Spring – 2015

ET 10. Evaluation of inbred lines against Sorghum shootfly under natural infestation (Delhi, Ludhiana) (3rd year testing replicated trial)

Experiment Plan
Row Length : 2.5m
Spacing : 70*10
No. of plants per row : 16 seeds are to be sown, 12 plants to be retained
Observations :

- Total number of eggs/germplasm
- Total number of dead hearts per germplasm

**Continue observation till no further increase in dead hearts…..

Germplasm	Total No. of plants	DAG							
		3		5		7……		**	
		Eggs	Dead Hearts	Eggs	Dead Hearts	Eggs	Dead Hearts	Eggs	Dead Hearts

All the trials of RAU, Dholi were rejected. The Entomologist from Dholi could not attend the workshop. Since Dr. Manoj Mahala, Entomologist of MPUAT, Udaipur has recently joined AICRP Maize, he needs to take 3-day training on maize entomology at DMR.
The following scientists attended the concurrent session.

1. Dr. JC Sekhar, Principal Scientist, DMR, WN Hyderabad
2. Dr. Lava Kumar Reddy, Princiipal Scientist, ANGARAU, Hyderabad
3. Dr. Jawala Jindal, Asstt. Professor, PAU, Ludhiana
4. Mr. Gurmail Singh, Asst. Entomologist, PAU, Ludhiana
5. Dr. Sushant Mahadik, MPKU, Rahuri
6. Dr. Manoj kumar Mahla, MPUAT, Udaipur
7. Dr. Anil Vyas, MPUAT, Udaipur
8. Dr. Hemant Swami, MPUAT, Udaipur
9. Dr. Lekha, MPUAT, Udaipur

Session VI

General session

Chairman	Rapporteurs
Dr. O.P. Yadav, Director, DMR	Drs. J. Kaul, Ishwar Singh and Bhupender Kumar

- Dr. O.P Yadav, Project Director informed the house that the funds allotments of different centres is being made as per funds allotted in the 12th plan of the project AICRP on maize. The funds are being released as per the post sanctioned by the ICAR in the plan. The retirement benefits, LTC claims, leave encashments and medical claims of AICRP scientists cannot be booked in the AICRP project by any centres. It was suggested by AICRP centres that this may be clearly mentioned to the university comptrollers when funds are released by DMR.
- Dr. O.P. Yadav, Project Director informed the house that the rating of different centres based on the report of monitoring teams is very critical input and pointed out the centres with average ranking performance. He advised the centres to improve performance in next crop season; otherwise the Directorate will be forced to take up the matter with the authorities of the respective centres to withhold the contingency grant and dropping of centre from AICRP network.
- Twenty nine new locations have agreed to work as cooperative centres. The respective AICRP centres will guide the scientists of the cooperative centres for conducting trials.
- A national demonstration on Maize was appreciated by all and this programme will also be taken up in *Kharif* 2014. CMDs of all state seed department will be invited to see the live demonstrations of the promising maize hybrids in order to upscale the adoption level of hybrids developed by AICRP centres.
- Maintenance breeding needs to be improved.
- All trials from CIMMYT should be routed through DMR
- Treated seeds cannot be accepted as a part of AICRP trial including entries from private sector.
- Data of different trials should be submitted in time. From 2014 onwards a format of data sheet (EXCEL) of each and every trial will be available on DMR web-site.
- Renaming of hybrids during the period of evaluation is not possible.
- ICAR is planning to publish information on each AICRP centres and centres were asked to submit the information within a week.
- All centres were requested to register their breeding materials having unique traits with NBPGR and released hybrids with PPVFRA.
- Significant achievements/good work form AICRP centres may be forwarded to DMR for inclusion in "DMR Newsletter"

- All the scientists, who participated in the brainstorming session held at DMR, New Delhi during September, 2013 were asked to submit the "Trait Prioritization" Performa to DMR as early as possible.
- Some universities are having more than one AICRP centre. They should present in workshop the joint resreach work undertaken and breeding matrial shared between them.

Session VII

ICAR-CIMMYT Collaboration

Chairman	Co-chairman	Speakers	Rapporteurs
Dr. R.P. Dua	Dr. O.P. Yadav	Dr. Chikkappa G.K. DMR, Dr. P.H. Zaidi and Dr. M.L. Jat, CIMMYT	Drs. C.M. Parihar, Chikkappa G.K.

The Chairman of the session welcomed the delegates and all the maize scientists from different parts of the country. As per the decisions taken during last annual maize workshop and approved ICAR-CIMMYT work plan, the progress report (2013-14) of crop improvement related activities was presented by Dr. P.H. Zaidi, Senior Breeder, CIMMYT and natural resource management research related activities in maize systems under ICAR-CIMMYT work plan presented by Dr. M.L. Jat, Senior Cropping Systems Agronomist, CIMMYT. Both the scientists also highlighted the progress of research as per the approved work plan.

The trials under ICAR-CIMMYT collaborative research were finalized after detailed discussions with all centres involved keeping in view resources available with each centre and the ecology of individual centres.

After the presentations of ICAR-CIMMYT Collaboration, following points have emerged:

- The approved technical programme of breeding trials form the next year (2014-15) onwards will be strictly followed. The data of these trials will be submitted to DMR and will be documented in the AICRP report.
- Any line/entry of CIMMYT will be tested at any AICRP on Maize centre should be routed through Director, DMR only.
- Any publication coming out of such evaluations will be jointly shared by scientists of ICAR/SAUs and CIMMYT contributing in evaluation, analysis and documentation.

CIMMYT-Asia Trials for *Kharif* 2014 and *rabi* 2014-15						
Trial No.	**Description / Objective**	**Centres**				**Management**
CAT1416	Advance stage early-medium maturity yellow hybrids-Set 4	Varanasi	Ambikapur			Optimal
CAT1417	Advance stage medium maturity yellow hybrids-Set 5	Hyderabad	Varanasi	Kolhapur	Banswara	Optimal
CAT1419	Advance stage early-medium maturity yellow hybrids-Set 7	Ranchi	Ambikapur			Optimal
CAT1418	Advance stage medium maturity yellow hybrids-Set 6	Hyderabad				Optimal
CAT1431	Advance stage early-medium maturity yellow hybrids-Set 4	Begusarai	Pantnagar			WL
CAT1432	Advance stage medium maturity yellow hybrids-Set 5	Begusarai				WL
CAT1433	Advance stage medium maturity yellow hybrids-Set 6	Begusarai				WL
CAT1434	Advance stage early-medium maturity yellow hybrids-Set 7	Begusarai	Pantnagar			WL
CAT1440	Advance stage early-medium maturity yellow hybrids-Set 4	Udaipur	Godra	Biloda	Midnapur	Drought
CAT1441	Advance stage medium maturity yellow hybrids-Set 5	Karimnagar	Dharawad	Midnapur		Drought
CAT1442	Advance stage medium maturity yellow hybrids-Set 6	Karimnagar	Dharawad	Kolhapur	Midnapur	Drought
CAT1443	Advance stage early-medium maturity yellow hybrids-Set 7	Udaipur	Godra	Biloda	Ranchi	Drought
CAT1446	Advanced stage CIMMYT Asia lines	Udaipur	Midnapur	Delhi		BLSB
CAT1447	BC1F2 population of BLSB resistant/elite crosses	Udaipur	Delhi			BLSB

Trial No.	Description / Objective	Centres				Management
CAT1448	F2:3 population of BLSB resistant/elite crosses	Delhi	Ludhiana			BLSB
CAT1449	F5-6 lines derived from BLSB pedigree crosses	Udaipur	Dhaulakaun	Delhi		BLSB
CAT1450	Synthetic population development-Cycle 0	Delhi				
CAT1451	Advanced stage CIMMYT Asia lines	Udaipur	Arabhavi	Hyderabad		FSR
CAT1452	Advanced stage CIMMYT Asia lines	Hyderabad				MST
CAT1453	F2:3 population from TLB resistant/susceptible lines	Arabhavi				TLB
CAT1454	Advanced stage CIMMYT Asia lines	Udaipur				DM
CAT1455	F6-7 lines derived from DM pedigree crosses	Udaipur				DM
CAT1456	Lines derived from DM Syn pop.	Udaipur				DM
CAT1457	S2-S4 lines for Turcicum evaluation	Banswara	Biloda	Arabhavi		TLB
CAT1475	IET of Early duration yellow hybrids	Bajaura	Srinagar	Barapani	Arabhavi	Optimal
CAT1476	IET of White QPM Hybrids	Srinagar	Godra			Optimal
CAT1477	Test crosses with elite CIMMYT-Asia lines	Karnal	Barapani			Cold
CAT1478	Test crosses of elite CIMMYT-Asia lines with Mexican High Land lines	Karnal	Barapani			Cold
CAT1479	Advanced CIMMYT Africa lines	Barapani	Ludhiana			Cold

MAIZE SI2	MAIZE SI3	CCAFS
Resilient maize systems adapted to rainfed, mixed and irrigated systems	DSS for Precision nutrient management capturing spatial and temporal soil variability and farmer circumstances	Environmental footprints of different crop management practices in maize systems under various production environmental and ecologies
Complex weed flora and their management	Sensors for precision nutrient application in maize systems	Climate smart homologous regions and technology targeting
Development and adaptation of small farm CA machinery	Development and adaptation of precision planters for maize systems	Quantification of fraction of C, soil carbon stocks and sequestration
Climate change adaptation, mitigation and risk management	Precision in irrigation and rain water management for yield maximization	SI options for maize systems and define their domains
Capacity building in core areas.	Capacity building on precision input management and innovation systems	Strategic research on lifecycle analysis and the GWP potential of alternative agronomic practices.
DMR & AICMIP, CSSRI, CRIDA, ICAR-CER, PDFSR, IARI	DMR & AICMIP, PDFSR, CSSRI, CRIDA, ICAR-CER, PDFSR, IARI, CIAE, DWSR, IPNI	DMR, IARI, CSSRI, ICAR-CER, PDFSR, CRIDA, IPNI, NPL, NRSA etc

These projects of NRM excluding IFAD-Maize will be continued during 2014-15 at the respective centres/locations under different projects listed in the ICAR-CIMMYT work plan.

Session VIII

FLDs, Training Programmes and Breeder Seed Production

Chairman	Co–Chairman	Rapporteurs
Dr. A. K. Roy Project Coordinator (Forage Crops), IGFRI, Jhansi	Dr. Dinesh Kumar, Principal Scientist, ICAR	Drs. Amit Dadheech, J. Kaul, V.K. Yadav

Dr. Virendra Kumar Yadav, Senior Scientist (Agricultural Extension) presented the review of frontline demonstrations (FLDs), Tribal Sub-Plan (TSP) and Kisan Melas & Exhibitions organized during last year and plan for FLDs during 2014-15. A total of 2188 FLDs during *rabi* 2012-13, 754 in spring 2013 and 3983 FLDs during *kharif* 2013 were organized in 26 states of India through 48 agencies of public and private sectors. An average grain yield of 5203 kg/ha was recorded which showed an increase of 102.77 per cent over all India average yield of maize. All promising technologies were demonstrated at farmers' field. The Directorate of Maize Research (DMR) implemented TSP in tribal populated states of India. 840 demonstrations, 7 national level trainings, 15 regional level training programmes and 11 field days were organized and inputs (seed, fertilizer, sprayer, weeder, sheller, storage bins, line marker, sickle, etc.) were distributed by DMR and AICRIP centres. Besides this, DMR actively participated in eleven Kisan Melas and Exhibitions by putting up stalls.

FLD programme would be implemented by National Food Security Mission (NFSM) from 2014-15 and onward. NFSM has approved FLDs in maize for 200 ha area during 2014-15. State wise and agency wise allocation of FLDs (Table 1) were proposed to NFSM for approval.

Annual action Plan of FLDs for 2014-15

S.No	**Name of the Centres/ Agencies /Organizations**	**No. of FLDs (one FLD is of one hectare) to be allotted**			
		Kharif 2014	Rabi 2014-15	Spring 2015	Total
1	ANGRAU, Hyderabad (A.P.)	10	10	-	**20**
2	RMR & SPC, DMR, Begusarai (Bihar)	-	10	-	**10**
3	DMR, New Delhi (Delhi)	-	-	10	**10**
3	Ludhaina centre of DMR (Punjab)	10	-	-	**10**
4	Godhra, GAU, Ahmedabad (Gujarat)	10	-	-	**10**
5	Bajaura, HPKVV, Palampur (HP)	10	-	-	**10**
6	CCSHAU, Uchani (Haryana)	10	-	-	**10**
7	Birsa Agril. Univ. Ranchi (	10	-	-	**10**

S.No	Name of the Centres/ Agencies /Organizations	No. of FLDs (one FLD is of one hectare) to be allotted			
	Jharkhand)				
8	SKUAT, Srinagar (J&K)	10	-	-	**10**
9	Mandya, UAS, Bangalore (Karnataka)	10	-	-	**10**
10	Kolhapur, MPKVV (Maharashtra)	10	-	-	**10**
11	OUAT, Bhubaneshwar (Orissa)	10	10	-	**20**
12	PAU, Ludhiana (Punjab)	-	-	10	**10**
13	Directorate of Extension, MPUAT Udaipur, (Rajasthan)	10	-	-	**10**
14	Coimbatore, TNAU (Tamilnadu)	10	10	-	**20**
15	GBPUAT, Pantnagar, (Uttarakhand)	10	-	-	**10**
16	Varanasi, BHU (U.P.)	10	-	-	**10**
Total		**140**	**40**	**20**	**200**

As per guidelines of NFSM, to create better and visible impact of a technology the demonstration may be conducted in **cluster approach of at least 10.0 hectares**. One demonstration at individual farmer should never be less than 0.4 hectare and not exceeding to one hectare.

Tribal Sub Plan would be implemented by DMR and AICRIP centres on maize. Fund for AICRIP centres for implementation of TSP would be released very shortly.

The indent of breeder seed received from DAC was presented by Dr. J Kaul. It was discussed at length and the breeder seed allotment was done as per indent received from DAC.

The session was concluded by the chairman with thanks.

Breeder seed Indent for *Kharif* 2015

A. MAIZE HYBRID:

Production year: 2014 Qty. in Qtls.

S. No.	Variety Name	Year of notification	CG	MH	NSC	RJ	SAI	SFCI	UP	UK	HIL	Total	Allotted centre
1	HQPM-4 (F)	2010				4.0						4.0	CCS, HAU, Karnal
	HQPM-4 (M)					1.0						1.0	
2	HM-10 (F)	2008			0.4							0.4	
	HM-10 (M)				0.2							0.2	
3	HQPM-7 (F)	2008			0.8							0.8	
	HQPM-7 (M)				0.2							0.2	
4	HQPM-5 (F)	2007						1.2				1.2	
	HQPM-5 (M)							0.3				0.3	
5	HM-8 (F)	2007			0.15							0.15	
	HM-8 (M)				0.05							0.05	
6	HQPM-1 (F)	2007			1.2	4.0						5.2	
	HQPM-1 (M)				0.4	2.0						2.4	
7	HQPM-5 (F)	2007			1.2							1.2	
	HQPM-5 (M)				0.4							0.4	
8	HM-4 (F)	2005			0.4							0.4	
	HM-4 (M)				0.1							0.1	
9	Shaktiman-4 (F)	2006								0.4		0.4	RAU, Dholi
	Shaktiman-4 (M)									0.1		0.1	
10	Shaktiman-2 (F)	2004	1.6									1.6	
	Shaktiman-2 (M)		0.4									0.4	
11	PEEHM-5 (F)	2004						1.2		0.04	0.4	1.64	IARI, Delhi
	PEEHM-5 (M)							0.3		0.01	0.2	0.51	
12	PEHM-2 (F)	1997								0.04		0.04	
	PEHM-2 (M)									0.01		0.01	
13	Prakash(F)	1997							0.04			0.04	PAU,

S. No.	Variety Name	Year of notification	CG	MH	NSC	RJ	SAI	SFCI	UP	UK	HIL	Total	Allotted centre
	Prakash (M)								0.01			0.01	Ludhiana
14	Vivek Maize Hybrid-9 (F)	2001					0.04					0.04	VPKAS, Almora
	Vivek Maize Hybrid-9 (M)						0.01					0.01	
15	Pratap Hybrid Maize-1 (F)	2004				2						2	MPUAT, Udaipur
	Pratap Hybrid Maize-1 (M)					1						1	
16	Ganga Safed-2 (CM-400)	1969		0.6			0.6					1.2	GBPUAT, Pantnagar
	Ganga Safed-2 (CM-300)			0.3			0.3					0.6	
	Ganga Safed-2 (CM-600)			0.2			0.2					0.4	
	Total		**2**	**1.1**	**5.5**	**14**	**1.15**	**3**	**0.05**	**0.6**	**0.6**	**28**	

B. Maize Variety

Production year: 2014 **Qty. in Qtls.**

S. No.	Variety Name	Year of notification	CG	MP	NSC	RJ	SAI	SFCI	UP	UK	HIL	Total	Allotted centre
1	Pratap Kanchan-2 WC-236(Y)	2009				1.0			0.05			1.05	Banswara
2	Pant Sankul Makka-3 (D131)	2008							0.06			0.06	Pantnagar
3	Amar (D-941)	2001							0.06			0.06	
4	Gaurav (D-931)	1999							0.16			0.16	
5	Sharadmani	2008							0.06			0.06	Kanpur
6	Azad Kamal (R 9803)	2005		0.2								0.2	
7	Azaduttam (Composite R-2)	1991							0.16			0.16	
8	Vivek Sankul Makka-31(VL-103)	2008							0.11	0.08		0.19	Almora
9	Pratap Makka-5 (EC-3116)	2006				2.0					0.6	2.6	Udaipur
10	Pratap Makka-4	2004									0.6	0.6	
11	Pratap Makka-3 (EC-3108)	2005				2.0		2.0				4.0	
12	Pusa Composite-3 (Composite-85134)	2005	2						0.08			2.08	Delhi
13	Pusa Composite-4(Composite-8551)	2005		0.2	0.05				0.08			0.33	

S. No.	Variety Name	Year of notification	CG	MP	NSC	RJ	SAI	SFCI	UP	UK	HIL	Total	Allotted centre
14	Jawahar Makai-216 (JM-216)	2002	2.6									2.6	Chhindwara
15	Narmada Moti (IC-9001)	2002					0.5					0.5	Godhra
16	Priya Sweet corn	2002					0.01					0.01	Hyderabad
17	NAC 6004	2001	2.0									2.0	Mandya
18	BIRSA MAKKAI-1	1996					0.3					0.3	Ranchi
	Total		**6.6**	**0.4**	**0.05**	**5.0**	**0.81**	**2.0**	**0.82**	**0.08**	**1.2**	**16.96**	

Session IX

Germplasm exchange, registration and seed issues

Chairman	Speakers	Rapporteurs
Dr. O.P. Yadav	Dr. J.C. Sekhar, DMR Dr. B. Vivek, CIMMYT Dr. J Kaul, DMR Dr. Ashok Kumar, NBPGR	Drs. J. Kaul, Chikkappa G K

Maintenance, advancement, multiplication and distribution of germplasm are some of the major activities of Directorate of Maize Research, New Delhi. Dr. J.C. Sekhar, I/c and Principal Scientist, WNC, Hyderabad briefed the germplasm available at WNC, DMR which includes normal maize, quality protein maize, sweet corn, popcorn, waxy and high oil germplasm. He also presented information on number of germplasm displayed during the annual field day, number of germplasm lines supplied to different AICRP centres, number of germplasm (NBPGR accession) regenerated and characterized during 2008-2013. Finally he also highlighted the need to diversify the existing germplasm by enriching with exotic collections especially the temperate germplasm.

Dr. Ashok Kumar from NBPGR gave presentation on germplasm collections available at NBPGR under both medium and long-term storage (MTS and LTS). He also explained the major activities of NBPGR and the details of maize germplasm material like landraces, wild relatives, traditional cultivars, genetic stocks, breeding lines procured. He concluded his presentation by briefing on CRP-Biodiversity platform which is being implemented during 12^{th} five year plan.

All the centres are advised to share and registered their germplasm for their effective and efficient utilization in breeding programme. Parental lines of hybrids which are in advanced stage of testing but not indentified, should be registered at NBPGR. Application for protection of the released hybrids should be filed within a year at PPV&FRA.

A presentation on issues in germplasm registration at NBPGR and PPV&FRA was also made by Dr. J Kaul. A request was also made to all centres to take necessary steps to register the material with NBPGR and PPV&FRA.

Session X

Presentations of work plan 2014-15

Chairman	Speakers	Rapporteurs
Dr. P.L. Maliwal, Director Research, MPUAT, Udaipur	Dr. Bhupender Kumar(Breeding) Dr. A.K. Singh (Agronomy) Dr. P. Kumar (Entomology) Dr. K.S. Hooda (Pathology)	Drs. J.C. Sekhar, S.S. Sharma, S.L. Jat, Chikkappa, G.K

Breeding

Dr. Bhupender Kumar presented the proposed work plan of breeding section for the year 2014-15.The work plan was approved by the house. Twenty nine new volunteer centres were included this time for evaluation of AICRP maize trials.

Agronomy

After presentation from Dr. A.K. Singh, following suggestions were made in AICRP agronomy work plan:

1. There is need of consideration of plant population in early and extra early maturity pre-release genotype trials.
2. It was felt that an additional fertility levels including state recommended dose of fertilizer must be added in pre-release genotype trials, however such data may not be part of reprt due to problem in compilation.
3. Insect and disease observation must be a part all nutrient and tillage management trials
4. Barrenness percentage should be a part of all planting density trials with mention of plant type i.e. erect or spreading type
5. Observation on days to maturity of the crop must be added in all experiments

Entomology

Dr. P. Kumar, PI Principal Investigator (Maize Entomology) presented the proposed work plan of Maize Entomology group for the year 2014-15.The work plan was approved by the house.

Pathology and Nematology

After presentation from Dr K.S. Hooda, the proposed work plan was approved. Dr S.M. Khanorkar, AAU, Anand, Gujarat, suggested that residue analysis of tested chemicals will be required after completing two years of management trials.

At the end, Session chairman, Dr. P.L. Maliwal, Director Research, MPUAT, Udaipur congratulated all the speakers. He expressed satisfaction on the proposed technical work presented during the session and also emphasized that it is the duty of scientist to implement all the recommendations. He thanked all the participants and delegates in the session.

Session XI

Plenary Session

Chairman	Speakers	Rapporteurs
Dr. P.L. Maliwal, Director Research, MPUAT, Udaipur	Dr. Bhupender Kumar(Breeding) Dr. A.K. Singh (Agronomy) Dr. P. Kumar (Entomology) Dr. K.S. Hooda (Pathology)	Drs. J.C. Sekhar, S.S. Sharma, S.L. Jat, G.K Chikkappa,

All the PI's presented the review of work during *Kharif* 2013 and *rabi* 2012-13 and work plan for the next year which were approved in the session. A total of additional 29 locations were identified for testing. Germplasm collection and evaluation will be further strengthened in collaboration with DMR, NBPGR and CIMMYT. A new format will be devised and made available for testing of EDV's. A total of 77 new lines were identified for multiple disease resistance which must be registered by developing centres for its further utilization.

Dr. O.P. Yadav, Director, DMR presented the VIC report, in which a total of 33 proposals were received consisting of 22 for *Kharif* and 11 for *rabi*. Out of these, 25 proposals were accepted and these were identified for release. During his overall remarks about the workshop, he praised the deliberations and participation of the scientists at par excellence.

Dr. P.L. Maliwal, in his remarks, emphasised on the hybrid seed production for wider dissemination of the technologies. He also emphasised that micro nutrients must be also taken into consideration along with N, P, K and Zn for sustainable maize production. The extension of the technologies at the farmers' field is equally important. He also emphasised on the speciality corn research and its area expansion for higher profitability. The QPM needs to be promoted by contractual farming and premium pricing for which there is a need to take forward step by state as well as central government. Being predominantly rainfed crop, the transgenic maize for drought, herbicide and insect resistance must be developed and promoted.

The session ended with vote of thanks to chairman, speakers and all participants by Dr. S. K. Sharma, Organizing Secretary & ADR, MPUAT, Udaipur.

Indian Council of Agricultural Research