PROCEEDINGS

Joint Annual Group Meeting of AICRP- National Seed Project (Crops) & ICAR Seed Project- Seed Production in Agricultural Crops

Technical Programme
(2018-19)

held at
Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, Puducherry
(09-11 May, 2018)

ICAR-Indian Institute of Seed Science
(Indian Council of Agricultural Research)
Mau 275 103, Uttar Pradesh, India
(ISO 9001:2015 Certified Institute)

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Dr. Dinesh K. Agarwal
National Coordinator, AICRP-NSP (Crops) & ICAR Seed Project &
Director (Acting)

ICAR-Indian Institute of Seed Science
Kushmaur, Post – Kaithauli
Maunath Bhanjan - 275 103, Uttar Pradesh, India
Phone: 0547-2530326; Fax: 0547 – 2530325
Email: director.seed@icar.gov.in

Website: www.seedres.in

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Session I

Inaugural Session

Date : 09.05.2018 **Time : 09:30-11:00**

Chief Guest	:	**Shri. R. Kamalakannan** Hon'ble Agriculture Minister, Govt. of Puducherry
Chairman	:	**Dr. D.K. Yadava** ADG (Seed), ICAR, New Delhi
Co-chairman	:	**Dr. V. Kanthaswamy** Dean (I/c), PAJANCOA & RI, Karaikal
Rapporteurs	:	**Dr. S.K. Lal** PS, DSST, ICAR-IARI, New Delhi **Dr. Govind Pal** PS, ICAR-IISS, Mau

Joint Annual Group Meeting i.e., 33rd Annual Group Meeting of AICRP-NSP (Crops) & 13th Annual Review Meeting of ICAR-Seed Project "Seed Production in Agricultural Crops" was organized in liaison with PAJANCOA & RI, Karaikal, Puducherry during 09th -11th, May 2018. Inaugural session was graced by Hon'ble Agriculture Minister, Govt. of Puducherry, Shri. R. Kamalakannan and Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi. The inaugural session started with welcome address by Dr. V. Kanthaswamy, Dean (I/c) PAJANCOA& RI, Karaikal, who also briefed about the activities being undertaken by the institute. Delegates from State Agricultural Universities and ICAR institutes participated in the meeting.

Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi made the introductory remarks and briefed about the genesis of AICRP-NSP (Crops) and ICAR Seed Project and their contribution in bolstering the seed production, research, infrastructure capabilities and human resource development of SAUs and ICAR institutes in NARES. Dr. Yadava highlighted the fact that the food grain production has increased from a level of 131mt in 1979-80 to 267 mt in 2016-17, which has been made possible through appreciable increase in the breeder seed production over the years. He laid emphasis on issues such as share of Public and Private sectors in Indian seed domain, identification of alternative niches for seed production under climate change, amelioration of Varietal Replacement Rate and Seed Replacement Rate, maintenance breeding, maintenance of generation system, quality control, revision of IMSCS, seed health testing, strengthening of seed chain in NEH region, organic seed production and use of molecular tools for augmentation of seed production capabilities.

Dr. Dinesh K. Agarwal, Director (Acting), IISS, Mau presented achievements of AICRP-NSP (Crops) and ICAR Seed Project during 2017-18. Estimated Breeder Seed Production is 1.16 lakh quintals during the year 2017-18. He further briefed the major achievements under STR component in seed production and certification, seed physiology

and storage, seed pathology and seed entomology themes. He highlighted the reduction of mismatch in breeder seed production and underlined the problem of non-lifting of breeder seed. The quality seed production in ICAR-Seed Project is estimated to reach 6.08 lakh quintals in 2017-18.

During the inaugural function, PAU, Ludhiana and TNAU, Coimbatore were awarded as the best performing centers under Breeder Seed Production and Seed Technology Research components of AICRP-NSP (Crops), respectively. ICAR Complex for NEH region, Manipur Centre, Imphal and UAS, Raichur were awarded as the best performing centers as ICAR institute and university centre, respectively under ICAR-Seed Project.

Shri. R. Kamalakannan, Hon'ble Agriculture Minister, Govt. of Puducherry and the chief guest of the function welcomed all the delegates and lauded the significant achievements made by the scientists in seed domain. In his inaugural address, he emphasized the importance of seed in augmenting the agricultural production and productivity, enhancing employment opportunities in rural areas particularly for women. He also expressed the concern to improve the SRR and VRR, availability of quality seed at farmers' door-step and dissemination of relevant technologies to the farmers.

The inaugural session ended with the formal vote of thanks proposed by Dr. R. Govindarasu, Professor& Head, Dept. of Plant breeding & Genetics, PAJANCOA& RI, Karaikal.

Session II

Discipline- wise Presentation of progress report by Principal Investigators

Date : 09.05.2018 **Time : 11:30-13:30**

Chairman	:	**Dr. D.K. Yadava** ADG (Seed), ICAR, New Delhi
Co-chairman	:	**Dr. K. Keshavulu** Director, TSSCA, Hyderabad
Rapporteurs	:	**Dr. M. Ashraf Bhat** Nodal Officer (Seeds) SKUAST- Kashmir, Srinagar

Some important issues deliberated in the session are:

- Benefit: Cost ratio must be calculated for all the experiments so that the technology generated is beneficial to the farming community
- Additional cost with additional value to be calculated for all the experiment (economics)
- Appropriate statistical designs has to be employed to interpret the analyzed data in a more accurate way
- Centers are requested to provide coefficient of variation as standard error and critical difference is not sufficient to analyze the precision of the experiment carried over locations
- Centers should provide soil test report and meteorological data to analyze the environmental variations between the centers. This is more important in experiments where macro/micro nutrients are added to the soil
- Centres should provide the net and gross plot area as envisaged in technical program guidelines
- It was impressed upon all the centres to submit the data before 15th January so that the pooled data over locations/years is analyzed and submitted to concerned quarters before stipulated time. Such Centre (which submitted data late) were warned and advised to submit the data on time in future
- Recommendations to be made after 3 year data is generated/analyzed over locations
- The recommendations to be applied /adopted at the AICRP centres has to come in the form of field demonstration trials before it goes in the package and practices
- PIs were suggested to present only the uniform data over locations/years

- It was desired by Chairman to adopt tripartite MoU wherein Scientist working under the scheme can be transferred by university only after proper approval from the ICAR
- DNA fingerprinting to be adopted by all centres for varietal identification. Extra budget (8-10 lakhs) may be provided to centres involving in the Molecular Work.
- Isozyme profiling has to be adopted for varietal identification
- Dr. D. K. Yadava, ADG, Seeds impressed upon all the PIs to have frequent interactions with concerned centres so that the results are discussed before presenting in the Annual Group Meet.
- He emphasized that there must not be any deficit for the supply of the Breeder Seed (by any Centre). He desired that there must be efficient co-ordination amongst the breeders for timely supply of breeder seed.
- Dr. D K Agarwal, Director, IISS, Mau emphasized for "Licensing of variety and identification of few centres of excellence"
- All centres must keep 10 percent more target every year for all the crops under mention
- Care must be taken in production of breeder to breeder seed. Mostly breeder seed must be multiplied from nucleus seed to avoid contamination.
- Encouragement for good performing Centres/ Scientists.
- The chairman advised that a multi-disciplinary research and efficient co-ordination amongst various centres is essential to end up with framing a platform for providing space to the intellectual enthusiasm of the scientists, encourage them to simulate and organize their energies to develop potent research proposals which will ultimately lead to frame a comprehensive strategy for the Resource Poor Farming Community of the country.

The meeting ended with a vote of thanks to the Chair, the co-chair and others present.

Session- III

Centre-wise Presentation of Progress Report

Date : 09.05.2018 **Time : 14:30-17:00**

Chairman	:	**Dr. J.S. Chauhan** Former ADG (Seed), ICAR, New Delhi
Co-chairman	:	**Dr. Malavika Dadlani** Former Joint Director Research, ICAR- IARI, New Delhi
Rapporteurs	:	**Dr. P.R. Choudhary** Principal Scientist (Seed), ICAR, New Delhi **Dr. Vakeswaran** Asst. Professor (SST), TNAU, Coimbatore

The session was comprised of centres from South Zone I and North Zone I. Under South Zone I, UAS, Bengalore; UAS, Raichur; PJTSAU, Hyderabad; KAU, Thrissur and UAS, Dharwad presented the progress report, while ANGRAU, Guntur and UAHS, Shimoga did not participate in the meeting. Among the centres of North Zone- I, SKUAST, Srinagar and Jammu campus; CSKHPKV, Palampur, PAU, Ludhiana and ICAR-VPKAS, Almora presented the progress report.

UAS-Bengaluru produced more breeder seed than the indent, while total quality seed production especially certified seed was much less. The deficit was mainly due to less production of pigeonpea due to heavy rainfall and improper flowering. The co-chair was of the opinion that the economic advantage/ cost-benefit ratio are to be calculated in the experiment “Integrated technology for seed production in millets” since many a times the input is found to be very expensive, even though yield advantages are obtained, which is not desirable as for as economics is concerned.

UAS, Raichur performed satisfactorily, however in case of breeder seed production, target was not achieved due to shortfall in the production of chickpea. In case of STR experiment, Dr. Dadlani suggested to use natural adhesive in seed priming experiments instead of fevicol. In BSP, non-lifting and insufficient fund for maintenance breeding were few constraints while marketing of seeds was the main constraints in ICAR Seed Project. The centre requested the separate budget for maintenance breeding. The centre attempted the sunflower seed production in non-traditional area of Bagepalli and became successful.

In case of PJTSAU, Hyderabad, overall achievements and progress was satisfactory. New initiative has been made in gaining self-sufficiency in soybean and groundnut through seed bank development. The chairman opined that the SRR/VRR calculations should be based on the actual data instead of calculated data. Director, IISS, Mau asked for the AUC for the year 2016-17 in order to release the subsequent funds. No representation by ANGRAU, Guntur.

KAU, Thrissur had taken up STR experiment on terminal heat tolerance, wherein chairman and co-chair opined that the experiment should be conducted involving newly released varieties instead of Jaya. Nearly double the amount of breeder seed has been produced by the centre and it was advised to stick to indent since production of breeder seed is high input intensive. In case of promotion of new varieties, it was advised not to use non-notified varieties for breeder seed production, since production of breeder seed is restricted to notified varieties only. Very good care has been taken by the centre towards conservation of traditional varieties and promotion of seed village programme.

In case of UAS, Dharwad, around 2000 q deficit of breeder seed production has been observed, mainly in soybean and chickpea, due to rain during post-harvest stage. Varietal mismatch has been observed in blackgram, which was mainly due to severe moisture stress. Chairman advised to take best fields for breeder seed production having irrigation and other facilities. Director, IISS, Mau informed that there has been drastic reduction in seed production by the centre even though it was advised to increase production by 10%. Further, most of the HRD money has not been utilized by the centre and therefore chairman advised to rationalize the budget.

Among the North Zone I centres, SKUAST, Srinagar reported the emergence of a new disease Corn Rot of Saffron which was not reported earlier, which is a complex of *Fusarium, Penicillium* and others for which further investigations are being carried out. The centre has come out with a very good CD entitled “Shalimar Beej”, depicting the success stories of the ICAR Seed Project.

In case of SKUAST, Jammu, breeder seed production was more than the indent. However, Director, IISS, Mau informed that Rs. 25 Lakhs Revolving Fund money of XII Plan are lying with the centre and if not returned, the next installment will not be released. ADG (Seed) opined to circulate the standard procedure for calculating the SRR/VRR by IISS, Mau. The Chairman asked the presenters to quantify the gender parity in seed production.

Breeder Seed Production of CSKHPKV, Palampur was found to be just above the indent. In case of high impact factor publications, chairman opined that those publications which are related to the project, that only have to be figured in the publication list and in the annual report. However, publications that are not interlinked with the related projects, should be refrained from citing.

Overall performance of PAU, Ludhiana was satisfactory. However, it was advised that the GOI and State indent should be displayed separately to get rid of confusion. Chairman commented that PAU is producing forage seeds, but Mescavi variety production may be taken up since country is importing huge quantity of seed every year.

ICAR-VPKAS, Almora has faced rainfall deficit during September to April and seed production plots were destroyed by wild boars to some extent. Wild boar damage is a major reason for varietal mismatch in Breeder Seed Production in this centre.

After the presentation, co-chair raised some issues and asked to take care of the matters like the way of calculation of VRR/SRR which should be same in all the centres. In case of terminal heat stress experiments, no. of treatments should be uniform and in case of new biological formulations, a common source or parameter should be employed. Raichur was advised to use acacia gum instead of synthetic gum for priming experiments and all the centres were advised to stick to the technical program while conducting the experiments.

The session ended with a vote of thanks to the Chair, the co-chair and others present.

Session IV

Enhancing Quality Seed Production of Oilseeds

Date : 09.05.2018 **Time : 17:15-19:30**

Chairman	:	**Dr. A. Vishnuvardhan Reddy** Director, ICAR- IIOR, Hyderabad
Co-chairman	:	**Dr. D.K. Yadava** ADG (Seeds), ICAR, New Delhi
Rapporteurs	:	**Dr. S.N. Sudhakara Babu** Principal Scientist, ICAR- IIOR, Hyderabad **Dr. Narendra Kumar** Scientist, ICAR – DGR, Junagadh

Joint Annual Group Meeting of AICRP-NSP (Crops) and ICAR-Seed Project "Seed Production in Agricultural Crops" has been organized in liaison with PAJANCOA&RI, Karaikal, Puducherry from 09th -11th, May-2018. During the occasion, a special session on enhancing quality seed production of oilseeds under the ambit of ICAR Seed Project was convened to address the issues of seed sufficiency and model deployment aspects (FPSP) of Oilseeds. At the outset, Dr. Dinesh K. Agarwal, Director, ICAR-IISS, Mau presented the status of seed production in major oilseeds and disparities in seed replacement rates (SRR) across states. He deliberated upon shortfalls in seed production of soybean and groundnut crops over the last 2 to 3 years and stressed upon essentiality of seed planning and contingency measures for tackling referred issues.

Dr. A. Vishnuvardhan Reddy, Director, ICAR – IIOR, Hyderabad; in his introductory remarks revealed the present crisis situation of vegetable oil economy in the country with more than 60% of import dependence amounting to import bill of Rs.73000 crores annually (2016-17). He also highlighted that among all nine oilseed crops, groundnut and soybean are the major crops occupying more than 60% of acreage and there is considerable shortfall in meeting the quality seed of improved varieties. Whereas, both groundnut and soybean being high volume crops and largely grown under rainfed conditions facing the vagaries of weather and extreme climate effects.

Issues *viz.* addressing unrealistic large indents for breeder seed, measures for strengthening seed chain, strict monitoring of breeder seed movement, addressing non-lifting problems, niche identification for safe and high productive seed production, developing safe and long term storage conditions/infrastructure, seed production in assured irrigation conditions, adoption of BBF method of sowing / dibbling to reduce seed rate and encouraging entrepreneurship (licensing of varieties) were pondered during referred technical session.

Following are the recommendations/action points emerged for consideration and follow up.

- Deployment of crop-specific strategies, especially in case of Soybean and Groundnut crops, targeting an incremental production of 10 % with respect to major Oilseeds of respective cooperating centres under the ambit of ICAR Seed Project during the year 2018-19. Accentuation on model deployment i.e. Farmers' Participatory Seed Production of Oilseeds shall be taken up under ICAR Seed Project.
- Correction of deficit situation of breeder seed production (soybean in particular) with compensatory safe and assured production zones and technology adoption.
- Drought or climate proofing i.e. seed production under assured irrigation and protective cultivation, adoption of BBF / ridges and furrows, plant protection, etc.
- State-wise seed rolling plans for Oilseeds to make available quality seeds thereby ushering Oilseeds quality seed sufficiency.
- Providing infrastructure for safe processing and long term storage. With respect to safe storage, medium & long term seed storage facilities may be contemplated in major Oilseed production zones.
- Providing special incentives for groundnut and soybean seed production centres.
- Encouraging licensing of varieties to private agencies to achieve higher Seed Replacement Rates (SRR) and Varietal Replacement Rates (VRR).

The session ended with a vote of thanks to the Chair, the co-chair and others present.

Session V

Centre-wise Presentation of Progress Report

Date : 10.05.2018 **Time : 09:30-11:30**

Chairman	:	**Dr. R.R. Hanchinal** Ex- Chairman, PPV & FRA, New Delhi
Co-chairman	:	**Dr. D.K. Yadava** ADG (Seed), ICAR, New Delhi
Rapporteurs	:	**Dr. C. S. Kar** Principal Scientist, CRIJAF, Barrackpore **Dr. (Mrs.). S.D. Deka** Principal Scientist, AAU Jorhat

All the centres of south Zone II except IIRR, Hyderabad and North Zone II presented their progress report of NSP and / or ICAR Seed Project for 2017-18. Dr. Selvaraju, Special Officer (Seed), TNAU, Coimbatore presented progress of breeder seed production and seed technology research of TNAU, Coimbatore. He expressed that there was shortfall in breeder seed production of paddy and oilseed due to erratic rainfall. The centre conducted all the STR experiments allotted. Chairman suggested pesticide residue aspect to be look after in case of chemicals mediated storage.

Dr. Prabhakaran, Principal Scientist, ICAR-Sugarcane Breeding Institute, Coimbatore presented progress of ICAR Seed Project in the centre. He mentioned that weather condition was not favorable for sugarcane seed production. However, target was achieved at both Coimbatore and Karnal centres for three sugarcane varieties. New initiative was taken for tissue culture planting materials production. However, Chairman expressed concern about not following seed chain in sugarcane and also requested to increase quantum of planting material production to cover maximum area under cultivation.

Dr. S.N. Sudhakar Babu, Principal Scientist, ICAR-IIOR, Hyderabad presented progress of breeder seed production of castor, sunflower, safflower and sesame. He informed that target was fulfilled for all crops. New varieties like CUMS 17 (2017) and DSH 185 (2018) first CMS based hybrid parents seed production was done. He also told that beekeeping was promoted in niger under tribal sub plan. Dr. D.K. Yadava, Co- chairman emphasized to increase share of IIOR varieties in national seed chain. Chairman suggested to take consideration of exact contribution of honeybee in enhancing seed production along with crop specific data.

Dr. Sooganna presented progress report of IIMR, Hyderabad and mentioned that targeted breeder and certified seed was produced in 4 hybrids of sorghum. He revealed that varietal replacement rate (VRR) is 18% in fodder sorghum and 20-30 % in grain sorghum.

Dr. K.K. Manohara, Scientist, CCARI- Goa presented progress of ICAR Seed Project in the centre. He reported some shortfall in foundation (5q) seed and certified (0.20 q), breeder seed (0.50q). Dr. D.K. Yadava, ADG (Seed) emphasized to meet the target. The nodal officer also exposed that CCARI- Goa is maintaining and conserving traditional paddy germplasm having salinity tolerance (> 100 in numbers).

Chairman expressed concern about share of seed supply from formal seed chain (30%) in comparison to informal sources (70%). In Chhattisgarh and NEH Region, some farmers' varieties are better than improved varieties in terms of quality, yield and tolerant to biotic and abiotic stresses. He also emphasized that proper multiplication of farmers' varieties as TL seed should be taken into consideration either through tribal sub plan / other projects. Dr. Yadava stressed upon registration of farmers' varieties in NBPGR & PPVFRA.

Dr. P.K. Singh presented the progress of ICAR Seed Project in CIARI, Port Blair. He expressed that some shortfall was there in breeder seed production of paddy but the target of TL seed was fulfilled at farmers field. Dr. J.S. Chauhan, Former ADG (Seed) raised the question that how breeder seed was produced in CIARI Dhan 8 as it was not yet released and notified. Chairman suggested to release the variety in state first and then endorse in CVRC to be included in seed chain.

Dr. V.P. Sangwan, CCSHAU, Hisar presented progress of both breeder seed production and seed technology research of the centre. He said that there was shortfall in breeder seed production due to bad weather this year but all STR experiments were conducted. Dr. Yadava, Co- chairman expressed concern about shortfall in breeder seed production.

Dr. (Mrs.) Karuna Vishunavat, Professor, GBPUA&T, Pantnagar presented progress of STR experiments in the centre. She reported that all the STR experiments were conducted successfully. Dr. P.S. Shukla presented progress report of breeder seed production and ICAR Seed Project in GBPUAT, Pantnagar and he said that targets of both breeder seed production & ICAR seed project was fulfilled. Chairman suggested that economic feasibility of film coating of seed should be worked out.

Dr. R.B. Yadav presented the progress of ICAR Seed Project in SVBPUAT, Meerut. He informed that all the targets were fulfilled. Dr. Sanjay Kumar presented progress of ICAR seed project at IARI, New Delhi and he stated that all targets of seed production were fulfilled and all (9) STR experiments were conducted. Chairman suggested to make the use of pusa hydrogel feasible at farmers' level.

Dr. S.B. Singh, Nodal Officer, IIMR, Ludhiana presented progress of ICAR seed project in the centre and he expressed that target of breeder seed (61q) and TL (500q) and foundation (435q) & TL seed in farmers' field (135q) was fulfilled. Chairman Dr. Hanchinal invited suggestion for infusing some science component in farmers' participatory seed production. Dr. J.S. Chauhan suggested that standardized priming and pelleting

technologies should be communicated to crop specific AICRPs. Dr. R.R. Hanchinal, suggested to make provision of a brainstorming session preferably in next workshop.

Dr. Raj Kumar, IIWBR presented progress of breeder seed production & ICAR Seed Project in the centre and the centre has achieved target. Chairman suggested to follow standard procedure for calculation of SRR & VRR. He also suggested to take seed production of Kathia variety of wheat which is salt tolerant and to spread the variety among farming community.

The session ended with a vote of thanks to the Chair, the co-chair and others present.

Session VI

Centre-wise Presentation of Progress Report

Date : 10.05.2018 **Time : 11:45-13:45**

Chairman	:	**Dr. R.R. Hanchinal** Ex- Chairman, PPV & FRA, New Delhi
Co-chairman	:	**Dr. S. Rajendra Prasad** Ex- Director, IISS, Mau and Dean, CoA, GKVK, UAS, Bengaluru
Rapporteurs	:	**Dr. R.K. Kapila** Nodal Officer (Seeds), CSKHPKV, Palampur

Two special presentations were made in the Session apart from 11 scheduled centre-wise presentations. In the first special invited presentation, Dr. Hillol Chakdar, ICAR-NBAIM, Mau presented the results obtained using various microbial formulations developed by them and explained the promising results got in various crops. Consequent upon the discussions and the promise shown by these formulations, Chairman and Dr. M. Dadlani recommended testing of these formulations under the umbrella of NSP project in a common experiment at all centres. ICAR-NBIAM, Mau had instantly agreed to make available all formulations to all centres. The chairman also highlighted the scope of use of these formulations in organic agriculture/seed production for crop productivity and crop protection. In the second presentation, Dr. Sharad Tiwari from JNKVV, Jabalpur explained his successful work on use of panel of molecular markers (SSRs) supported by the computer programme for identification of varieties of soybean and expressed his desire to develop such a set of markers for other important crops in the future.

In centre-wise presentations of the progress of NSP (Crops) and ICAR seed project, 10 presentations were made in all out of a total of 11 scheduled. None represented ICAR-CAZRI, Jodhpur and ICAR-IGFRI, Jhansi. While having discussions on centre-wise presentations made, the following points emerged specific to the centres and in general:

The directorate pointed out non-returning of the seed money of Revolving Fund of ICAR Seed Project from NDUAT, Faizabad and CSAUAT, Kanpur and the scientists were asked to expedite the same. The Chairperson pointed out and took a serious note of not conducting the allocated experiments under Seed Pathology component by CSAUAT, Kanpur. The chairman further stressed the need of coming out with documentation of recommendations by the IISS, Mau and circulate it to the centres for their further inclusion in the Package of Practices (POP) in their respective states.

BHU, Varanasi reported successful development of seed entrepreneurship through their efforts, particularly 2 farmers. Dr. N.K. Gupta, SKNAU, Jobner highlighted their work

on heat shock proteins and their involvement in the identification of heat susceptible and resistant cultivars. While reviewing the performance of the MPAUT, Udaipur, the Chairman pointed out that the specific purpose of the multiplication of TFL should be clear to the centres before taking up the TFL seed multiplication. TFL multiplication may be relevant to new varieties and farmer's varieties as specific cases.

While having discussions on the shortfall in the production of BSP component of AU Kota, the Chairperson stressed the need to have contingent planning to make-up steep deficits in Breeder seed production of crops, specifically like oilseeds.

In the concluding remarks, the Co-chair pointed out the need of networking with ICAR-NBIAM, Mau and JNKV Jabalpur for taking advantage of their leads and expertise and for its further use in NSP (Crops). He also stressed the need of publishing the recommendations and their further inclusion in POPs. He emphasized the need of producing more seed of public sector hybrids in order to compete with hybrids of private sector and to target increase in the share of public sector hybrid seeds in the seed market. He highlighted the importance of developing seed entrepreneurship and focus on tribal trainings to have better impact of HRD component in terms of developing local seed industry and for enhancing the access of tribal farming communities to better seeds.

The chairman in his concluding remarks appreciated the observations of Co-chair and he expressed his satisfaction with all presentations made in the session, in general. He, however, felt that there is need to maintain overall excellence across centres and to have healthy competition among different centres to deliver the goods under this very important project. He also stressed the need to have healthy and balanced competition with private sector in promoting the hybrids of public sector using the brand and reputation of the public sector institutions. He asked the IISS, Mau to enquire the reasons from the centres that didn't participate in the AGM/ARM and take appropriate measures based upon their replies to curb such activities in the future.

The meeting ended with a vote of thanks to the Chair, the co-chair and others present.

Session VII

Centre-wise Presentation of Progress Report

Date: 11.05.2018 **Time: 15:00- 18:00**

Chairman	:	**Dr. S. Rajendra Prasad** Dean CoA, UAS, Bengaluru & Ex-Director, ICAR-IISS, Mau
Co-Chairman	:	**Dr. S.N. Sinha** Former Head, ICAR-IARI, RS, Karnal
Rapporteur	:	**Dr. Vijay Shelar** SRO, MPKV, Rahuri

The nodal officers from 11 centres (RPCAU, Pusa; OUAT, Bhubaneshwar; BAU, Ranchi; BAU, Sabour; BCKV, Nadia; ICAR-CRIJAF, Barrackpore; ICAR-NRRI, Cuttack; JAU, Junagadh; AAU, Anand; NAU, Navsari; & ICAR-DGR, Junagadh) presented the progress made in breeder seed production, seed technological research component of AICRP-NSP (Crops) and ICAR Seed Project during 2017-18. The SDAU, S K Nagar has not presented the progress report. The salient points which emerged are listed below.

- The vacant posts at all centres should be filled up immediately.
- Breeder seed indents should not be accepted by centres if nucleus seed is not available.
- Seed production targets under ICAR Seed Project should be increased by 10% especially in oilseed crops.
- Every centre should undertake Grow Out Test (GOT) for breeder seed.
- The data of survey experiments and farmers' saved seed quality should be utilized effectively by developing advisory recommendations.
- Dr. RPCAU, Pusa should immediately refund the seed money under revolving fund scheme and also should adjust the excess expenditure made under ICAR Seed Project of Rs. 62 lakhs made during XII plan to settle the audit para.
- BAU, Sabour failed to utilize the funds provided under ICAR Seed Project during the year 2017-18 under recurring contingency and other heads.
- The BCKV, Nadia may get permission from ICAR-IISS, Mau for engaging young professional on contractual basis under AICRP-NSP (Crops) due to vacant post of Technical Assistant till filling of same post by University.
- ICAR-NRRI, Cuttack should obtain the data of hybrid seed production by the licensed seed companies
- NAU, Navsari should indicate the Bt- Cotton seed production quantity in their report.

The session ended with thanks to the chair and co-chair.

Session VIII

Centre-wise Presentation of Progress Report and Plenary Session

Date: 11.05.2018 **Time: 9.00 – 15.00**

Chairman : **Dr. R. R. Hanchinal**
Former Chairperson, PPV&FRA, New Delhi

Co-Chairman : **1. Dr. Malavika Dadlani**
Former JDR, ICAR-IARI, New Delhi
2.Dr. J. S. Chauhan
Former ADG (Seeds), ICAR, New Delhi

Rapporteur : **Dr. K Kanaka Durga**
Pr. Scientist (Pl. Br.), SRTC, PJTSAU, Hyderabad
Dr Nitin Rastogi
Senior Scientist (Pl. Br.), IGKV, Raipur

The nodal officers from 14 centres (MPKV, Rahuri; PDKV, Akola; VNMKV, Parbhani; JNKVV, Jabalpur; IGKV, Raipur; KKV, Dapoli; VSI, Pune; RVSKVV, Gwalior; ICAR-CICR, Nagpur; ICAR-IISR, Indore of Central Zone and AAU, Jorhat; UBKV, Pundibari; CAU, Imphal; ICAR RC-NEH, Barapani of North Eastern Zone) presented the progress made in breeder seed production, seed technological research component of AICRP-NSP (Crops) and ICAR Seed Project during 2017-18. The salient points which emerged are listed below.

- MPKV, Rahuri should make efforts to enhance SRR in groundnut
- In view of huge demand for sorghum variety M 35-1, efforts should be made by MPKV, Rahuri to produce quality seed and be distributed to farmers of Maharashtra
- Dr. PDKV, Akola should make efforts to reduce the shortfalls in seed production of soybean and groundnut and to fulfill the targets in all the crops under different classes of seed
- Dr. PDKV, Akola should maintain the breeder seed production plots as per the prescribed field standards
- VNMKV, Parbhani should make efforts to fulfill the targets in all the crops under different classes of seed
- VNMKV, Parbhani should plan the experiment on “Development of technologies for mitigating heat stress in field crops” in such a way that the flowering period should be exposed with the elevated temperatures
- VNMKV, Parbhani should meet out the negative balance under the STR from the revolving fund
- JNKVV, Jabalpur should pursue the MP government for non-lifting of breeder seed

- Production of breeder seed should be proportionate to the targets keeping in view the non-lifting cases at JNKVV, Jabalpur
- JNKVV, Jabalpur should distribute quality seeds in place of breeder seed under TSP programme
- JNKVV, Jabalpur should refund the seed money of Rs. 40 lakhs immediately to ICAR-IISS, Mau
- IGKV, Raipur should take initiatives to avoid varietal mis-matches in seed production of various crops
- RVSKVV, Gwalior should take up production of foundation seed, certified seed under participatory seed production in the farmers' fields
- ICAR RC NEH, Barapani should focus attention on multiplication of popular traditional varieties to enhance productivity and profitability of the farmers
- ICAR-CICR, Nagpur should become a model centre for seed production of non Bt traditional varieties
- UBKV, Pundibari, West Bengal should include B-9 a yellow sarson variety under rapeseed in place of mustard
- All the co-operating centres should focus attention on the following points:
    - Encourage women farmers to participate in the capacity building programmes
    - Promote seed production of unique farmers or traditional varieties under TSP programme
    - Proper care should be taken before presenting the progress report
    - Targets for the ensuing year should be fixed on the basis of quantity of seed lifted in the last year
    - Analyze the varietal shift of major crops in their respective states for the last five years
    - The format of presentation provided by IISS should be strictly followed
    - Steps should be initiated to avoid varietal mis-matches in seed production of various crops
- All the PIs presented the technical programme for 2018-19 which was finalized in the concurrent sessions of respective disciplines.

The session ended with thanks to the chair and co-chair.

Finalization of Recommendations and Technical Programme Formulation for

2018-19

A. Seed Production and Certification

Date: 10.05.2018

Chairman	:	**Dr. R. R. Hanchinal** Former Chairperson, PPV&FRA, New Delhi
Co-Chairman		**Dr. Rajendra Prasad** Former Director, ICAR-IISS, Mau
Convener		**Dr. G. K. Koutu,** Principal Scientist, JNKVV, Jabalpur

The scientists involved in conducting experiments of seed production and certification participated in the deliberations. The progress, bottlenecks and performance of centers along with experiments conducted were discussed and points for improvement were also suggested. The observations, decisions, recommendations and technical programme for 2018-19 were finalized and are reported here under:

Observations

The delay in receipt of data and reports is being observed and it should be avoided. Data should be reported uniformly in the standard format and should be sent in time. The deviations and vitiations in conduction of experiments including difficulties should be communicated well in advance to the concerned PI and Director, ICAR-IISS, Mau.

Decision taken:

- **Centers should follow the technical programme strictly without any alterations.**
- **Reporting of the data in the format after proper statistical analysis should be submitted.**
- **Deadline given in the calendar of events given in the proceedings, should be strictly followed.**
- **Centers should provide cost benefit ratio of each experiment conducted.**
- As per the recommendation of last meeting and suggestions from ADG (seeds), centers should provide soil test report and meteorological data to analyze the environmental variations between the centers. Centres should strictly abide by this decision, however, the data will not be considered valid without soil test report and meteorological data report.
- Centers are requested to provide CV and CD data for the experiments conducted as standard error is not sufficient to analyze the precision of the experiment.

- As per the technical program guidelines, centre should provide the net and gross plot area.

Recommendations:

These recommendations will be validating through demonstration trials at centres where experiments had been conducted previously and ICAR Seed Project Centres with five demonstrations of one acre each

- In Vegetable Pea, seed priming with commercial formulation of Sodium Molybdate @ 0.5g/l + Seed coating with *T. harzianum* @15g /Kg seed prior to sowing enhances the plant stand and health that leads to increase in number of pods/plant, seed weight, seed germination and seed vigour, resulting in higher yield.

Crop	Validating centres
Field Pea	CSAUAT, Kanpur; JNKVV, Jabalpur; ICAR-IISS, Mau & ICAR Seed Project Centres (IIPR, Kanpur; BAU Ranchi)

- In Kabuli Chick Pea, seed priming with Carboxin + Thiram (as Vitavax Power) @ 2.5g / Kg seed prior to sowing enhances the plant stand and health that lead to increase in number of pods per plant, number of nodules, seed germination resulting in higher yield.

Crop	Validating centres
Kabuli chick pea	PAU, Ludhiana; JNKVV, Jabalpur; UAS, Raichur; SKNAU, Jobner (Durgapura); PDKV, Akola and CCSHAU, Hisar & ICAR Seed Project Centres (CSKHPKVV, Palampur; MPKV, Rahuri; UAS, Dharwad)

- In lentil, seed priming with commercial formulation of Sodium Molybdate @ 0.5g/l + *T. harzianum* @15g /Kg seed prior to sowing enhances the plant stand and health that leads to increase in number of pods/plant, number of nodules, seed germination and seed vigour, resulting in higher yield.

Crop	Validating centres
Lentil	JNKVV, Jabalpur; NDUAT, Faizabad; CSAUAT, Kanpur and SVBPUAT, Meerut & ICAR Seed Project Centers (PAU, Ludhiana; CSKHPKVV, Palampur; AAU, Jorhat)

- In Dhaincha, Sunhemp and Pillipesara, foliage application of DAP (20g/1L water) incorporated with micronutrient mixture containing Zinc as Zinc sulphate (5g/L water) + Boron as Boric acid (3g/L water) at flowering stage and removal of terminal bud (pinching or nipping) enhances the number of pods/plant, root nodules and seed quality characters resulting in higher yield. Nipping should be done on Daincha at 60 DAS,

Pillipesara at 30 DAS. In sunhemp, the main stem when attains a height of 90cm, nipping shall be done to break apical dominance and more branching.

Crops	Validating Centers
Dhaincha (*Sesbania aculeata*)	TNAU, Coimbatore; AAU, Jorhat; MPKV, Rahuri; UAS, Dharwad; PJTSAU, Hyderabad; RPCAU, Pusa; BCKV, Nadia; PAJANCOA&RI, Karaikal; JAU, Junagadh; OUAT, Bhubaneswar; HPKV, Palampur and CCSHAU, Hissar, RVSKVV, Gwalior
Sunhemp (*Crotolaria juncea*)	TNAU, Coimbatore; AAU, Jorhat; MPKV, Rahuri; UAS, Dharwad; ANGRAU, Guntur; BCKV, Nadia, JAU, Junagadh (Jamnagar), RVSKVV, Gwalior
Pillipesara (*Vigna trilobata)*	TNAU, Coimbatore; MPKV, Rahuri; UAS, Dharwad; ANGRAU, Guntur; JAU, Jamnagar

Technical Programme

Experiment 1. Standardization of isolation distance for hybrid seed production of mustard

(Both pollen parent (R line) and female parent (CMS line) will supplied by Dr. S.K. Chakraborthy, Principal Scientist, ICAR-IARI, New Delhi, Mob. No. 9968279444)

Year of start: 2017-18

Centers: IARI, New Delhi; PAU, Ludhiana; GBPUAT, Pantnagar; JNKVV, Jabalpur and NDUAT, Faizabad

Methodology

- Restorer line/pollen parent to be surrounded in all the four sides or one side (along the wind direction) by CMS line (female parent) at different distances viz. 100, 125,150, 200, 250,300, 350, 400,450, 500, 550 meters.
- Pollen parent: plot size of 1.5 m (width) X 24 m (length) with spacing of 45 X 15 cm to be grown in the center. (Minimum number of rows are 3)
- Pollen parent to be surrounded by the CMS line at different distances mentioned above (as depicted in the diagram for maize). Two rows of female line (of 2 meters length).

Observations

- Seed setting percentage in CMS line to be recorded at all distances.
- Per cent seed set in the CMS line should be recorded and submitted in the format given below

Mustard (*Brassica*)

Directions	**% Seed Set**										
	100 m	**125 m**	**150 m**	**200m**	**250m**	**300m**	**350m**	**400m**	**450 m**	**500 m**	**550m**

West											
East											
North											
South											

Experiment 2. Integrated approach for enhancing seed yield and quality in millets
Year of start: 2015-16

Crop	Centers
Finger millet	UAS, Bangalore; ANGRAU, Guntur; UAS, Dharwad; KKV, Dapoli; HPKV, Palampur and IGKV, Raipur
Foxtail millet	ANGRAU, Guntur; TNAU, Coimbatore and UAS Dharwad.
Kodo millet	JNKVV, Jabalpur; TNAU, Coimbatore and ANGRAU, Guntur
Proso millet	ANGRAU, Guntur; UAS, Bangalore and RPCAU, Pusa
Little millet	JNKVV, Jabalpur; TNAU, Coimbatore and IGKVV, Raipur

Objective: To standardize suitable seed quality enhancement techniques to enhance the production potential of millets

SMALL MILLETS TREATMENT DETAILS	
No of treatments	**Main plots** (Nutrient management): **04** **Sub-plots** (Seed Priming): **04**
Sowing method	
Finger millet: Transplanting with spacing of 30 X 10 cm (raising a nursery and transplanting at 21 days in wet field capacity of soil) **Other four millets:** Direct sowing – 30 x 10 cm – sown at 3-4 cm depth	
Note 1. Only one method of planting should be followed for each crop as mentioned above. 2. Nursery management and Transplanting (Finger millet) for one ha. Of main field: • Select 12.5 cents (500 m2) of nursery area near a water source, where water does not stagnate. Mix 37.5 kg of super phosphate with 500 kg of FYM or compost and spread the mixture evenly on the nursery area. • Plough two or three times with a mould board plough or five times with a country plough form raised beds by marking units of 6 plots each of size 3m x 1.5 m. • Provide 30 cm space between plots for irrigation. • Excavate the soil from the interspace and all around to a depth of 15 cm to form channels and spread the soil removed from the channels on the bed and level it. 4-5 days before removing plants, spray the nursery with the fungicide Mancozeb 75% W.P @ 2 gm /liter • Transplant the seedling from the nursery into the main field when they are only 15-25	

<table>
<tr><td colspan="3">days old.
• Before transplanting, irrigate the nursery for approximately 2 hours in advance, to moisten and loosen the soil for removing the plants easily if the soil is dry in that time.</td></tr>
<tr><td colspan="3">• Carefully uproot the seedlings, keeping the soil intact around the roots; if possible lift them out with a trowel or spade as this gives support to the soil and helps to keep it intact with the roots.
• Transfer the uprooted seedlings to the main plot within the next 30 minutes, before the roots and soil can dry out. The spacing will be 30 x 10 cm by using a rope or a marker.
• Transplant the seedlings at shallow depth in the pits; do not press or inure the roots while placing the seedlings at the intersection of planting lines.
3.Micronutrients: magnesium (20 kg per acre) and calcium (6 kg per acre) or dolomite / limestone (40 kg per acre). Apply these micronutrients, 20-25 days before transplantation in the field.</td></tr>
<tr><td colspan="3">Treatment details</td></tr>
<tr><td colspan="3">I. Main-Plot treatments (Nutrient management)</td></tr>
<tr><td colspan="3">N1 – No fertilizer</td></tr>
<tr><td colspan="3">N2 – 125 kg Neem + 1250 kg Vermi compost per ha or 12.5 tons FYM/ha</td></tr>
<tr><td colspan="3">N3 – 50 kg Urea + 50 kg Super phosphate and 50 kg Muriate of potash per ha + Top dressing urea at 3-4 weeks after transplanting + 2% Borax spay at flowering</td></tr>
<tr><td colspan="3">N4 - 125 kg Neem + 1250 kg Vermicompost (or) 12.5 tons FYM/ha + 50 kg Urea + 50 kg super phosphate and 50 kg Muriate of potash per ha + Top dressing urea at 3-4 weeks after transplanting + 2% Borax spay</td></tr>
<tr><td colspan="3">II. Sub-plot treatments (Priming)</td></tr>
<tr><td colspan="3">P1 – Control - No priming</td></tr>
<tr><td colspan="3">P2 - Hydropriming for 6 h (Finger millet, Kodo millet), 8 h (Foxtail millet, Proso millet, and Little millet) by adopting seed to solution ratio of 1:1 and then mixing with Carbendazim (Bavistin) @ 2.5 -3.0gm/kg seeds and leaving the mixture for 24 hours before sowing</td></tr>
<tr><td colspan="3">P3 – Seed priming with 2 % KH2PO4 for 6 h (Finger millet and Kodo millet), 8 h (Foxtail millet, Proso millet and Little millet) by adopting seed to solution ratio of 1:1 and then mixing with Carbendazim (Bavistin) @ 2.5-3.0gm/kg seeds, and leaving the mixture for 24 hours before sowing</td></tr>
<tr><td colspan="3">P4 – Seed priming with 20 % liquid Pseudomonas fluoresces</td></tr>
<tr><td colspan="2">Design</td><td>Split Plot Design</td></tr>
<tr><td colspan="2">No. of replications</td><td>3</td></tr>
<tr><td>Plot size</td><td>Gross plot size</td><td>2 m × 5.0 m (10.0 m^2)</td></tr>
<tr><td colspan="2">Space between plots</td><td>60 cm</td></tr>
<tr><td colspan="2">Recommended dose of fertilizer (NPK)</td><td>75 kg P_2O_5 and 25 kg K_2O per ha or best recommended fertilizer dosage for your state,</td></tr>
</table>

	region or zone
Cultivar	Any recommended (bunch or spreading type) cultivar appropriate for seed production season
Source fertilizers	
1. Nitrogen	Urea (46 % N)
2. Phosphorus	Single super phosphate (SSP) (16 % P_2O_5)
3. Potassium	Muriate of potash (MOP) (60 % K_2O)
OR	
1. Nitrogen and Phosphorus	Diammonium Phosphate (DAP) (18 % N and 46 % P_2O_5)
2. Potassium	Muriate of potash (MOP) (60 % K_2O)
Pest / disease control • **Blast:** Seed treatment, mixing Carbendazim (Bavistin) @ 2.5 gm/kg seed for at least 30 minutes. • **Seedling blight:** Spray Mancozeb 75 % WP @ 2 gm per liter in the nursery 15 days before sowing or 15 days after transplantation. • **Downy mildew:** Spray the crop with Mancozeb 75 % W.P. @ 2 gm per liter of water at the onset of the disease, or when symptoms are seen in 5-10% of the plants. • **Stem borer:** Use regent granules in the amount of 7 kgs / acre. In case of liquid formulation,1 ml of the regent chemical should be mixed with 2 liters of water.	

Observation

- Field emergence
- Plant height at 30 days and at harvest
- Chlorophyll content
- Days to first flowering
- Days to 50% flowering
- No. of tillers plant^{-1}
- Seed yield plant-1
- Seed yield ha-1
- 100 seed weight
- Seed recovery percent
- Resultant seed quality - seed germination and vigour index
- Cost Benefit ratio

Experiment 3: Planting windows for quality seed production of soybean in offseason (will continue)

Centers	Varieties
UAS- Dharwad	Dsb 21 (Oct. to January end)

UAS, Bangalore	JS 335 (Mandya) (in paddy fallows Nov. to Jan.)
MAU, Parbhani	MAUS 162 (Oct. to January end)
PJTSAU, Hyderabad	JS 335 (Andhra and Telangana) (Oct. to January end)
JNKVV, Jabalpur	JS 20-34 and JS 20-29 (Nov. to Jan. End)
MPKV, Rahuri	JS 335 and MAUS 162 (Sept. to January)

Objective: To standardize best planting date for off season soybean seed production and to assess seed quality.

Experimental details

Design : FRBD Replication : Three

Plot size : 3.6 m ×5.0 m Sowing : Ridges and furrow

Spacing : 45 × 5 cm

Fertilizer & Micro nutrients

50% higher dose than RDF 20:80:40 kg/ha (415kgDAP /ha), Ridge sowing + soil application of ZnSo4 @ 30 kg/ha along with foliar spray @ 0.5% at 48 and 56 days after sowing

Season: Best date of sowing for off season crop- centers will decide based on their data

Observations to be recorded

A. Growth and yield parameters

1. Field emergence (%)
2. Plant height (cm)
3. Number of primary branches per plant
4. Days to 50% flowering
5. Days to maturity
6. Number of pods per plant
7. Number of seeds per pod
8. Seed yield per ha.
9. Harvest index (%)

B. Flowering and Pod characteristics

1. Days to flower initiation
2. Days to 50% flowering
3. Days to pod maturity
4. Length of pod (cm)
5. Diameter of pod (cm)
6. Shattering (%)

C. Seed Morphometry (Image Analysis)

1. Length of seed (mm)
2. Width of seed (mm)
3. Area of seed (mm2)

4. Seed Diameter (mm)
5. Seed perimeter (mm)
6. Seed roundness

D. Biochemical parameters

1. Protein content (%)
2. Oil content (%)

E. Cost Benefit ratio

F. Storage study

The seeds from offseason production will be evaluated for seed quality parameters at monthly interval.

1. Germination (%)
2. Moisture content
3. Seed vigour
4. Dry matter production
5. Seed mycoflora
6. Electrical conductivity

Experiment 4: Optimization of seed rate in Soybean (*Glycine max* L.) (will continue this year)

Year of start: 2017-18

Centers	**Variety**	
	Medium maturity	**Early Maturity**
JNKVV, Jabalpur	JS 20-29	JS 20-34
RVSKVV, Gwalior	JS 20-29	JS 20-34
VNMKV, Parbhani	MAUS 162	JS 20-34
UAS, Dharwad	Dsb 21	JS 93-05
MPKV, Rahuri	KDS 344	JS 93-05
AU, Kota	RKS 45	JS 20-34
IISR, Indore	NRC 86	JS 20-34
PDKV, Akola	NRC 86	JS 20-34
PJTSAU, Hyderabad	Any suitable variety	Any suitable variety
UAS, Bengaluru	Any suitable variety	Any suitable variety

Objectives: Soybean crop is highly sensitive to climatic factors and supply of quality seeds is becoming a critical problem due to climatic uncertainties. Study need to be conducted on reduction of seed requirement with following objectives

- To increase the productivity with reduced seed rate

- To study the effect of less plant population on control of insect and disease infestation
- To enhance the Interaction of early and medium maturing varieties to reduced seed rate
- To find out economic viability of low seed rate and production

Treatment details

Main-Plot treatments

T_0 - Recommended seed rate @ 70 kg/ha

T_1 - Reduced seed rate @ 60kg/ha

T_2 - Reduced seed rate @ 50kg/ha

II. Sub-plot treatments (Sowing method)

S1-Hand dibbling with ridge & furrow

S2-Flat bed

Technical Details

- Plot size: 6 rows of 6m for each treatment
- Uniform seed treatment: 2g Xelora + 1.5 g Vitavax power + 2 g Thiomethoxam + 5 ml water per kg seed.
- Weed management: Due to less plant population weed may be more. Pre (Diclosulam @ 26g/ha) and post emergence (Imazythopyr @ 1 l/ha) herbicides may be followed.
- Sowing by dibbling of single seed per spot as per spacing at uniform depth of 3-5 cm.
- No. of replications: 4
- Experimental design: Split Plot design

Observations to be recorded

1. Plant population per sq. meter
2. Plant height at maturity
3. Plant canopy diameter
4. Number of branches per plant
5. Number of pods per plant
6. Yield per plant
7. Yield per ha.
8. 100 seed weight
9. Seed quality parameters (Germination % and SVI-I & II)
10. Storability of seeds at monthly interval (Germination %; seedling length; Seed Vigor; Dry matter production; Seed health)
11. Information on pests & diseases during crop growth.
12. Cost benefit ratio

Experiment 5: Redefining isolation distance of IMSCS 2013 in pigeonpea, cotton and maize.

Objectives: To redefine isolation distance of contaminants for foundation and certified seed production of pigeonpea, cotton and maize.

Year of start: 2018-19

Crop	Centers
Pigeonpea	PJTSAU, Hyderabad; MPKV, Rahuri; GBPUAT, Pantnagar
Cotton	PDKV, Akola; CICR, Nagpur; HAU, Hisar; UAS, Dharwad; JAU, Jamnagar
Maize	IARI, New Delhi; UAS, Dharwad; PAU, Ludhiana and GBPUAT, Pantnagar

Methodology:

- In pigeonpea, pollinator (R/B line) to be surrounded in all the four sides or one side (along the wind direction) by A line at different distance i.e., 100, 150, 200, 250 and 300m. Sufficient quantity of seeds of A line and pollinator (B/R line) should be **procured and supplied by JNKVV, Jabalpur**. Plot size 2m (width) x 10 m (length) with spacing of 60 X 30 cm row to row and plant to plant distance should be maintained (R/B line). Pollen parent to be surrounded by the CMS line at different distances mentioned above (as depicted in the diagram for maize). Two rows of female line (of 2 meters length).
- In cotton, pollen parent (R/B line) to be surrounded in all the four sides or one side (along the wind direction) by A line at different distance i.e., 25, 50, 75 and 100m. Sufficient quantity of seeds of pollen parent (B/R line) and A line should be **supplied by PDKV, Akola**. Plot size 2.5 m (width) x 8 m (length) with spacing of (75x45cm) row to row and plant to plant distance (R/B line). Pollen parent to be surrounded by the CMS line at different distances mentioned above (as depicted in the diagram for maize). Two rows of female line (of 2 meters length).
- In maize, pollen parent to be surrounded in all the four sides or one side (along the wind direction) by female parent at different distance i.e., 400, 450, 500, 550, 600, 650 and 700m. To avoid selfing in female parent detasselling should be followed strictly. Precaution should be taken that maize crop of other maize varieties should not be there in the periphery of 700m. Sufficient quantity of seeds of pollen parent and female parent should be **supplied by IIMR, New Delhi/ own source**. Plot size 3m (width) x 15m (length) with spacing of 60 cm row to row and 20 cm plant to plant distance (Pollen parent). Pollen parent to be surrounded by the female parent at different distances mentioned above (as depicted in the diagram for maize). Two rows of female parent (of 2 meters length).

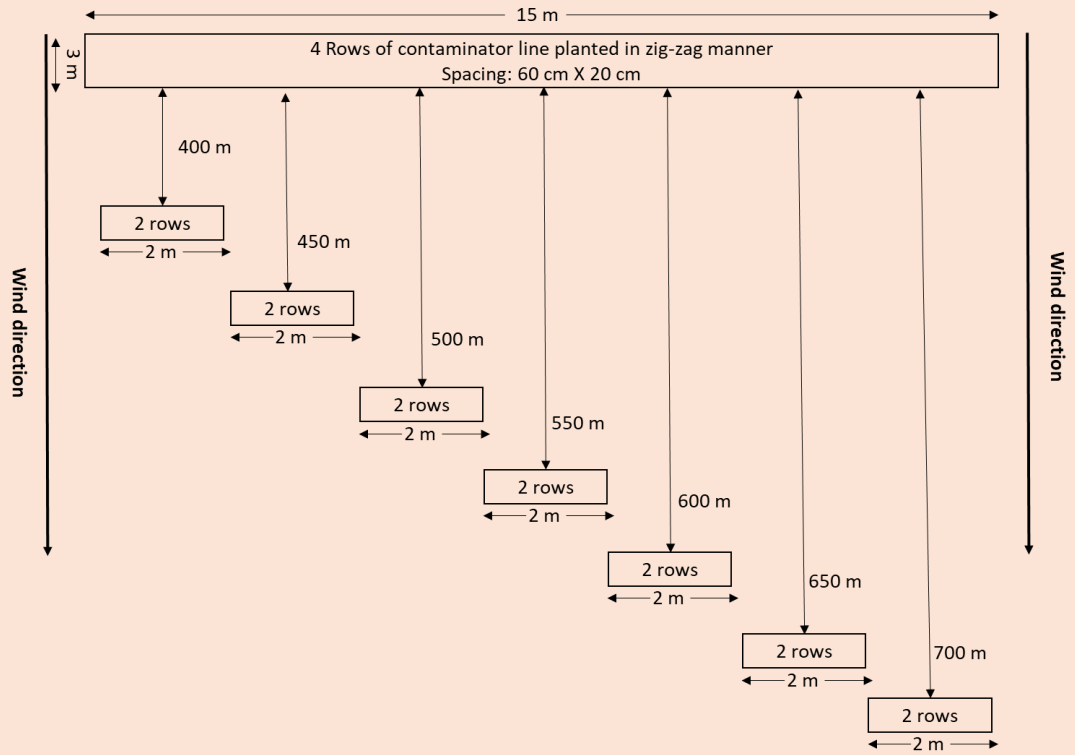

Fig.1 Schematic field layout for standardization of Isolation distance for maize

Observation to be recorded: Seed setting percentage in contaminator line should be recorded from all four directions at different distances in the following format.

Pigeon pea (Foundation: 250m and certified seed: 100m as per IMSCS 2013 norms)

Directions	% Seed Set				
	100m	150m	200m	250m	300m
West					
East					
North					
South					

Cotton (Foundation: 50m and certified seed: 30m as per IMSCS 2013 norms)

Directions	% Seed set			
	25m	50m	75m	100m
West				
East				
North				
South				

Maize (Foundation: 600m and certified seed: 400m as per IMSCS 2013 Norms)

	% Seed Set						
Directions	400m	450m	500m	550m	600m	650m	700m
West							
East							
North							
South							

Experiment 6: Redefining IMSCS 2013 for seed standard (ODV) in rice

Rationale

Foundation seed: Spacing of 20×10 cm leads to 500000 plant population; as SMR of paddy is 80; field standard (off-type) of 0.05% corresponds to 250 off-type plants/ha i.e. 250*80 = 20000 seeds / 25 q, whereas ODV/kg corresponds to 8/kg through field standard calculation however prescribed limit for ODV is 10/kg as per IMSCS standards, 2013.

Certified seed: Spacing of 20×10 cm leads to 500000 plant population; as SMR of paddy is 80; field standard (off-type) of 0.2% corresponds to 1000 off-type plants/ha i.e. 1000*80 = 80000 seeds / 25 q and whereas ODV/kg corresponds to 32/kg through field standard calculation however prescribed seed standard for ODV is 20/kg, corresponds to disparity among field and seed standards as per IMSCS, 2013. Hence, seed standard i.e., ODVs limit for paddy needs to be redefined.

Objectives

1. To redefine IMSCS 2013 norms for ODVs (No/kg) in foundation seed class of rice.
2. To redefine IMSCS 2013 norms for ODVs (No/kg) in certified seed class of rice.

Centers : PJTSAU Hyderabad; TNAU Coimbatore; PAU Ludhiana; IARI New Delhi; OUAT, Bhubaneshwar; ICAR-IISS, Mau; NDUA & T, Faizabad

Methodology

Plot size: 10 m X 4m (40 m^2 approximate plant population shall be 2000 plants) with spacing of 20 cm X 10 cm

Replications: 3

Treatment

A. **Foundation seed class (maximum permitted off-types as per IMSCS, 2013 is 0.05%)**

   Treatment: 2000 seeds (breeder seed) with one admixture (ODV)

Where 2000 seeds (breeder seed) of popular rice varieties **(atleast three varieties, one from each distinct groups viz. small, medium & long)** may be taken and **a single seed (ODV)** should be intentionally mixed for referred study.

B. Certified seed class (maximum permitted off-types as per IMSCS, 2013 is 0.2%)

Treatment: 2000 seeds (foundation seed) with four admixtures (ODV)

Where 2000 seeds (foundation seed) of popular rice varieties **(atleast three varieties, one from each distinct groups viz. small, medium & long)** may be taken and **four seeds (ODV)** should be intentionally mixed for referred study.

Note:

Admixture shall be morphologically identified as distinctive variety at seed level (but relatively of similar seed size)

Presence of offtype (mixed ODV seed) plant/s should be ensured (one for FS production & four for CS production) in plant stand

Observation to be recorded

Entire quantity of seed produced (each replication of a variety should be handled separately) shall be bulked and mixed thoroughly (BS to FS and FS to CS), from this, 400 g of sample may be extracted by proper mixing and dividing. Referred sample may be carefully analyzed for presence of ODV by keeping reference samples as check.

Reporting of result

Result obtained on 400 g of sample (three replications) may be extrapolated to 1000 g.

Class of seed	ODV observed (No/ kg)	ODV as per IMSCS, 2013 (No/ kg)
Foundation		
Small		
R1		
R2		
R3		
Medium		
R1		
R2		
R3		
Long		
R1		
R2		
R3		
Certified		
Small		

R1		
R2		
R3		
Medium		
R1		
R2		
R3		
Long		
R1		
R2		
R3		

Experiment 7: Development of Seed Production Technology for *Chenopodium quinoa* crop

Objective: To standardize suitable seed quality enhancement techniques to enhance the production potential of *Chenopodium quinoa*

Seed source: Seed Source will be supplied by Dr. Sharma, SKRAU-Bikaner, Mobile No.:9414451910/ 7014149820to the respective centers who will execute the experiment.

Crop	Centres
Chenopodium quinoa	HPKV, Palampur, JAU, Jamnagar and SKRAU-Bikaner

TREATMENT DETAILS

No of treatments **Main plots** (Nutrient management): **04**
Sub-plots (Seed Priming): **03**

Sowing method

Direct sowing – 30 x 10 cm – sown at 3-4 cm depth

Only one method of planting should be followed for each crop as mentioned above.

Micronutrients: magnesium (20 kg per acre) and calcium (6 kg per acre) or dolomite / limestone (40 kg per acre). Apply these micronutrients, 20-25 days before sowing in the field.

Treatment details

I. Main-Plot treatments (Nutrient management)

N1 – No fertilizer

N2 – 80 kg Urea + 50 kg Super phosphate and 50 kg Muriate of potash per ha+ 2% Ferrous sulphate spray at flowering

N3 – 80 kg Urea + 50 kg Super phosphate and 50 kg Muriate of potash per ha + 2% DAP spray at pre-flowering

N4 - 125 kg Neem + 1250 kg Vermicompost (or) 12.5 tons FYM/ha + 80 kg Urea + 50 kg super phosphate and 50 kg Muriate of potash per ha

II. Sub-plot treatments (Priming)

P1 – Control - No priming

P2 - Seed priming with *T. harziannum* (1.5%)

P3 – Seed priming with 20 % liquid *Pseudomonas fluorescence*

Design	Split Plot Design
No. of replications	3
Plot size **Gross plot size**	2 m × 5.0 m (10.0 m^2)
Space between plots	60 cm
Cultivar	Any recommended cultivar appropriate for seed production season
Source fertilizers	
1. Nitrogen	Urea (46 % N)
2. Phosphorus	Single super phosphate (SSP) (16 % P2O5)
3. Potassium	Muriate of potash (MOP) (60 % K2O)
OR	
1. Nitrogen and Phosphorus	Diammonium Phosphate (DAP) (18 % N and 46 % P2O5)
2. Potassium	Muriate of potash (MOP) (60 % K2O)

List of Participants

S. No.	Name	Designation	Centre	Email & Contact No.
1.	Dr. S. Rajendra Prasad	Former Director, IISS, Mau & Dean	CoA, GKVK, UAS, Bengaluru	srprasad1989@yahoo.co.in 9452883308
2.	Dr. G.K. Koutu	Principal Scientist & PI, Seed Production & Certification	JNKVV, Jabalpur	gk_koutu@yahoo.co.in 9424676726
3.	Dr. K.K. Dhedhi	Seed Research Officer	Pearl Millet Res. Station, JAU, Jamnagar	kkdhedhi@rediffmail.com 9428125674
4.	Dr. A.D. Patel	Research Scientist & Nodal Officer, ISP	AAU, Anand	nodalofficerseed@aau.in 9879000609
5.	Dr. M.D. Khanpara	Research Scientist (Pearl millet) (STR)	JAU, Jamnagar	rspearlmillet@jau.in 9429501621
6.	Dr. C.G. Intwala	Nodal Officer (ICAR Seed Project)	NAU, Navsari	megaseed.nau@gmail.com 9898116113
7.	Dr. V.J. Bhatiya	Nodal Officer (ICAR Seed Project)	JAU, Junagadh	megaseed@jau.in 9979298557
8.	Dr. J.B. Patel	Research Scientist	JAU, Junagadh	jbpatelvasai38@gmail.com 9909055981

9.	Dr. Prakash Borah	Pr. Scientist (PB) & Incharge, NSP Unit	AAU, Jorhat	pborah01@gmail.com 9435095462
10.	Dr. Sripathy K.V.	Scientist (Seed Technology)	ICAR-IISS, Mau	kudekallu2@gmail.com 8005202449
11.	Dr. Govind Pal	Principal Scientist (Agril. Economics)	ICAR-IISS, Mau	drpal1975@gmail.com 9473821374
12.	Dr. Parashiva Murthy	Professor (SST)	UAS, Bangaluru	parashiva2005@gmail.com 9886038788
13.	Dr. K. Madhusudan	Special Officer (Seeds)	UAS, Bangaluru	sosnsp@gmail.com 9449866925
14.	Dr. Faseela K.V.	Asst. Professor (PB&G)	KAU, Pattambi	faseela.kv@kau.in 9947542929
15.	Dr. Vijay R. Shelar	Seed Research Officer	STRU, MPKV, Rahuri	seedtech.mpkv@gov.in 8329938350
16.	Dr. Sharad Tiwari	Director (Farms)	JNKVV, Jabalpur	shtiwari@gmail.com 9424658241
17.	Dr. R.S. Shukla	Principal Scientist (BSP)	JNKVV, Jabalpur	shukla.rs90@gmail.com 9424676727
18.	Dr. Umesh Chandra Kalita	Principal Scientist (PB), STR	AAU, Jorhat	umesh_aau@yahoo.com 9435066205
19.	Dr. Bhojaraja Naik K.	Scientist (Plant Breeding)	ICAR-IISS, Mau	bharana.naik@gmail.com 8792695917
20.	M.V. Nagesh Kumar	Director (Seeds)	PJTSAU, Hyderabad	srtcpjtsau@gmail.com 8008404874
21.	Dr. K. Kanaka Durga	Principal Scientist (Plant Breeding)	SRTC, PJTSAU, Hyderabad	kanakakilaru@yahoo.com 9246243226
22.	Dr. Monika A. Joshi	Principal Scientist	ICAR- IARI, New Delhi	monikakshat622@gmail.com 9910026346
23.	Dr. Tarsem Singh Dhillon	Assoc. Director (Seeds)	PAU, Ludhiana	tarsemdhillon@pau.edu 9464037325
24.	Dr. I. Swarnalatha Devi	Principal Scientist (Plant Breeding)	SRTC, PJTSAU, Hyderabad	inapanuri.72@gmail.com 9440030212
25.	Dr. Lakshmi Kant	Nodal Officer, BSP & ICAR Seed project	ICAR-VPKAS, Almora	lakshmi.kant@icar.gov.in
26	Dr. Sanjay Kumar	Pr. Scientist & Nodal Officer (Seed)	ICAR- IARI, New Delhi	iariseed@gmail.com 09013563919
27.	Dr. R.P. Singh	Director (Seed & Farms)	BAU, Ranchi	dsfbau@rediffmail.com 9431701162
28.	Dr. Basave Gowda	Special Officer (Seeds)	UAS, Raichur	soseeds@uasraichur.edu.in
29.	Dr. Ashwani Kumar	Senior Scientist	ICAR- IARI, RS, Karnal	ashamash@gmail.com 9416251530
30.	Dr. S. S. Katake	Scientist	VSI, Pune	ss.katake@yahoo.in 8446386262
31.	Shri. R.M. Kokate	Asstt. Plant Breeder (BSP)	VNMKV, Parbhani	parbhaniseed@gmail.com 9422179938
32.	Dr. D.G. Dalvi	SRO	VNMKV, Parbhani	dalvi46@rediffmail.com 7588082160

33.	Dr. Gowhar Ali	Assistant Professor (BSP)	SKUAST-K, Srinagar	gowharpbg@gmail.com 7006353051
34.	Prof. M Ashraf Bhat	Nodal Officer (Seed)	SKUAST-K, Srinagar	mashrafbhat@skuastkashmir.ac.in 9419782624
35.	Dr. C.B. Singh Gangwar	SRO	CSAUA&T, Kanpur	cbgangwar7@gmail.com 9450935223
36.	Dr. R.K Kataria,	Principal Scientist (Agronomy) STR	CSKHPKV, Palampur	kataria1961@gmail.com 9418031137
37.	Dr. S. B. Thawari,	Assistant Seed Research Officer	DBSKKV, Dapoli	sachinthawari@gmail.com 9096322462
38.	Dr. U.K. Singh	Junior Scientist	TCA, Dholi DRPCAU, Pusa	uksinghraupusa@gmail.com 9931956795
39.	Dr. N.K. Rastogi	Sr. Scientist & Incharge, BSP	IGKV, Raipur	nspigkv@gmail.com 9425510169
40.	Dr. S.S. Sengar	Director Farms	IGKV, Raipur	directorfarmsigkv@gmail.com 9425535634
41.	Dr. V.S. Kandalkar	Principal Scientist and Nodal Officer (ICAR Seed Project)	RVSKVV, Gwalior	vsntkandalkar@gmail.com 9425087311
42.	Dr. J.N. Rai	Seed Production Officer	Dholi DRPCAU, Pusa	j.n.rai1954@gmail.com 9472551644
43.	Dr. R.B. Yadav	Professor & Nodal Officer, ICAR Seed Project	SVPUA&T, Meerut	nodalofficersvpuat@gmail.com 9412525632
44.	Dr. Mrigendra Ghosh	Director (Farms) & Nodal Officer, ICAR Seed Project	UBKV, Pundibari	adfagubkv@gmail.com 9732359206
45.	Dr. Prabir Chakraborti	Nodal Officer, ICAR- Seed Project	BCKV, Nadia, West Bengal	prabcbckv@gmail.com 9433805401
46.	Dr. Prabir Kumar Bhattacharyya	Officer-incharge, BSP	BCKV, Nadia, West Bengal	bhattacharyya.pk@gmail.com 9433242858
47.	Mr. Jogendra Singh	Asstt. Professor (PBG), STR	SKNAU, Jobner	jschouhanpbg@gmail.com 9772072274
48.	Dr. M.M Sharma	Additional Director Research (Seed)	SKRAU, Bikaner	mmohanrau@yahoo.com 9414451910
49.	Dr. S. Mohanty	ASRO (Seed Production)	OUAT, Bhubaneswar	simantamohanty@yahoo.com 9437301110
50.	Dr. Axay Bhuker	Assistant Scientist	CCS HAU, Hisar	bhuker.axay@gmail.com 9812375695
51.	Dr. V.S. Mor	Assistant Scientist (STR)	CCS HAU, Hisar	virendermor@gmail.com 9468337001
52.	Dr. M.K. Kuchlan	Scientist (SS)	ICAR-IISR, Indore	mrinal.kk@gmail.com 9009562694
53.	Dr. V. Vakeswaran	Assistant Professor (SST), Seed Centre	Seed Centre, TNAU, Coimbatore	vakeswaran@gmail.com 9952176477
54	Dr. S.M. Mantur	Special Officer (Seeds)	Seed Unit, UAS, Dharwad	soseed@uasd.in 9448497353
55	Dr. P.S. Shukla	Joint Director) & Nodal Officer (BSP)	GBPUAT, Pantnagar	jdbspc1@gmail.com 8475001523

B. Seed Physiology, Storage and Testing

Date: 10.05.2018

Chairman : **Dr. (Mrs) Malavika Dadlani**
Former JDR, ICAR-IARI, New Delhi

Convener : **Dr. Shiv K. Yadav**
Principal Scientist, ICAR-IARI, New Delhi

There were a total of six experiments in Seed Physiology, Storage and Testing conducted during 2017-18. Based on the deliberations with the scientists and experts present in the house, following decisions were taken.

- Experiment number 6 was concluded with compilation of salient findings to be brought out in the form of a bulletin.
- Rest of the experiments will continue with some modifications. Two more crops; castor and groundnut are added in experiment 1 and observations will be recorded only up to final stand establishment.
- Experiment 2 was modified as "Hybrid purity testing using molecular markers in public sector hybrids of field crops" with the suggestion to necessarily compare laboratory results with GOT in maize, paddy, cotton, sunflower and pearl millet.
- Experiment 2 under Seed Production and Certification/ Seed Processing "Seed quality, health, yield, storability as affected by pre-sowing seed priming treatments in kabuli chickpea, field pea and lentil" was merged with experiment 3 "Basic studies for developing priming technology in crop plants" of Seed Physiology, Storage and Testing. It was renamed as "Physiology studies and Development of priming technologies for enhancing planting value of seed in field crops under optimal and sub-optimal conditions". Considering the importance of biologicals, it was decided that treatments with microbial formulations will be included in seed enhancement treatments. One more objective "Development of seed enhancement techniques for low temperature stress during seedling establishment in maize and rice" was also added to this experiment. It was recommended to try new microbial formulations for seed enhancement.
- In experiment 4, the ICAR-IARI, New Delhi and PAU, Ludhiana centres were included with three more crops; Paddy, Soybean and Onion. It was also suggested to integrate with this the experiment "Evaluation of silver nano-conjugates as seed priming agents against *Fusarium fuzikoroi* causing Bakkane disease of rice" planned for "Seed Pathology" project.
- It was recommended to elucidate the impact of elevated temperatures experiment 5 may be conducted with three dates of sowings; normal, late and very late. Centres

with facilities to maintain controlled growth conditions (Temp.), shall take it up sowings at optimal and 5°C elevated temperatures in growth chambers.

Recommendations:

- Based upon the one year data, it was not possible to recommend on time and period of revalidation for any of the crops studied, therefore it was recommended to do further the experimentations.
- RM228 molecular marker was identified for differentiating DRRH3 rice hybrid.
- RM 55, RM-452, RM-316, RM 407, RM 433, RM 472, RM 490, RM 525, RM 3769, RM 3805 and RM22863 markers found to differentiate various paddy varieties could be validated.
- The treatments; Soaking of pigeon pea seeds for 11 hrs at 25^0C under 60% available water and halopriming (NaCl + $CaCl_2$ @ $6dSm^{-1}$) for 8 hrs at 25^0C were recommended for validation of 18% and 13% improvement in vigour parameters over the mean under water stress and salt stress conditions, respectively.
- Foliar spray of salicylic acid @800ppm and 400ppm were found to mitigate the influence of terminal heat stress on seed set, seed yield and quality in various field crops.

Experiment 1: To validate the validity periods of certified seeds of field crops (as per the IMSC regulations)

Year of Start: 2017

Objective: To study the planting values of seeds to examine the prescribed periods of validity of fresh and revalidated certified seed lots of some major field crops.

Crops		Centres
Wheat	:	ICAR-IARI, New Delhi; GBPUAT, Pantnagar; VNMKV, Parbhani; SKNAU, Durgapura; MPKV, Rahuri; HAU, Hisar; NDUAT, Faizabad; CSAUAT, Kanpur; SKUAST, Kashmir, Srinagar and CSKHPKV, Palampur
Rice	:	ICAR-IARI, New Delhi; PAU, Ludhiana; PJTSAU, Hyderabad; TNAU, Coimbatore; UAS, Bengaluru; PAJANCOA&RI, Karaikal; KAU, RARS, Pattambi; AAU, Jorhat; SKUAST, Kashmir, Srinagar and OUAT, Bhubaneswar
Maize	:	ICAR-IARI, New Delhi; TNAU, Coimbatore and PAU, Ludhiana
Sorghum	:	ICAR-IIMR, Hyderabad; VNMKV, Parbhani; MPKV, Rahuri and UAS, Dharwad
Cotton	:	ICAR-CICR, Nagpur; PJTSAU, Hyderabad and UAS, Dharwad
Soybean	:	ICAR-IARI, New Delhi; GBPUAT, Pantnagar; JNKVV, Jabalpur; VNMKV, Parbhani; MPKV, Rahuri and UAS, Dharwad
Chickpea	:	ICAR-IARI, New Delhi; JNKVV, Jabalpur; VNMKV, Parbhani; SKNAU, Jobner and

CSAUAT, Kanpur

Castor : PJTSAU, Hyderabad; JAU, Jamnagar; AAU, Anand; ICAR-IIOR, Hyderabad and SKNAU, Durgapura;

Groundnut : AAU, Anand; OUAT, Bhubaneswar; JAU, Jamnagar; MPKV, Rahuri; UAS, Bengaluru and UAS, Dharwad; SKNAU, Durgapura; BSKKV, Dapoli and BCKV, Mohanpur

Technical Programme:

Materials:

Seed lots: Sufficient quantities of certified seeds (fresh) of minimum two most popular varieties in each crop and revalidated (Once or twice) seeds of same varieties, if available, will be procured from State Seed Corporations/Agencies or its vendors. Date of harvesting, date of test and validity period should be noted. In case the revalidated (Once or twice) seeds are not available, sufficient quantities seeds of same varieties will be procured and stored at prescribed packaging material under seed godown conditions. All centres must explore every possibility to procure fresh certified and revalidated seed lots from the respective sources. Same seeds can be procured from one source and shared with other cooperating centres, coordinating unit of IISS, Mau to facilitate, if needed.

Evaluation for Vigour:

The seed lots; fresh and revalidated or stored seeds will be periodically tested for Moisture content (MC), First count and Germination and vigour indices at one month interval for at least 24 months from date of harvesting. The seed lots will also be field tested at an interval of every 2 months for seedling emergence, speed of emergence and the experiment will be terminated with recording of final plant stand establishment. The final plant stand establishment will be recorded/ taken 6 weeks after sowing for cotton and all cereal crops, whereas it will be 3-4 weeks after sowing for groundnut and pulses.

Laboratory Observations:

- Seed Moisture content (ISTA)
- First count %
- Germination % (ISTA)
- Vigour index-I & II (Abdul Baki and Anderson, 1973)

Field observations:

- Speed of emergence (Maguire, 1962)
- Final plant stand establishment (%)

NB: Observations to be recorded on minimum four replications of 100 seeds each, except SMC, which will to be estimated on dry weight basis as per ISTA recommendations.

Experiment 2: Hybrid purity testing using molecular markers in public sector hybrids of field crops

Year of Start: 2011- 2012

Objective:

1. To assess the efficiency of molecular markers in hybrid purity testing in comparison to the grow-out test (GOT) in various field crops.

Crops		Centres
Rice	:	PJTSAU, Hyderabad; TNAU, Coimbatore; ICAR-IISS, Mau; JNKVV, Jabalpur; AAU, Jorhat; ICARRC NEH Region - Manipur Centre; SKUAST, Kashmir, Srinagar and KAU, RARS, Pattambi
Maize*	:	UAS, Bengaluru; CSKHPKV Palampur and PAU, Ludhiana
Pearl millet	:	SKNAU, Durgapura; MPKV, Rahuri; CCS HAU Hisar and VNMKV, Parbhani
Sunflower	:	UAS, Bangalore; JAU, Jamnagar; ICAR-IIOR, Hyderabad and RAU, TCA, Dholi
Cotton	:	ICAR-CICR, Nagpur**; PDKV, Akola; NAU, Navsari; and UAS, Dharwad

*ISTA recommended method of testing of hybrid purity using isozymes is available in maize (Orman *et al.,* 1991) will also be tried by the maize centres.

**ICAR-CICR, Nagpur will also be investigating the trait specific purity of cotton hybrids (Singh *et al.,* 2016).

Technical Programme:

Materials: Each centre will take seeds of the available public sector released hybrids and their parental lines, preferably from the breeding institutes. If possible, private sector hybrids could also be taken for the study. DNA profiles of parents and hybrids for which they are available at ICAR-NBPGR, New Delhi or in public domain will be used as standard profiles. Also, for varieties/hybrids for which unique polymorphic markers are not available, will be developed through genotyping.

Methodology: There are standardized methods available for testing of hybrid purity/ hybridity using molecular markers in each crop and will be used for;

1. Genomic DNA extraction by CTAB/modified CTAB method (Taylor *et al.,* 1995; Liu *et al.,* 2003) or Kit method
2. Quantification of DNA and assessment of DNA quality for each sample on 1.2% agarose gel.
3. PCR analysis using unique markers (e.g. Rice- Nandakumar *et al.*, 2004, Sundaram *et al.*, 2008; Maize- Mingsheng *et al.*, 2010; Pearl millet- Nagawade *et al.*, 2016; Sunflower- Antonova *et al.*, 2006, Pallavi *et al.*, 2011 and Cotton- Dongre *et al.*, 2011). The protocols may need further standardization for detection of mixtures or off-types using serial dilution of DNA as template DNA for PCR based detection.

4. The results of molecular marker analysis will be compared with Grow-Out Test (GOT):
   Size of working sample for GOT: The minimum population required for taking the observations shall be 400 plants when minimum genetic purity of ≤99% is required; however, it will also depend on the maximum permissible off-type plants prescribed for the species under consideration in the Indian Minimum seed Certification standards. The number of seeds required for raising the crop to obtain the required number of plants shall depend on the germination percentage of the seed sample and hence seed rate should be adjusted accordingly. Grow out test shall be conducted in specified areas recommended for the hybrid or in off-season nurseries. The standard sample of a hybrid (control) to be obtained from the originating plant breeder / breeding institute, which will be the official standard against which all other samples of the seed of the hybrid will be judged/compared. Standard and recommended agronomic / cultural practices such as field preparation, size of the plot, row length, distance between the rows, distance between the plants, irrigation and fertilization, etc., in respect of the specific crop shall be followed both for the sample in question and its control (standard sample).
   Methods for taking observations: Grow-out test plots must be examined throughout the growing season with emphasis on the period from the flowering to ripening. All plants must be examined keeping in view the distinguishing characters described for the hybrid both in the test crop as well as the control. While taking the observation, the plants showing deviations in characters against the control should be tagged and examined carefully at a later stage to confirm whether they are off-types or not. The number of the total plants and the off-type plants found should be recorded.
   Calculation and interpretation of the results: Percentage of other cultivars, species or aberrant found must be calculated up to first decimal place. While interpreting the results, tolerances should be applied by using the reject number for prescribed standards with reference to sample size. The reject numbers will be; 8, 24, 44 and 64 for sample size of 400 plants if 99, 95, 90 and 85% purity, respectively is targeted.
5. The DNA profiling of all the hybrids along with parents grown as check in GOT plots may be done to validate the findings.
6. Cost effectiveness (C/B ratio) for GOT vis-à-vis molecular markers will be worked out.

Experiment 3: Physiology studies and development of priming technologies for enhancing planting value of seed in field crops under optimal and sub-optimal conditions

Note: The experiment 2 "Seed quality, health, yield, storability as affected by pre-sowing seed priming treatments in kabuli chickpea, field pea and lentil" (Year of start: 2014-15) of the Seed Production and Certification/ Seed Processing project was merged with experiment 3 "Basic studies for developing priming technology in crop plants" (Year of start: 2016-17) of

Seed Physiology, Storage and Testing project. One more objective "Development of seed enhancement techniques for low temperature stress during seedling establishment in maize and rice" was added.

Year of start: 2018-19

Objective:

1. Development of priming technologies for enhanced planting value of seed under sub-optimal conditions in field crops
2. Validation of standardized priming technologies in pigeonpea for sub-optimal conditions
3. Development of seed enhancement techniques for low temperature stress during seedling establishment in maize and rice

Crops		**Centres (Objective I)**
Chickpea	:	ICAR-IISS, Mau and CCS HAU, Hisar
Kabuli Chickpea	:	PAU, Ludhiana; JNKVV, Jabalpur; UAS, Raichur; MPKV, Rahuri; SKNAU, Durgapura and PDKV, Akola
Rice	:	UAS, Bengaluru; GBPUAT, Pantnagar; OUAT, Bhubaneswar and SKUAST, Kashmir, Srinagar
Field pea	:	CSAUAT, Kanpur; JNKVV, Jabalpur and NDUAT, Faizabad
Lentil	:	JNKVV, Jabalpur; NDUAT, Faizabad and CSAUAT, Kanpur
Mustard	:	ICAR-IARI, New Delhi; ICAR-CAZRI, Jodhpur and AAU, Anand;
Cotton	:	ICAR-CICR, Nagpur
Speciality Maize	:	ICAR-IARI, New Delhi; RAU, TCA, Dholi and ICAR-VPKAS, Almora

For testing and validation (Objective II)

Pigeonpea	:	ICAR-IARI, New Delhi; AAU, Jorhat; PAU, Ludhiana; BSKKV, Dapoli; PAJANCOA&RI, Karaikal and ICAR-IISS, Mau

For low temperature stress (Objective III)

Maize	:	ICAR-VPKAS, Almora and RAU, TCA, Dholi
Rice	:	AAU, Jorhat; ICAR Research Complex for NEH Region, Shillong and ICAR RC NEH Region - Manipur Centre.

Technical programme:

Sub Experiment I (As per Objective 1): Development of priming technologies for enhanced planting value of seed under sub-optimal conditions in field crops

Materials: Each center will use the seeds of location specific two most popular varieties (preferably one tolerant and other susceptible to sub-optimal condition of their locality). Two lots; fresh and one year old seeds of each variety will be taken for study for comparison, as germinability and other vigour parameters of high quality (Fresh) seeds may not significantly be improved by seed priming technologies. In case of non-availability

of aged seeds of same variety, the fresh seeds will be aged by giving recommended accelerated ageing treatments for creating the other (old) lot(s).

Treatment Details: For development of priming technologies for enhanced planting value of seed under sub-optimal conditions in field crops, following treatments will be given;

1. Control (Untreated)
2. Control (Crop and location specific recommended seed treatment(s) as per package of practices)
3. Hydropriming – Soaking in water for 4h (at 20°C for Kabuli Chickpea), 6h (at 20°C for Chickpea), 30h (at 25°C for Paddy), 10h (at 20°C for Field pea), and 8h (at 25°C for Lentil) and air-drying at 25°C for 48h. The period, temperature and drying specified above may be the same for all other priming treatments. It is suggested to see if there are any instances of radicle *emergence during soaking period or the seeds are still absorbing water. If noticed, the duration has to be standardized first in each crop by respective centre. While standardization, please take into due consideration the temperature at which seeds are being primed and seed to solution ratio would be 1:1.5 (weight by volume)*
4. Halopriming- Soaking in 800ppm solution of Salicylic acid and drying
5. Halopriming- Soaking in KNO_3(@0.3%) solution and drying
6. Halopriming- Soaking in $MgNO_3$ (@2%) solution and drying
7. Halopriming- Soaking in KH_2PO_4(@0.5%) solution and drying
8. Halopriming- Soaking in $ZnSO_4$ (@0.3%) solution and drying
9. Halopriming- Soaking in $MnSO_4$ (@0.5%) solution and drying
10. Halopriming- Soaking in $ZnSO_4$ (@0.3%) + $MnSO_4$ (@0.5%) solution for and drying
11. Halopriming- Soaking in Nitric oxide (@0.25 mM) solution prepared by mixing 6.548g Sodium Nitroprusside (SNP) in 100ml water and drying
12. Seed coating (on hydro primed seeds) with *T. harzianum* (**CFU –** 2 X 10^6per gm) @ 15 g / kg seed (Mix 15g in 50 ml of water and applied on 1 kg of seed uniformly. Shade drying the seeds for 20 – 30 minutes before sowing). CFUs are required to be counted before treatment.
13. Seed coating (on hydro primed seeds) with *T. viride* (**CFU –** 2 X 10^9per gm) @ 10 g / kg seed (Mix 10g in 50 ml of water and applied on 1 kg of seed uniformly. Shade drying the seeds for 20 – 30 minutes before sowing). CFUs in the consortium must be confirmed before treatment.
14. Seed coating (on hydro primed seeds) with BioNPK (containing 1 x 10^9 cfu)
15. Seed coating (on hydro primed seeds) with Biogrow (containing 1 x 10^9 cfu)
16. Seed coating (on hydro primed seeds) with Biophos (containing 1 x 10^9 cfu)
17. Seed coating (on hydro primed seeds) with Drought Alleviating Bacteria + BioNPK
18. Seed coating (on hydro primed seeds) with Drought Alleviating Bacteria + Biogrow
19. Seed coating (on hydro primed seeds) with Drought Alleviating Bacteria + Biophos

Note:

- Duration for halopriming is same as hydropriming
- The Microbial consortia (for treatment No. 14 to 19) will be supplied by ICAR-IISS, Mau. **Method/dosage of treatment of microbial consortia:** 100 ml of liquid formulation (containing 1 x 10^9 cfu) will be diluted in 1000 ml water. To this diluted suspension, 10 gram of sucrose will be added. The final suspension will be sprinkled over the seeds required for 1 acre (two hours before sowing). Then the seeds will be mixed with hands and kept for 45 minutes. After that the seeds will be shade dried and sown.

Laboratory observations:

- Moisture content (ISTA) before and after treatment i.e. Before sowing
- First count %
- Germination % (ISTA)
- Vigour index-I & II (Abdul Baki and Anderson, 1973)
- Incidence of seed borne pathogens (%)

Field observations:

- Speed of emergence(Maguire, 1962)
- Final plant stand establishment (%) after 3 weeks in pulses and 6 weeks in cereals

NB: Observations to be recorded on minimum four replications of 100 seeds each, except SMC, which will to be estimated on dry weight basis as per ISTA recommendations.

Sub. Experiment II (As per Objective 2): Validation of standardized priming technologies in pigeonpea for sub-optimal conditions

Materials:

For validation of standardized priming technologies in pigeonpea for sub-optimal conditions, the primed seeds of two IARI varieties; Pusa 991 and Pusa 992 of Pigeonpea will be provided to each centre by ICAR-IARI, New Delhi (Contact person: Dr. Shiv K. Yadav, 9868273684). However, each center may use the seeds of two; location specific and most popular varieties and treat them as per the details given below;

Treatments:

1. Control (Untreated).
2. Hydropriming (Soaking in water for 10 h at 25-30°C) and drying- standardized for rainfed conditions.
3. Exposure of seeds for 24 h at 40°C (Standardized for heat stress conditions).

4. Osmopriming (Soaking in PEG-6000 solution of 60% available water (-0.62MPa) for 11h at 25-30°C) and drying- standardized for moisture stress conditions. For preparing solution of 60% available water add 21g PEG-6000 per litre of water. *Kindly note that available soil water also depends upon the soil texture.*
5. Halopriming (Soaking in NaCl + $CaCl_2$ solution having EC of 6dSm^{-1} for 8 h at 25-30^{0}C) and drying. For preparing solution of 6dSm^{-1} EC, use 1.7532g NaCl + 4.4106g $CaCl_2$ $2H_2O$ (Dihydrated) of 58.44g and 147.02g Molar weights, respectively in 1 lt of water. You may still require adjusting the EC

Experiment Design:

Number of Treatments: Five
Number of Varieties: Two
Plot size: 3X6.25m
Row Length: 6.25m
Plant to plant: 25cm (25seeds/row)
Row to row: 75cm
Number of rows per replication: Four (100 seeds/replication)
Number of replications: Four
Total Area required for experiment: 750sqm

Laboratory observations:

- Seed Moisture content (ISTA)
- First count %
- Germination % (ISTA)
- Vigour index-I & II (Abdul Baki and Anderson, 1973)

Field observations:

- Speed of emergence(Maguire, 1962)
- Final plant stand establishment (%) after 6 weeks
- Seed yield (g/plot)

NB: Observations to be recorded on minimum four replications of 100 seeds each, except SMC, which will to be estimated on dry weight basis as per ISTA recommendations.

Sub. Experiment III (As per Objective 3): Development of seed enhancement techniques for low temperature stress during seedling establishment in maize and rice

Year of start: 2018

Rationale: There are areas in our country where growing of rice and maize in normal season are chronically affected by various biotic, abiotic and natural calamities. This forces

the farmers to grow particularly in a winter season in which these crops normally don't perform better. Because, there are some problems related to offseason cultivation like; low temperature at seedling stage can cause stunted seedling growth, yellowing of leaves, leaf spots, slow and delayed tillering and non-synchronous, delayed flowering etc. Exposure to low-temperature stress, during germination and early seedling growth, can negatively affect the initial stand establishment and finally the yields. Therefore, this experiment has been designed: To attenuate low-temperature stress at seedlings stage with seed enhancement techniques in rice and maize; To improve the tillering and synchronous flowering under low-temperature stress in rice and maize and To study the effect of different seed enhancement techniques on field emergence and yield attributing traits in rice and maize raised under low temperature conditions.

Technical Programme:

Materials: Each center will use the seeds of three most popular varieties (preferably one each from normal, tolerant and susceptible to low temperature stress at their locality). Please note the initial seed moisture content should be below 10.0% (on dry weight basis).

Treatments:

1. Control (Untreated)
2. Control (Crop and location specific recommended seed treatment(s) as per package of practices)
3. Hydropriming – Soaking in water for 18h (at 20°C for maize) and 30h (at 20°C for Paddy) and drying
4. Chilling treatment (Place the *seeds* in contact with the moist substratum at 4^0C for five days)
5. Thermal treatment (at 40^0C for 24h)
6. Chilling followed by Thermal treatment
7. Priming with Gibberellic acid (@100 mg/l) and drying
8. Halopriming- Soaking in 800ppm solution of Salicylic acid and drying
9. Halopriming- Soaking in 400ppm solution of Salicylic acid and drying
10. Halopriming- Soaking in 50µM solution of Melatonin and drying
11. Halopriming- Soaking in 500 µmol l^{-1}solution of GABA (Gamma-aminobutyric acid) and drying
12. Halopriming- Soaking in aerated solution 2.2% of $CaCl_2$ and drying
13. Seed coating (on dry seeds) with cold adoptive PGPB (The bio-formulation/Microbial consortia will be supplied by ICAR-IISS, Mau along with detailed methodology of treatment)
14. Microbial consortia (As supplied and treatment method suggested by the ICAR-*VPKAS, Almora* - Contact Person: **Dr. P. K. Misra,** misrapank12@gmail.com (+91-9412589393).

Observations: To be observed in minimum of 5 randomly selected plants or panicles/cobs /rep/treatment from # 3 to 9.

1. Speed of emergence(JD Maguire, 1962)
2. Final plant stand establishment (%) after 5 weeks
3. Total number of tillers
4. Number of productive/effective tillers
5. Plant height
6. Panicle or cob length
7. Total number of seeds/panicle or cob
8. Number of empty seeds/panicle or cob
9. Seed set %
10. 1000 seed weight of seed produced
11. Plot yield (kg)
12. Harvest Index
13. Evaluation of quality (as per ISTA) of seed produced
14. α-amylase activity in seed produced
15. Total soluble sugar content in seed produced
16. EC of seed leachates in seed produced
17. Cost benefit ratio of the best treatment in each crop identified at your centre

Experiment 4: Use of nano-particles in enhancing seed quality and storability of seeds

Note: In this experiment, three more crops; Paddy, Soybean and Onion were included with an additional experiment "Evaluation of silver nano-conjugates as seed priming agents against Fusarium fuzikoroi causing Bakkane disease of rice" with ICAR-IARI, New Delhi and PAU, Ludhiana as new centres.

Year of start: 2016

Objectives:

1. To standardize the optimum concentration of different nano-particles for seed treatment
2. To know the effect of different nano-particles on seed quality and storability of treated seeds
3. To evaluate silver nano-conjugates as seed priming agents against *Fusarium fuzikoroi* causing Bakkane disease of rice

Crops		**Centres**
Pigeon pea	:	TNAU, Coimbatore and UAS, Bengaluru
Onion & Soybean	:	ICAR-IARI, New Delhi and TNAU, Coimbatore
Paddy	:	PAU, Ludhiana

Technical programme

Materials:

Crops and Varieties: **Use any two recommended local varieties** e.g.

Pigeonpea: BRG 2 and BRG4

Soybean: Pusa 9712 and Pusa 9814

Onion: Pusa Madhvi, Pusa Riddhi and Pusa Red

Paddy: Only in Basmati varieties; Pusa Basmati 1509 and Pusa 1121

Treatments:

Nano-particles: Zinc oxide, Silver, Silicon dioxide (both bulk and nano form).

Dosage: Control (no treatment); 100 ppm, 250 ppm, 500 ppm, 750 ppm and 1000 ppm

Formulation: Dry form

*The sufficient quantities of seeds of each variety of Soybean and Onion will be sent to TNAU, Coimbatore by ICAR-IARI, New Delhi (Dr. Sandeep K. Lal-9811048932) for various Nano-particle treatments.

Experiment Details:

Treatment combinations: Nano form x concentrations (3 x 5) = 15
Bulk form x concentrations (3x5) = 15

Replication: Three

Design: FCRD

Sub. Experiment I (As per Objective 1): Standardization of optimum concentration of different Nano-particles for seed treatment

Methodology:

- Freshly harvested seeds will be dried to safe and uniform moisture level (8 - 9%).
- The seeds will be directly treated with the selected chemicals (bulk and nano form) in a plastic or glass jar by mixing thoroughly for even distribution.
- Thereafter, the treated seeds shall be evaluated for various seed quality attributes like seed moisture content (SMC), germination and vigour, electrical conductivity (EC) and total dehydrogenase activity (TDH) etc.

Observations:

1. Seed Moisture content and Seed germination (%) (ISTA)- First count, final count and T_{50} value
2. Seedling vigour index I and II (Abdul Baki and Anderson, 1973)
3. Electrical conductivity of seed leachate (µS/cm/g)
4. Total dehydrogenase activity (A_{480} nm)

5. Seed health (infection and infestation)
6. Field emergence %

Sub. Experiment-II (As per Objective 2): Studies on effect of selected nano-particles on seed quality and storability of treated seeds

Materials and Treatments:
The best treatment (s), which responded positively to nano-particles in Experiment-I shall be selected to study their influence on seed quality and storability. The treated seeds of same varieties will be packed in cloth bag and stored under ambient conditions. Storage studies will be conducted up to 10-12 months and the following observations will be recorded at monthly interval including weather data of storage conditions.

Observations:
1. Seed Moisture content and Seed germination (%) (ISTA)- First count, final count and T_{50} value
2. Seedling vigour index I and II (Abdul Baki and Anderson, 1973)
3. Electrical conductivity of seed leachate (µS/cm/g)
4. Total dehydrogenase activity (A_{480} nm)
5. Seed health (infection and infestation)

Sub. Experiment III (As per Objective 3): Evaluation of silver nano-conjugates as seed priming agents against *Fusarium fuzikoroi* causing Bakkane disease of rice.

Technical programme
Materials:
To develop novel, low dosage antifungal seed treatment agents as an alternative to existing fungicides different doses on nano-conjugates will be tried only in paddy varieties; Pusa Basmati 1509 and Pusa 1121.

Treatments:
T1: Control (Untreated)
T2: Seed priming for 8 hours prior to sowing with silver nano conjugate-A
T3: Seed priming for 8 hours prior to sowing with silver nano conjugate-B
T4: Seed priming for 8 hours prior to sowing with silver nano conjugate-C
T5: Seed priming for 8 hours prior to sowing with silver nano conjugate-D
T6: Seed priming for 8 hours prior to sowing with Carbendazim@ 0.2% + Streptocycline @0.01% + Seedling root dip treatment for 6 hours with Carbendazim@ 0.2%
T7: Hydro-priming for 8 hours prior to sowing
T8: T2 + Seedling root dip treatment before transplanting for 6 hours with A*

T9: T3+ Seedling root dip treatment before transplanting for 6 hours with B*
T10: T4+ Seedling root dip treatment before transplanting for 6 hours with C*
T11: T5+ Seedling root dip treatment before transplanting for 6 hours with D*

***(A)** 1,2,4-triazolosulfonamide conjugated Silver nano-particles (TS-AgNPs) aqua emulsions

***(B)** 1,2,4-triazolodithiocarbamate conjugated Silver nano-particles (TS-AgNPs) aqua emulsions

***(C)** 1,2,4-triazolopyrimidine conjugated Silver nano-particles (TS-AgNPs) aqua emulsions

***(D)** 1, 2, 4-triazolopyridine conjugated Silver nano-particles (TS-AgNPs) aqua emulsions

Observations:

1. Mycoflora and Initial seed health status of seed
2. Disease incidence (in field)%
3. Seed yield/plot
4. Quantification (%) of loss in seed yield
5. Mycoflora and seed health status of harvested seed

Statistical Analysis: RBD

NB: Observations on seed quality parameters to be recorded on minimum four replications of 100 seeds each, except SMC, which will to be estimated on dry weight basis as per ISTA recommendations.

Experiment 5: Influence of terminal heat stress on seed set, seed yield and quality in field crops

Year of start: 2017

Objectives: To evaluate the adverse effect of heat stress during reproductive phase in selected field crops and its mitigation.

Crops		Centres
Wheat	:	ICAR-IARI, New Delhi; PDKV, Akola; JNKVV, Jabalpur; UAS, Dharwad; RAU, TCA, Dholi; PAU, Ludhiana; GBPUAT, Pantnagar; CCSHAU, Hisar; VNMKV, Parbhani; CSAUAT, Kanpur and NDUAT, Faizabad
Sorghum	:	ICAR-IIMR, Hyderabad; MPKV, Rahuri; VNMKV, Parbhani and PDKV, Akola
Rice	:	ICAR-IIRR, Hyderabad; PJTSAU, Hyderabad; UAS, Bengaluru; TNAU, Coimbatore; ICAR RC NEH Region - Manipur Centre; OUAT, Bhubaneswar; BSKKV, Dapoli; KAU, RARS, Pattambi and PAJANCOA&RI, Karaikal

Mustard : ICAR-IARI, New Delhi; ICAR-CAZRI, Jodhpur; NDUAT, Faizabad and CSAUAT, Kanpur

Technical Programme:

Materials: Three most popular varieties; one recommended for normal dates of sowing and others recommended for late and very late dates of sowings, in each crop will be taken for the study.

Methodology:

1. Set 1: The experiment in open field conditions (where growth chamber facilities for elevated temperature are not available) is to be conducted by sowing each crop thrice; normal, late and very late sowing dates. The dates may differ depending upon the location of centre with respect to a particular crop. Hence, the sowing dates may be adjusted accordingly (experiment may be conducted with normal date of sowing and two more sowings at 15-20 days intervals, thereafter). Dates of sowings and harvestings shall be recorded. The climatic data also need to be collected and correlated with the results.
2. Set 2: Where growth chamber facilities for elevated temperature are available, the experiment will also be conducted at normal temperature requirements of that crop and 5°C elevated temperature conditions to be maintained from anthesis onwards.

Mitigation treatments:

1. Control
2. Salicylic acid (800 ppm)
3. Salicylic acid (400 ppm)
4. Ascorbic acid (10 ppm)
5. KCl (1%)
6. Thiourea (400ppm)
7. Cycocel (2ml in 350ml water)

Spray Schedule:

1. Vegetative stage (35-40 days after sowing or transplanting)
2. Anthesis stage (Vary from crop to crop and location to location)
3. Vegetative and Anthesis stage

Note:

1. Please don't mix or store Cycocel in aluminium containers or use any aluminium equipment.
2. Avoid using biomass/straw or seeds for feed or food until 6 weeks of spray of these chemicals.

Observations (*In Cereals*)**:** To be observed in minimum of 5 randomly selected plants or panicles /rep/treatment

1. Total number of tillers
2. Number of productive/effective tillers
3. Plant height
4. Panicle length
5. Total number of seeds/panicle
6. Number of empty seeds/panicle
7. Seed set %
8. 1000 seed weight
9. Plot yield (kg)
10. Harvest Index
11. Evaluation of quality of seed produced (as per ISTA)
12. Cost benefit ratio of the best treatment in each crop identified at your centre

Observations (*In Mustard*)**:** To be observed (Trait 1 to 8 at physiological maturity) in minimum of 5 randomly selected plants or pods/rep/treatment

1. Plant height
2. Main shoot length
3. Total number of siliqua on main shoot
4. Number of unfilled siliqua on main shoot
5. Siliqua set % on main shoot
6. Number of primary branches/plant
7. Number of secondary branches/plant
8. Total number of seeds/pod
9. 1000 seed weight
10. Plot yield (kg)
11. Harvest Index
12. Evaluation of quality of seed produced (as per ISTA).
13. Cost benefit ratio of the best treatment in each crop identified at your centre

NB: Observations on seed quality parameters to be recorded on minimum four replications of 100 seeds each, except SMC, which will to be estimated on dry weight basis as per ISTA recommendations.

Experiment 6: Standardization of seed testing protocols and development of seed standards for Jatropha

Centres: JNKVV, Jabalpur; TNAU, Coimbatore

Technical Programme:

A. Standardization of working sample size

Plan of work:

Two thousand five hundred seeds from each processed seed lots (as many seed lots as possible from at least three diverse locations) shall be counted in numbers and weighed separately in eight replicates and the average weight shall be recorded up to three decimal places and the size of working sample shall be determined.

B. Standardization of seed testing protocols

(i). Identification of optimum temperature and test duration for conducting the germination test.

Germination test shall be conducted at three temperature levels using **sand as substrata**. The following treatments shall be used for identification of optimum temperature for germination test.

Sample size: 400 seeds (100 seed in 4 replication or 50 seeds in 8 replications or 25 seeds in 16 replications)

Temperature- Three levels

T_1- 25^0C; T_2-30^0C, and T_3- 35^0C

Design: Completely randomized design (CRD)

Fixing the final count

The days to final count of germination shall be fixed when the maximum germination is obtained in each temperature levels.

Observations

- Daily germination counts
- Mean germination time (MGT): $\sum (fx)/ \sum x$

  Where f: number of days from initiation of germination test; x: number of newly germinated seeds in each day

(ii). Standardization of tetrazolium test for seed viability

Seed lots shall be subjected for TTZ test as detailed below.

a. Pre-moistening: (factor one at three levels)
   I. whole seeds soaked in water for 36 hr;
   II. Seed coat, specifically the part opposite the hilum, shall be cracked and seed soaked in water for 24 hr,
   III. Kernel soaked (seed coat removed completely) in water for 6 hr.

Note: For the first (I) treatment, water shall be changed after 24 hrs and after pre-moistening treatments (I & II), the seed coats shall be removed and kernels shall be divided

into two. Seeds found to be empty, clearly deformed, damaged, decayed, or attacked by insects or diseases shall be removed and counted as non-viable. These seeds shall be discarded and not include in the TTZ test.

b. Type of tissue (factor two at two levels)

For the remaining undamaged seeds, two types of seed tissues shall be exposed to TTZ: (a) Cotyledon+ embryo (b) embryo only.

c. Staining duration (factor three at three levels)

The above cited tissues shall be completely immersed in 0.5% aqueous solution of 2,3,5-triphenyl tetrazolium chloride for 2,3 and 4 h while kept in total darkness at 25-30^{0}C. After staining, the treated seeds shall be washed twice with water and placed in petri dishes with moist filter paper for viability evaluation. The development of red colour on the respiring tissues is the basis for assessment of whether the seed is alive or not. Since TTZ test does not distinguish between dormant and non-dormant seeds, TTZ test results of each seed lot shall be correlated with the results of germination test.

Total treatment combination: 3×2×3

No. of replication in each treatment combination: 3

Sample size for each replication: 10 seeds

Development of seed standards

The following seed standards have to be standardized.

1. Pure seed (Minimum)
2. Inert matter (Max.)
3. Total weed seeds (Max.) in nos.
4. Other crop seeds (Max.) in nos.
5. Germination % (Min.)
6. Moisture content (Max.)
7. Moisture content for vapour proof containers (Max.)

Plan of work: Submitted samples of seed lots (as many as possible) of any variety shall be collected and following observations shall be taken in each sample.

1. Pure seed (%) (Definition of ISTA Pure Seed Definitions shall be taken into compliance)
2. Inert matter (%) (shall be conducted as per ISTA protocols of same genera)
3. Total weed seeds recorded (nos.)/kg (based on provenance factor and review of relevant genera information)
4. Other crop seeds recorded (nos.)/kg
5. Germination% (shall be conducted as per ISTA protocols of same genera)

6. Moisture content (%) (based on ISTA seed classification for desiccation *per se)*
   (Both high temperature short duration and low temperature and long duration shall be experimented)

Note:

1. The experiment 3 under "Seed Pathology" the farmers' saved seeds samples are to be collected to know the seed health status. Additional information to be collected in their questionnaire or the staff visiting villages under MGMG may also collect the information on ITK's being used by the farmers for seed/grain storage.
2. All the centres are requested to remove weed seeds from the samples, if any, received for seed testing purpose and store them properly to jointly develop weed seed atlas.
3. The data sheet of each experiment and reporting requirements is to be separately communicated by the PIs.

List of Participants

S. No.	Name	Designation	Centre	Email and Contact Number
1.	Dr. M. Dadlani	Former Joint Director	ICAR- IARI, New Delhi	malavikadadlani@rediffmail.com
2.	Dr. S.K. Yadav	Principal Scientist & PI, Seed Physiology, Storage & Testing	ICAR-IARI, New Delhi	skysst@gmail.com; pispnsp@gmail.com 9868273684
3.	Dr. Sooganna	Scientist (Seed Technology)	ICAR-IIMR, Hyderabad	sooganna@millets.res.in 9540331656
4.	Dr. Ramesh K.V	Scientist (Plant Physiology)	ICAR-IISS, Mau	ramesh.iari@gmail.com 8005202098
5.	Dr. S.P. Jeevan Kumar	Scientist (Agricultural Biotechnology)	ICAR-IISS, Mau	jeevaniitkgp@gmail.com 07839038085
6.	Dr. U.K. Singh	Junior Scientist	TCA, DRPCAU, Pusa	uksinghraupusa@gmail.com 9931956795
7.	Dr. Hillor Chakdar	Scientist	ICAR-NBAIM, Mau	hillol.chakdar@gmail.com 8765107799
8.	Dr. R. Shiv Ramakrishnan	Asstt. Professor (Crop Physiology)	JNKVV, Jabalpur	rshivram007@gmail.com 9174056526
9.	Dr. D. Shashibhushan	Asst. Professor	SRTC, PJTSAU, Hyderabad	danamshashi@yahoo.com 9440361302
10.	Dr. R. Siddaraju	SRO	GKVK, UAS, Bangaluru	srostrc@gmail.com 9880047284
11.	Dr. T.M. Ramanappa	Senior Scientist (BSP)	GKVK, UAS, Bangaluru	ramantm@gmail.com 9448975828
12.	Dr. Navjyot Kaur	Asstt. Plant Physiologist (STR)	PAU, Ludhiana	navjyot_grewal@yahoo.com 9915151165
13.	Dr. Pawar G.S.	ASRO	VNMKV, Parbhani	gsp.mau@rediffmail.com 7588082156
14.	Dr. I. Meghachandra	Principal Scientist (Seed	ICAR-RC NEH	meghais@rediffmail.com

	Singh	Technology)	Region Manipur centre Imphal	9436027223
15.	Dr. S.C Vimal	ASRO, Seed Physiology	NDUAT, Faizabad	scvimalndgpb@gmail.com 9451955851
16.	Dr. C.B. Singh Gangwar	SRO	CSAUAT, Kanpur	cbgangwar7@gmail.com 9450935223
17.	Dr. S.K. Lal	Principal Scientist	ICAR- IARI, New Delhi	skl_nsp@yahoo.com 9811048932
18.	Dr. T. Ramanadane	Professor	PAJANCOA & RI, Karaikal	raman_nadane@yahoo.com 9443875443
21.	Dr. Ravi Hunje	Professor (SST)	Seed Unit, UAS, Dharwad	ravihunje@gmail.com 9448301595
22.	Dr.(Mrs.) S. D. Deka	Principal Scientist (Seed Technology), STR	AAU, Jorhat	sharmila9368@gmail.com 9435351698
23.	Dr. P. R. VijayaKumari	Principal Scientist	ICAR- CICR, Nagpur	rachelvk123@gmail.com 9822572302
24.	Dr. Sudipta Basu	Principal Scientist	ICAR- IARI, New Delhi	sudipta_basu@yahoo.com 9871177657
25.	Dr. N.K. Gupta	Professor & Incharge, STR	RARI, Durgapura, Jaipur	nkgupta69@yahoo.co.in 9460987039
26.	Dr. V.P. Sangwan	Principal Scientist (BSP)	CCSHAU, Hisar	vpsangwan@hau.ernet.in 9416796346
27.	Dr. Deshmukh, D.T.	Deputy Director (Seeds)	Dr. PDKV, Akola	ddrseed@yahoo.com 9923585117
28.	Dr. S.K. Ransing	ASRO (Seed Physiology)	MPKV, Rahuri	skransing@gmail.com 7588695567
29.	Dr. K C Dhiman	Principal Scientist (Plant Breeding) (STR)	CSKHPKV, Palampur	karam_dhiman@yahoo.co.in 9418035580
30.	Dr. M.C. Narayana Kutty	ADR	, RARS, Pattambi, KAU	adrptb@kau.in 9447624591
31	Dr. G.S. Pawar	ASRO	VNMKV, Parbhani	gsp.mau@rediffmail.com 7588082156
32	Dr. Basave Gowda	Special Officer (Seeds)	UAS, Raichur	soseeds@uasraichur.edu.in 9480696343

C. Seed Pathology

Date: 10.05.2018

Chairman-cum-Convener : **Dr. Karuna Vishunavat**
Prof. & Head, Dept. of Plant Pathology
GBPUAT, Pantnagar

Recommendations

1). The sunflower seeds hydroprimed for 12 h and treated with local isolates of *Trichoderma harzianum + Pesudomonas fluorescens* (10gm / Kg) at the rate of 5gm each with subsequent to foliar sprays of Mancozeb (0.25%), first spray at appearance of the disease and second after 15 days, is recommended for reducing *Alternaria helianthi* in seed and to increase seed germination, seedling vigour index and seedling emergence.

2). In safflower, seeds hydroprimed for 12 h and treated with *Trichoderma harzianum + Pesudomonas fluorescens* (10gm / Kg) at the rate of 5gm each reduces the incidence of *Fusarium carthami* in field and increases seed germination, seedling vigour index and field emergence.

Experiment 1: Monitoring and detection of rice bunt in processed, unprocessed and farmers' seed sample, and bacterial leaf blight & bacterial panicle blight at farmer's field.

Objective

1) To determine the status of pathogen in seed sample from farmer and processing plant
2) To prepare the distribution map in different locations

Year of start : 2012-13

Status : To be continued during 2018-19

Centres : All centres (AAU, Anand; AAU, Jorhat; NDUAT, Faizabad; GBPUA&T, Pantnagar; OUAT, Bhubaneswar; , PJTSAU, Hyderabad; PAU, Ludhiana; CCSHAU, Hisar; CSKHPAU, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV, Rahuri; VNMKV, Parbhani; SKUAST, Srinagar; PAJANCOA&RI, Karaikal; ICAR-IARI, New Delhi; CSAUAT, Kanpur; KAU, Pattambi and RPCAU,Pusa)

Methodology

- **Detection Technique:** Standard NaOH seed soak be followed for bunt in rice seed samples. Minimum seed sample size is 100 from all the sources, covering the popularly grown rice varieties. Mention the range of infection for each location.

- For BLB rating scale is 0-9. Record the disease in farmer's field and seed production plots. Minimum number of fields to be visited is 50 per location and plants to be observed are 100 for bacterial blight and Panicle blight.
- For BLB rating scale is 0-9.
- Bacterial Panicle blight may be reported as present or absent.
- Meteorological data should be incorporated for correlation studies.

Note: *Already supplied data sheet to be followed.*

Experiment 2: Monitoring of emerging new diseases of seed borne nature

Objective

To record the prevalence of new diseases and pathogens associated with seed pathogens

Year of start : 2013-14

Status : Continued during 2018-19

Centres: All Centres (AAU, Anand; AAU, Jorhat; NDUAT, Faizabad; GBPUAT, Pantnagar; OUAT, Bhubaneswar; PJTSAU, Hyderabad; PAU, Ludhiana; CCSHAU, Hisar; CSKHPAU, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV Rahuri; VNMKV, Parbhani; SKUAST, Srinagar; PAJANCOA&RI, Karaikal; ICAR-IARI, New Delhi; CSAUAT, Kanpur, KAU, Pattambi, RPCAU, Pusa and SKNAU, Jobner

Note:

1) The incidence of unreported new pathogens and diseases of seed-borne nature should be observed.
2) *Information on symptoms, causal organism and factors affecting development of the particular diseases (all about epidemiology) is to be supplemented with photographs.*

Experiment 3: Studies on seed health status of farmers own saved seeds

Objective

To determine the health status of seed samples from the farmers own saved seeds

Year of start : 2000

Status : Continued during 2018-19

Crop (a) : **Wheat**

Centres: PAU, Ludhiana; CCSHAU, Hisar; GBPUAT, Pantnagar; CSKHPAU, Palampur; SKNAU, Durgapura; ICAR-IARI, New Delhi; RPCAU, Pusa; AAU, Anand; CSAUAT, Kanpur and MPKV, Rahuri

Note:

1) For each crop, respective centre will compile and prepare the disease distribution map of the state based upon the last 5 years data.
2) Sensitization drive of farmers shall be made at hot spots for the management of rice bunt and Karnal bunt of wheat with awareness for safe storage and significance of

replacement of varieties.

Methodology:

- **Detection Technique:** Standard NaOH seed soak be followed for bunt in seed samples. Minimum seed sample size is 100 from all the sources, covering the popularly grown wheat varieties.
- For ear cockle, visual observation and standard water soak be followed.
- Incidence of loose smut is to be recorded under field conditions by GOT.

Note:

1) *Prepare a map depicting the selected locations;*
2) *Provide the photographs showing the associated seed-borne pathogens.*

Crop (b) : Soybean

Centre: SKNAU, Durgapura; JNKVV, Jabalpur; MPKV, Rahuri; VNMKV, Parbhani and PJTSAU, Hyderabad

Methodology

- A minimum of 100 seed samples from all the sources, covering the popularly grown varieties. Seed health is to be determined by employing standard blotter method (ISTA, 1996) and visual inspection of seeds.
- The per cent recovery of the important seed borne pathogens (*Macrophomina phaseolina, Fusarium oxysporum, Colletotrichum dematium* (*C. truncatum*), *Cercospora kikuchii, Fusarium* spp, *Diaporthe* spp) in farmers own saved seed shall be recorded based on the observations of 400 seeds / sample.
- Symptoms of SMV be also recorded both in field and seed samples.
- Impact of different seed-borne pathogens on germination, seedling growth and seed rot be recorded
- Correlation of association of pathogen with seed germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) is specified separately.

Note: *Prepare a map depicting the selected locations; Provide the photographs showing the associated pathogens; Provide the information that farmers used their own saved seeds or of any public or private agency/company.*

Crop (c) : Rice

Centres: OUAT, Bhubaneswar; AAU, Jorhat; SKUAST, Srinagar; TNAU, Coimbatore; CSKHPAU, Palampur; NDUAT, Faizabad; PAJANCOA&RI, Karaikal; MPKV, Rahuri; ICAR-IARI, New Delhi; RPCAU, Pusa; PAU Ludhiana, PJTSAU, Hyderabad and AAU, Jorhat

Methodology

- **Detection Technique:** Standard NaOH seed soak be followed for bunt in rice seed

samples. Minimum seed sample size is 100 from all the sources, covering the popularly grown rice varieties. Report the range of infection for each location

- Seed borne pathogens responsible for seed discoloration be reported.
- Impact on germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) and seed rot be reported.
- Correlation of association of pathogen with seed germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) is specified separately.

Note: *Prepare a map depicting the selected locations; Provide the photographs showing the associated pathogen; Provide the information of the crop (upland or lowland); Information of storage conditions.*

Crop (d) : Groundnut

Centre: AAU, Anand; MPKV, Rahuri; SKNAU, Durgapura; JNKVV, Jabalpur; PJTSAU, Hyderabad

Methodology:

- Seed health is to be determined by employing visual inspection of seeds and standard blotter method (ISTA, 1996)
- Minimum seed sample size is 100 from all the sources, covering the popularly grown varieties.
- Impact on germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) and seed rot be reported.
- Correlation of association of pathogen with seed germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) is specified separately.

Note: *Prepare a map depicting the selected locations; provide the photographs showing the associated pathogen*

Crop (e) : Chickpea

Centre: MPKV, Rahuri; SKNAU, Durgapura

Methodology:

- Seed health be determined by employing standard blotter method (ISTA, 1996) and visual inspection of seeds
- A minimum number of seed sample is 100 from all the sources, covering the popularly grown varieties. Report the range.
- Impact on germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) and seed rot be reported.
- Correlation of association of pathogen with seed germination (normal seedlings)

and seedlings with primary infection (part of abnormal seedlings category) is specified separately.

Note: *Prepare a map depicting the selected locations; Provide the photographs showing the associated pathogen.*

Crop (f) : Saffron

Disease New corm rot

Centre : SKUAST, Srinagar

Methodology:

- Seed health be determined by visual inspection of seeds (corm) and by employing grow out test as per the ISTA protocol. Grow out test, be conducted under controlled conditions with sterilized substrate.
- A minimum sample size is 100 corms per farmer and collection from as many farmers as possible from all the sources, covering the popularly grown varieties.
- Economically important pathogens must be isolated and reported
- Impact on germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) and seed rot be reported.
- Correlation of association of pathogen with seed germination (normal seedlings) and seedlings with primary infection (part of abnormal seedlings category) is specified separately.

Note: *Prepare a map depicting the selected locations; Provide the photographs showing the associated pathogen*

Experiment 4: Standardization of detection methods for seed borne pathogens of significance

Objective

To work out the efficacy of different techniques for the detection of seed borne pathogens of significance prevalent in a particular region

Year of start : 2008

Status : To be continued during 2018-19

Centres: All Centers (AAU, Anand; AAU, Jorhat; NDUAT, Faizabad; GBPUAT, Pantnagar; OUAT, Bhubaneswar; PJTSAU, Hyderabad; PAU, Ludhiana; CCSHAU, Hissar; CSKHPAU, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV, Rahuri; VNMKV, Parbhani; SKUAST, Srinagar; ICAR-IARI, New Delhi; CSAUAT, Kanpur and RPCAU, Pusa)

Note:

- *Provide the photographs showing the associated pathogen.*
- *The protocol found effective should be documented step by step with critical information on temperature, humidity, light cycles, substrate, incubation period,*

identification under stereoscopic binocular and characteristics of pathogen, to draw the conclusions and must be compared with the standard protocol of ISTA.

- *If the ISTA protocol is not available for the subjected pathogen, a protocol be developed and standardized which gives the maximum recovery of the pathogen.*
- *If required, serological and nucleic acid based techniques must also be developed and standardized.*

*** The effective protocol developed by the respective centres would be circulated among other selected centers with seed samples for internal validation.**

Experiment 5: Non chemical management of seed borne infection of bean anthracnose

Objective

- To manage seed borne infection and seed health through bio-agents and organic inputs

Year of start : 2015 -16
Status : To be continued during 2018-19
Crop : Bean (*Phaseolus* spp.)
Pathogen : *Colletotrichum* spp.
Centre : CSKHPAU, Palampur and SKUAST, Srinagar

Note:

- *The results must be supplemented with on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented*

Experiment 6: Detection and molecular characterization of BCMV of mung bean / Common bean

Objective

1) To determine the location of virus pathogen in parts of seed
2) To characterize the pathogen using molecular techniques

Year of start : 2015 -16
Status : To be continued during 2018-19
Crop : Mung bean
Pathogen : Bean common mosaic virus (BCMV)
Centre : AAU, Anand and SKUAST, Srinagar

Experiment 7: Monitoring of seed borne viruses in soybean and pulses and standardization of methods for detection through biological, serological and molecular techniques

Objective

- To identify the seed associated viruses in the samples obtained from various parts

of the country.

- To develop and standardize the nucleic acid based techniques for detection of seed associated viruses.

Year of start : 2009
Status : Continued during 2018-19
Pathogen : Soybean Mosaic Virus
Centre : AAU, Anand and IARI, New Delhi

Note:

1) For identification of seed borne viruses in different crops, the other cooperating Centers are directed to supply the samples to AAU, Anand.
2) Samples of leaves and /or seeds may be sent, for determination of viruses.
3) Information on sampling and dispatch procedure may be enquired from AAU, Anand prior to submission.

***A detailed account with documentation with the findings and protocol be submitted for conclusion in the next group meeting for Soybean Mosaic Virus in soybean.**

Experiment 8: Management of *Alternaria solani* in tomato through seed treatment and foliar application of newer fungicides

Objective

- To determine the transmission of pathogen from seed to plant.
- To determine the influence of fungicide application on the quality of harvested seeds and fruits.

Year of start : 2016 -17
Status : To be continued during 2018-19
Crop : Tomato
Pathogen : *Alternaria solani*
Centre: AAU, Anand; PAU, Ludhiana; SKUAST, Srinagar; MPKV, Rahuri and GBPUAT, Pantnagar

Methodology:

1. Investigate the efficacy and spray frequencies of fungicides. Fungicides as listed below with spray frequencies (every 7, 14 and 21 days) may be applied.

2. Treatment: Fungicide: 8+1, Replication: 3, Design: RBD

S.No	Treatment	Mode of treatment	Doses	Spray schedule
T0	Captan 75WS	Seed treatment	2.5g/kg	To be supplied by AAU Anand
T1	Pyraclostrobin	prophylactic spray	1g/l	
T2	Azoxystrobin	prophylactic	1g/l	

		spray		
T3	Cymoxanil (8%) + Mancozeb 64 %)WP	prophylactic spray	3g/l	
T4	Azoxystrobin (18.2 %) + difenoconazole (11.4)	prophylactic spray	1g/l	
T5	Metiram(55%+ pyraclostrobin 5% WG	prophylactic spray	3g/l	
T6	Azoxystrobin (18.2 %) + Difenconazole 11.4%)	prophylactic spray	1g/l	
T7	Trifloxysytrobin (25 %) WG +Tebuconazole (50%)	prophylactic spray	0.7g/l	
T8	Famoxadone (16.6 %) + Cymoxanil (22.1 %)	prophylactic spray	1g/ l	
T9	Untreated	Spray only water	-	

Observation:

1. Disease development; yield and impact on seed quality on the harvested seed.
2. Determine yield loss incurred due to early blight
3. Assess cost benefit of the fungicides.

Note: *Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

Layout plan and data sheet is to be supplied by AAU, Anand centre for uniform execution of the experiment to all centre.

**** Please strictly adhere to the treatments mentioned.***

Experiment 9: Impact of different storage conditions on longevity of storage fungi in Green gram / Black gram

Objective

1) To determine the extent of association of pathogen(s) with freshly harvested seeds.
2) To determine the influence of fungicide treatment on development of pathogen and its impact on seed quality parameters under different storage conditions and periods

Year of start : 2016
Status : To be continued during 2018-19
Crop : Green gram / Blackgram
Source of seed : (i) Farmer (ii) Seed production / Research Fields
Pathogen : *Macrophomina phaseolina, Colletotrichum dematium*, *Cercospora* spp., *Fusarium* spp.

Centre: TNAU, Coimbatore, PAJANCOA&RI, Karaikal; MPKV, Rahuri; OUAT, Bhubaneshwar and AAU, Jorhat

Storage container: (i) Gunny bags (ii) Poly lined gunny bags and (iii) Cloth bags

Methodology:

- Basic seed dressing with Thiram @ 0.25% (prior to storage); 2. Subsequent storage in different containers; 3. Untreated seeds will serve as check.
- Freshly harvested seeds will initially be tested for extent of mycoflora and other seed quality parameters and designated as zero stage evaluation.
- Later at 30 days interval, sample(s) will be withdrawn from the lot and tested for associated mycoflora by standard blotter method, determination for seed moisture by universal seed moisture meter, seed germination by standard paper towel method, seed emergence by GOT (in pots / trays filled with natural field soil /sterile soil), seedling vigour by standard method (root /shoot elongation technique).
- The investigation will be terminated when any of the sample exhibit the value of seed germination below the Indian Minimum Seed Certification Standard

Note: ***Information on storage condition including temperature, moisture should be provided.***

Experiment 10: Detection, location and transmission of seed borne *Macrophomina phaseolina* in sesame

Objective : To determine the transmission of seed borne target pathogen
Year of start : 2016
Status : To be continued during 2018-19
Crop : Sesame
Pathogen : *Macrophomina phaseolina*
Centre : TNAU, Coimbatore

Action to be taken: TNAU, Coimbatore

To conclude the experiment, a working sheet be prepared before the termination of the experiment.

- The protocol developed by TNAU for detection of infection of *Macrophomina phaseolina* is to be revalidated by MPKV, Rahuri and PJTSAU, Hyderabad in comparison with the standard ISTA protocol.

- For that matter, the developed protocol and the infected seed would be supplied by TNAU to the respective centres for validation of the protocol.

Experiment 11: Management of purple blotch / Stemphylium blight of onion through fungicide and plant based products

Objective

- To determine the influence of fungicide application on the quality of harvested seed and development of diseases.

Year of start : 2016-2017
Status : To be continued during 2018-19
Crop : Onion
Pathogen : *Alternaria porri / Stemphylium vesicarium*
Centre : PAU, Ludhiana; SKUAST, Srinagar and MPKV, Rahuri

Methodology

1) Basic seed dressing with Captan /Thiram
2) Subsequent 2 or 3 foliar applications after first appearance of disease at 10 days interval (iii) amended with sticker agent.

Treatment: Fungicide: 9+1, Replication: 3, Design: RBD

Application combination	Periodicity
T1: Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 sprays of Mancozeb @ 0.3% + 0.11% Triton / Linseed oil assticker	At 10 days interval after disease appearance
T2: Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 sprays of Copper oxy chloride @ 0.25 % + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T3 : Seed Treatment with Captan / Thiram @ 3 g / kg seed + 2 sprays of Propiconazole @ 0.1% + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T4: Seed Treatment with Captan / Thiram @ 3 g / kg seed + 2 sprays of Hexaconazole @ 0.1% + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T5: Seed Treatment with Captan / Thiram @ 3 g / kg seed + 2 sprays of Tebuconazole @ 0.1 % + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T6: Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 sprays of crude leaf extract of *Azadirachta indica* @ 0.5 % + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T7: Seed Treatment with Captan / Thiram @ 3 g / kg seed +	At 10 days interval

sprays of Lantana camara @ 0.3 % + 0.11 % Triton / Linseed oil as sticker	after disease appearance
T_8: Seed Treatment with Captan / Thiram @ 3 g / kg seed + sprays of *Pungamia pinnata* @ 0.3 % + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T_9: Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 sprays of Mancozeb @ 0.3 % + 0.11 % Triton / Linseed oil as sticker	At 10 days interval after disease appearance
T_{10}:No spray (control)	

Observations: Disease development; yield; impact on seed quality parameters including seed germination, emergence, vigour

Note: Information on statistical data, cost: benefit ratio (economics); yield data and correlation with meteorological data should be supplemented. Selection of fungicides, dosages, application may be refined by PAU, Ludhiana considering the crop label claim as per recommended and approved list and data sheet will be supplied among the centers.

Experiment 12: Detection, location and transmission of seed borne *Alternaria sesami* in sesame

Objective : To determine transmission of seed borne target pathogen
Year of start : 2016
Crop : Sesame
Pathogen : *Alternaria sesami*
Centre : PJTSAU, Hyderabad

Action to be taken: PJTSAU, Hyderabad

- The protocol developed by PJTSAU, Hyderabad for detection of *Alternaria sesami* in seed is to be revalidated by TNAU, coimbatore and GBPUAT, pantnagar in comparison with the standard ISTA protocol.
- For that matter, the developed protocol and the infected seed would be supplied by PJTSAU, Hyderabad to the respective centres for validation of the protocol.

Experiment 13: Effect of pre-harvest fungicidal sprays on seed health and quality of soybean.

Objective

- To sustain the quality and viability of soybean seed by reducing seed borne infections

Year of start : 2018-2019
Crop : Soybean
Variety : JS 335
Pathogen : All Seed borne fungal infections
Centre : PJTSAU, Hyderabad

Methodology: would be supplied by PJTSAU, Hyderabad

Treatments:

	Treatments	Mode of treatment	Doses
T_1	Carbaxin + Thiram	Seed treatment	0.3%
T_2	T1 + Pyraclostrobin + Metiram	Prophylactic spray	0.2%
T_3	T1 + Carbendazim + Mancozeb	Prophylactic spray	0.2%
T_4	T1 + Pyraclostrobin + Thiophanate	Prophylactic spray	0.2%
T_0	Control (Untreated)		

Stages of the Plant:

S1 : At 50% pod maturity
S2 : At 75% pod maturity
S3 : At 100%

Replication : 3

Layout would be supplied by PJTSAU, Hyderabad

Observation

Percent Disease incidence, Seed yield, Seed health status with reference to fungal seed borne pathogens on harvested seed. Harvested seeds would be treated with T1 and kept in the storage for subsequent seed health studies till further sowing.

List of Participants

S. No.	Name	Designation	Centre	Email
1.	Dr. KarunaVishunavat	Professor (Plant Pathology) & PI, Seed Pathology	GBPUAT, Pantnagar	karuna_vish@yahoo.co.in 7500241408
2.	Dr. R.K. Ranjan	Asstt. Professor	DRPCAU, Pusa (Bihar)	rkrrau@rediffmail.com 9934416674
3.	Dr. Tulika Medhi	Jr. Scientist (Seed Pathology)	AAU, Jorhat	tulika_medhi@yahoo.co.in
4.	Dr. S.S. Jakhar	ASRO (Seed Pathology)	CCS HAU, Hisar	jakhar2023@gmail.com 9416397522
5.	Dr. S.R. Zanjare	Sr. Scientist (Plant Pathology)	STRU, MPKV, Rahuri	srzanjare@rediffmail.com 9422921871
6.	Dr. A.V. Suryawanshi	ASRO (Seed Pathology)	STRU, MPKV, Rahuri	avsseed@gmail.com 8275033779
7.	Dr. M.S. Dadke	ASRO	STRU, VNMKV, Parbhani	dr.dadkems@gmail.com 9420013960
8.	Dr. Atul Kumar	Principal Scientist	DSST, ICAR-IARI,	atulpathiari@gmail.com

			New Delhi	9013440112
9.	Dr. Vijayakumar H.P.	Scientist (SS)	ICAR- IISS, Mau	vijayhpm@yahoo.com 8887326854
10.	Dr. B. Pushpavathi	Principal Scientist (Pathology)	PJTSAU, Hyderabad	pushpaboyapati@gmail.com 9440595020
11.	Dr. N. Indra	Assistant Professor, (Pathology)	Seed Centre, TNAU, Coimbatore	nindra73@yahoo.com 9965524495
12.	Mrs. A. Priyadarsini	ASRO (Pathology)	OUAT, Bhubaneswar	anita.priyadarsini@yahoo.in 9437612648
13.	Dr. R. G. Parmar	SRO	AAU, Anand	rgparmarars@gmail.com 9638034617
14.	Dr. A.B. Brahmbhatt,	Professor & Head, Dept. of Plant Pathology	AAU, Anand	abbrahmbhatt@aau.in 9998387015
15.	Mr. Tarun Kumar Jatwa	Asstt. Professor (Plant Pathology)	SKNAU, Jobner RARI, Durgapura, Jaipur	tarunjatwa@gmail.com 9461553414
16.	Mrs. Rashmi Tewari		GBPUAT, Pantnagar	rashmipnt@gmail.com 9412100770
17.	Dr. Aflaq Hamid	Assistant Professor	SKUAST, Srinagar	falak19@gmail.com 7889617904
18.	Dr. Anju Bala	Asstt. Plant Pathologist	PAU, Ludhiana	anjusharma@pau.edu 8146557690
19.	Dr. G. Somanagouda	Associate Professor	Seed Unit, UAS, Dharwad	sgouda@gmail.com 09448497365/09900213620

C. Seed Entomology

Date: 10.05.2018

Chairman : **Dr. S. N. Sinha**
Principal Scientist & Former HOD, IARI Regional Station, Karnal

Convener : **Dr. Amit Bera**
Senior Scientist, ICAR-CRIJAF, Barrackpore

Recommendation: Groundnut pod (<10%MC) treatment with Emamectin benzoate (5 SG) @ 2 ppm (40 mg diluted in 15ml water/kg of pod) or Spinosad (45 SC) @ 2ppm (4.4 mg diluted in 15ml water/kg of pod) can provide effective management of groundnut pod borer during storage up to 6-9 months under ambient condition without affecting seed quality.

Experiment 1: Survey and evaluation of seed health status of farmers' saved seed with respect to insect infestation (to be combined with pathology / storage).

A portion of the sample should be taken from pathology/physiology group for detecting insect damage in seed, type of insect infesting seed as being done earlier under the experiment. Farmer's practice to store/protect seed should also be recorded.

Objectives

- To know the type and level of infestation by insects under storage condition.
- Impact of insect infestation on seed quality
- Farmer's practice, if any, to store / protect seeds from insect damage.

Year of start: 2006

All NSP centers including voluntary centers will do the experiment

Methodology: About 500 g of seeds of crop/ variety will be collected from farmers / seed producers before sowing on payment or gratis. **While collecting samples specific location should be recorded through GPS.** Each centre should collect seed samples of three major crops of that area and minimum 100 samples from each crop should be collected. Sample should be collected following appropriate sampling procedure so that entire zone can be covered within 2-3 years. While collecting seed a questionnaire will also be filled to know crop / variety, period and conditions of storage, treatments, if any, source of seed, if it is not farmers - saved one. The following observations are to be recorded.

1. Storage period
2. Seed moisture content (%)
3. Live insect, its species

4. Damage in 400 seeds including internal infestation
5. Germination (%)
6. Vigour test

Experiment 2: Effect of carbon dioxide (CO_2) treatment on the control of storage insect pests and the seed quality attributes under ambient conditions.

Year of Modification: 2017

Objectives

- To assess the effect of carbon dioxide (CO_2) treatment on the mortality/survival of storage insect pest under ambient conditions.
- To monitor effect of carbon dioxide (CO_2) treatment on seed quality attributes particularly seed viability and vigour after 3, 6, 9 and 12 months of storage under carbon dioxide (CO_2) atmosphere.

Crops	Centre
Sorghum	TNAU, Coimbatore, (*Sitophilus*)
Pearl millet	JAU, Jamnagar (*Rhyzopertha*)

Treatment

A. Treatment

T_1 - Normal air treatment (untreated control)
T_2 - Carbon dioxide (CO_2) @ 30% of the volume
T_3 - Carbon dioxide (CO_2) @ 40% of the volume
T_4 - Carbon dioxide (CO_2) @ 50% of the volume

B. Exposure period (P) in months

P_1 - 03
P_2 - 06
P_3- 09
P_4 - 12

Replication: 3 **Design:** FCRD

Materials

1. 48 air tight plastic containers with provision for air/gas inlet/outlets;
2. Carbon dioxide (CO_2) gas cylinder with metering device;
3. CO_2 / O_2 measuring device.

Methods

Seed of a popular crop variety with high germination and free from insect infestation (fumigate prior to use to ensure complete kill of field infestation, if any) should be used in the experiment. Fabricate or purchase airtight plastic containers of 1 kg capacity with rubber septa on its lid to insert syringe to remove air and add (CO_2) in

proportion to give-desired level of concentration in the containers by flushing method with an inlet and an outlet which will be sealed after release of CO_2.

Fill 500 g of seed in each container and put 10 pairs of test insects few days (20 days) prior to CO_2 treatment. To create a particular concentration (%v/v) for each treatment, calculated volume of CO_2 is injected by opening the inlet for specified time. Turn the containers twice upside down to mix intra-granular gases with CO_2 thoroughly. After completion of treatment, check the concentration of CO_2 with the metering device. Also check the concentration periodically to confirm any leakage, if so, plug it. Normally, a properly airtight container retains desired concentration of the gas. The temperature and RH will be recorded on weekly basis.

Observations to be recorded at the end of each storage period

- Percent damaged seed (insect infestation).
- Germination of undamaged seed
- Seed moisture content
- Number of live/dead insects in the representative sample

Experiment 3: Efficacy of insecticides and botanicals against storage insects of seeds and their influence on seed viability during storage under ambient condition

Crop	Centre
Wheat	SKNAU, Jobner; ICAR-IISR, Mau; NSRTC, Varanasi
Maize	TNAU, Coimbatore
Paddy	AAU, Jorhat; PJTSAU, Hyderabad; PAJANCOA, Karaikal
Pigeonpea	NDUAT, Faizabad; PDKV, Akola
Cowpea	UAS, Bangalore
Chickpea	PJTSAU, Hyderabad; JAU, Jamnagar;
Green gram	OUAT, Bhubaneswar;
Black gram	TNAU, Coimbatore; PAJANCOA, Karaikal
Field pea	CSAUAT, Kanpur

Objectives

- To evaluate insecticides/ botanicals against major storage insect-pests damaging seeds.
- Study of the storability of treated seeds.

Treatment

A. Insecticides/botanicals

1. Emamectin benzoate (Proclaim 5 SG) @ 2 ppm (40.0 mg/kg seed)

2. Spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed)
3. Deltamethrin @ 1ppm (0.04 ml/kg of seed)
4. Neem Azal 10000ppm @ 1.5ml/kg seed (=15 mg Azadirachtin/ kg seed)
5. *Karanj (Pongamia pinnata)* oil @ 5ml/kg seed
6. *Acorus calamus* TNAU Formulation @ 10 ml/kg of seed
7. Untreated control

B. Packaging Material: Gunny bag-lets of 2 kg capacity

Replications: 3 **Design:** CRD

Method: One kg of freshly harvested certified seed with very high percentage of germination and low moisture content (<10%) will be taken for each treatment. Required quantity of insecticides will be diluted in 5 ml water to treat 1 kg of seed for proper coating. Botanicals will be directly mixed with seed for coating. After drying in shade, seeds will be packed and kept in room under ambient temperature. The temperature and relative humidity of the room will be recorded on standard weekly basis.

Observations

Residual toxicity: Take out 100 g of treated seed, release 10 adult insects *Rhizopertha dominica / Callosobruchus chinensis* or important insects depending upon the crop and record mortality after 3,7 and 15 days and thereafter, every 3 months for a total period of 12 months or loss of germination below IMSCS, whichever is early.

Observation to be recorded

- Seed germination, seed moisture
- Insect infestation (% kernel damage and types of insect)
- Presence / Absence of insects (live and dead)

Experiment 4: Evaluation of pre-harvest spraying of insecticides for management of pulse beetle (*Callosobruchus* sp.)

Objective

- To evaluate efficacy of pre-harvest spray of insecticides for management of field infestation of pulse beetle.

Crop	Centre
Pigeonpea	UAS, Bangalore; PJTSAU, Hyderabad and PDKV, Akola
Green gram	OUAT, Bhubaneswar and JAU, Jamnagar;
Chickpea	MPKV, Rahuri; SKNAU, Jobner and NDUA&T, Faizabad
Black gram	TNAU, Coimbatore; PAJANCOA, Karaikal and AAU, Jorhat

Treatments

A. Insecticides/Botanicals

1. Emamectin benzoate @ 0.3ml/L
2. Malathion dust @10kg/acre
3. Profenofos 50EC @1ml/L
4. Neemazal 10000ppm @1ml/L

5. Control

B. Spraying schedule

1. Spraying at 50% pod maturity
2. Spraying at Maturity
3. Spraying at 50% pod maturity and maturity

Replication: 3 **Design:** Strip plot

Methodology: Seed crop should be grown with standard package of practices. For each treatment, plot size should be 5m x 3m. Harvest the crop leaving border rows. After threshing seed should be kept in cloth bag ensuring protection from cross infestation during storage. Observation on adult emergence should be taken at 7 days interval up to two months.

Observation: No. of exit hole

Experiment 5: Effect of solarization on bruchids (pulse beetle) infestation and quality of pulse seeds

Crop	Centre
Pigeonpea	NDUAT, Faizabad; PDKV, Akola
Cowpea	UAS, Bangalore; SKNAU, Jobner
Chickpea	JAU, Jamnagar; UAS, Dharwad; MPKV, Rahuri
Black gram	TNAU, Coimbatore; PAJANCOA, Karaikal; AAU, Assam
Green gram	OUA&T, Bhubaneswar; PJTSAU, Hyderabad; CSAUAT, Kanpur

Objectives

- To develop effective eco-friendly, low cost techniques for the control of bruchids infesting pulse seed.
- To study the effect of solarization on seed quality attributes of treated seeds.

Treatments

1. Solarization of fresh seeds in clear polythene (700 gauge) packet for 3 h for 2 days
2. Solarization of fresh seeds in clear polythene (700 gauge) packet for 3 h for 4 days
3. Solarization of fresh seeds in clear polythene (700 gauge) packet for 3 h for 6 days
4. Solarization of inoculated-seeds in clear polythene (700 gauge) packet for 3 h for 2 days
5. Solarization of inoculated-seeds in clear polythene (700 gauge) packet for 3 h for 4 days
6. Solarization of inoculated-seeds in clear polyethylene (700 gauge) packet for 3 h for 6 days

7. Control (Fresh seed)
8. Control (inoculated seed)

C. Packaging Material: Clear polyethylene (700 gauge) packets (30X20 cm) of 2 kg capacity

Replications: 3 **Design:** CRD

Method: One kg of freshly harvested certified seed with very high percentage of germination and low moisture content (<10%) will be taken for each treatment. For inoculated pulse seed, it will be inoculated with bruchids (5 pairs/kg seed) and will be kept under ambient condition in the room for two weeks. The adult insects would be removed from seed lot before transferring them in the polythene packets; its germination, insect damage (%) will also be recorded as per standard procedure. Solarization should be done around noon and same schedule should be maintained in every treatment. During solarization, thickness of seed layer inside seed packet should be kept at 5 cm. The temperature outside/inside of packets should be recorded each day before and after the solarization. After treatment, the seed packets should be kept under ambient conditions ensuring prevention of cross infestation. The temperature and relative humidity of the room will be recorded on standard week basis.

Observations to be recorded

Every 3 months for a total period of 12 months or loss of germination below IMSCS, whichever is early.

- Seed germination
- Seed moisture content
- Insect infestation (damaged kernel and kernel with bruchid eggs)
- Live and dead insects

The temperature outside/inside of packets should be recorded each day before and after the solarization.

Day	Outside Temperature ^{o}C		Inside Temperature ^{o}C		Remarks
	Before solarization	After solarization	Before solarization	After solarization	
01					
02					
03					
04					
05					
06					
Cumulative heat					

Cumulative Heat = Temperature ^{o}C x total no. of hours

Experiment 6: Survey and monitoring of insecticide resistance in storage insect pests infesting seeds in storage godowns

Centres
TNAU, Coimbatore; UAS, Bangalore; PDKV, Akola;
SKNAU, Jobner; PJTSAU, Hyderabad; MPKV, Rahuri;
UAS, Dharwad; OUA&T, Bhubaneswar; AAU, Assam

Objective: To estimate level of resistance to commonly used insecticides in storage godowns

Target insects:
Rhyzopertha dominica
Sitophilus oryzae
Tribolium castaneum
Callosobruchus maculatus

Insecticides:
Deltamethrin
Malathion

Methodology: All NSP centres should collect the surviving insects from seed storage godowns and also collect information regarding insecticide application schedule. Rear collected insects in the laboratory and Bioassay should be conducted for determination of LC_{50} through probit analysis against suspected insecticide resistance. Conduct two different Bioassay methods; one following film method and another by contact or residual method with treated seed. For film method, coat Petri dish (5 cm diameter) with one milliliter solution of insecticide on their inner sides through uniform spreading in the Petri dish by swirling it gently and then allowing it dry up at room temperature prior to release of insects. While in contact method, seeds shall be treated with different concentrations of insecticides prior to release of insects.

1. Batches of 20 insects are exposed to dosages of an insecticide. It is desirable to replicate at least four times. The batches of insects should be so formed as to ensure that each batch is a random sample of the population.
2. The dosages for testing should be spaced as evenly as possible over the mortality range (20%-80%). Since the toxicity is being tested with commercially available insecticides, different concentrations of insecticide should be prepared using water/ preferably distilled water. One batch of insects should be treated with water alone for untreated control.

Proceedings of the meeting held at PAJANCOA, Karaikal on 10th May, 2018 to finalize technical programme of Seed Entomology for the year 2018-19

Dr. Amit Bera, PI, Seed Entomology convened the session with a warm welcome to the Chairman, Dr. S.N. Sinha, Principal Scientist & Former HOD, IARI Regional Station, Karnal. Dr. Arulprakash R., Asst. Prof., Seed Centre, TNAU, Coimbatore acted as rapporteur. 15 seed entomologists from different centres participated in this session.

- Experiment No. 1 on 'Survey & evaluation of seed health status of farmers' saved seed' will be continued in its existing format. Survey should be done following proper sampling procedure. **Specific location of sample collection should be ascertained through GPS.**
- Experiment No. 2 on 'Effect of carbon dioxide (CO_2) treatment on the control of storage insect pests and the seed quality attributes under ambient conditions will be continued in its existing format on sorghum and pearl millet seed.
- Experiment No. 3 on "Efficacy of insecticides and botanicals against pests of stored seeds and their influence on seed viability during storage under ambient condition" will be continued in existing format.
- Experiment No. 4 on "Management of groundnut pod borer (*Caryodon serratus*) in groundnut pods" will be concluded with recommendation.
- Experiment No. 5 "Evaluation of pre-harvest spraying of insecticides for management of pulse beetle (*Callosobruchus* sp)" will be continued in existing format.
- In experiment No. 6 on "Effect of new packaging material (insecticide incorporated polypropylene bags - Zerofly) on storability of seed under ambient condition" will be concluded.
- New experiment on '**Effect of solarization on bruchids (pulse beetle) infestation and quality of pulse seed**s' will be taken up at various centres
- New experiment on '**Survey and monitoring of insecticide resistance in storage insect pests infesting seeds in storage godowns'** will be conducted at various centres

The meeting ended with thanks to the delegates.

List of Participants

S. No.	Name	Designation	Centre	Email
1.	Dr. S. N. Sinha	Principal Scientist & Former HoD, IARI Regional Station, Karnal	House no.-1604/Sector -9 Urban Estate, Karnal,	9812020071 s.n.sinha@gmail.com
2.	Dr. Amit Bera	PI, Seed Entomology	ICAR-CRIJAF, Saheb Bagan, Nilganj, Barrackpore WB, 700121	09732709874 amitbera.iari@gmail.com

3.	Dr. K. Kumar	Prof & HoD, Dept of Entomology	PAJANCOA&RI	9443315351 kumarkaliaperumal@gmail.com
4.	Dr.R. Arulprakash	Asstt. Prof. (Agri. Entomology)	TNAU, Coimbatore	09597481060 avrarulprakash@gmail.com
5.	Dr. Manja Naik C	Professor Entomology	UAS, Bangaluru	9480773978 naik_196710@yahoo.com
6.	Dr. S.S. Bareth	Professor Entomology	RARI, Durgapura	9784628551 ssb1971958@gmail.com
7.	Dr. D. Das	ASRO (Seed Entomology)	OUA&T, Bhubaneswar	dash_691961@yahoo.com 09437919435
8.	Dr. Mathura Mohan Goswami	Principal Scientist	STR, AAU, Jorhat, 785013, Assam	094351 83919 mgoswami57@gmail.com
9.	Prof. Rashmi S. Bhoge	ASRO	MPKV, Rahuri	9921372793 bhoge.rashmi@gmail.com
10.	Dr. G. Somana Gowda	SPO	Seed unit, UAS, Dharwad	9900213620 sgowda111@gmail.com
11.	Vijayakumar A. G.	SPO	Seed unit, UAS, Dharwad	9739982111 vijayakumarag@uasd.in
12.	Dr. R. B. Singh	ASRO, STR	NDUAT, Faizabad	09415717971 rbsinghnduat@gmail.com
13.	Dr. Jitendra Kumar	Junior Entomologist	CSAUA&T, Kanpur	962163301 jitendraento_csa@rediffmail.com
14.	Dr. K. Parimala	Associate Professor	PJTSAU, Hyderabad	9885040499 pari_mala123@rediffmail.com
15.	Mr. B. V. Patoliya	ASRO, STR	Main Pearl millet Research station, JAU, Jamnagar	08238040604 patoliyabv@jau.in

E. Seed Processing

Date: 10.05.2018

Chairman : **Dr. S. Rajendra Prasad**
Dean CoA, GKVK UAS, Bengaluru

Convener : **Dr. Ashwani Kumar**
Principal Investigator/ Senior Scientist, ICAR-IARI, Regional Station, Karnal.

Technical programme

- Under experiment no. 1 (optimization of sieve sizes), the seed recovery (%) shall be calculated using standard formulae considering the seed physical and engineering properties across crop/varieties and only notified varieties (existing in seed chain) shall be chosen for the study.
- Experiment no. 2 on Management of Karnal Bunt through mechanical seed processing (New Experiment)

Experiment 1 : Optimum sieve size and type of screen for grading seeds of different crop varieties and hybrids including their parents.

Objective:

1. Crop-wise classification of varieties in seed chain with respect to their seed size (small, medium and bold)
2. To standardize the size and type of grading sieve.

Crop		Centres
Chickpea	:	CSAUAT, Kanpur; MPKV, Rahuri; UAS Dharwad and UAS, Raichur
Pigeonpea	:	UAS, Bangaluru and UAS, Raichur.
Soybean	:	UAS, Dharwad; UAS, Raichur and MPKV, Rahuri
Paddy	:	ICAR-IARI, RS, Karnal; UAS, Raichur; NDUAT, Faizabad and TNAU, Coimbatore
Maize	:	TNAU, Coimbatore; UAS, Bengaluru
Mustard	:	CSAUA&T, Kanpur
Field bean	:	UAS, Bengaluru
Finger millet	:	UAS, Bengaluru
Sunflower	:	UAS, Bengaluru

Treatments

Crop: As above

Machine: Standard sieve shaker (specifications as per ISTA)
Sieve sizes: Grading sieve:

a. Recommended sieve (as per IMSCS)
b. Two sieves above the recommended sieve
c. Two sieves below the recommended sieve

Procedure

Unprocessed seed of the each crop variety will be procured from reliable source. Specified quantity of unprocessed seed material will be sieved using sieve shaker for 10 minutes at the rate of 25 strokes per minutes. Seed material retained over each grading sieve will be tested for observation on seed quality. The screen that retains maximum seeds with superior seed quality will be considered as optimum.

Observations

1. Recovery (%)
2. Seed size: Length, breadth & thickness (mm)
3. Germination (%)
4. Vigour index
5. Physical purity (%)
6. 1000 seed weight (g)
7. Moisture content (%)

Experiment 2: Management of Karnal Bunt through mechanical seed processing.

Objective: Elimination of bunted seed to maximum the processing efficiency

Crop		Centres
Wheat	:	ICAR-IARI RS Karnal; PAU Ludhiana, UAS Dharwad, GBPUA& T Pantnagar, JNKVV Jabalpur

Treatments

Machine: Specific Gravity Separator
Slope of deck: S_1-2.0^0 and S_2-2.5^0
Feeding: F_1-10 and F_2-15 Kg/minute
Replications: 3

Procedure

Unprocessed seed of each crop variety will be procured from reliable source. Specified quantity of unprocessed seed material will be sieved using pre- cleaner and seed cleaner cum grader using optimum sieve size. After that material will be processed at the specific gravity separator by using four combinations *viz.,* S_1F_1, S_1F_2, S_2F_1, S_2F_2.

Representative samples from unprocessed seed and after the pre- cleaner, seed cleaner cum grader and specific gravity separator will be analyzed for Karnal bunt infested seed by NaOH soaking method.

Observations

1. Karnal bunt infection (%) in feed (unprocessed seed)
2. Karnal bunt infection (%) in seed after pre- cleaner
3. Karnal bunt infection (%) in seed after seed cleaner cum grader
4. Karnal bunt infection (%) in final output
5. Recovery Kg/minute
6. Germination (%)
7. Vigour index
8. Physical purity (%)
9. 1000 seed weight (g)
10. Processing efficiency (%)

$$\text{Processing efficiency (\%)} = \frac{\text{Final output (100 – KB infection (\%) in final output)}}{\text{Feeding (100 – KB infection (\%) in feeding)}} \text{ X100}$$

Reference:

- Ashwani Kumar and Gupta Anuja (2017). Post-Harvest Management of Karnal Bunt in Wheat by Mechanical Seed Processing. *Indian Journal of Agricultural Sciences*. 87 (8): 1030-4.
- Ashwani Kumar and Gupta Anuja (2018). Management of paddy bunt (*Tilletia barclayana*) through mechanical seed processing. *Indian Journal of Agricultural Sciences* 88 (1): 132-7.

Joint Monitoring Team for 2018-19

Kharif season: Sept. / Oct. 2018; *Rabi* season: Feb. / Mar. 2019

Zone / NSP centres	Name/ Address/ Convener & Member		Email	Mobile No.
Northern Zone: Group I SKUA&T, Srinagar; SKUA&T,Jammu; HPKV, Palampur; PAU, Ludhiana	Dr. K. Madhusudhan, UAS, Bengaluru	Convener	sosnsp@gmail.com	09449866925
	Dr. N.K. Gupta, SKNAU, Durgapura	Member	nkgupta69@yahoo.co.in	09460987039
	Dr. Bhagirath Ram, DRMR, Bharathpur	Member	bhagirathram_icar@yahoo.com	09660114965
	Dr. Bhojaraja Naik K., IISS, Mau	Member	bharana.naik@gmail.com	09452559649
Northern Zone: Group II HAU, Hisar; GBPUAT, Pantnagar; IIWBR, Karnal; VPKAS, Almora; DSST,IARI, Delhi/ Karnal; SVBPUA&T, Meerut; IIMR, Delhi	Dr. G.K. Koutu, JNKVV, Jabalpur	Convener	gk_koutu@yahoo.co.in	09424676726
	Dr. J.B. Patel, JAU, Junagadh	Member	jbpatelvasai38@gmail.com	09909055981
	Dr. Aflaq Hamid, SKUAST, Srinagar	Member	falak19@gmail.com	07889617904
	Dr. S.P. Jeevankumar, IISS, Mau	Member	jeevaniitkgp@gmail.com	07839038085
Western Zone I SKRAU, Bikaner / CAZRI, Jodhpur; IGFRI, Jhansi; RVSKVV, Gwalior; RARI, Jaipur; DRMR, Bharatpur	Dr. P.K. Singh, BHU, Varanasi	Convener	pksbhu@gmail.com	09935126942
	Dr. T.P. Singh, PAU, Ludhiana	Member	tonasaini@yahoo.com	08847438107
	Dr. Godhavari S. Pawar, VNMKV, Parbhani	Member	gsp.mau@rediffmail.com	07588082156
	Dr. Faseela, KAU, Thrissur	Member	faseelajafer@yahoo.co.in	09947542929
Western Zone II JAU, Junagadh /Jamnagar; DGR, Junagarh; AAU, Anand; SDAU, SK Nagar; AU, Kota; NAU, Navsari; MPUAT, Udaipur	Dr. Govind Pal, IISS, Mau	Convener	drpal1975@gmail.com	09473821374
	Dr. Nitin Rastogi, IGKV, Raipur	Member	nitinrastogi1966@gmail.com	09425510169
	Dr. Sharmila D. Deka, AAU, Jorhat	Member	sharmila9368@gmail.com	09435351698
	Dr. B. Pushpavathi, PJTSAU, Hyderabad	Member	pushpaboyapati@gmail.com	09440595020
Eastern Zone: Group I NDUAT, Faizabad; IISR, Lucknow; CSAUAT, Kanpur / IIPR, Kanpur; BHU, Varanasi; IISS, Mau	Dr. Sanjay Kumar, IARI, New Delhi	Convener	sanjay_iari@rediffmail.com	09013563919
	Dr. R.P. Singh, BAU, Ranchi	Member	dsfbau@rediffmail.com	09431701162
	Dr. Amit Bera, CRIJAF, Barrackpore	Member	amitbera.iari@gmail.com	07003465890
	Dr. Arul Prakash, TNAU, Coimbatore	Member	avrarulprakash@gmail.com	09597481060
Eastern Zone: Group II RPCAU, Pusa; BAU, Sabour, BAU, Ranchi; CRIJAF, Barrackpore; BCKV, Nadia	Dr. C.L. Maurya, CSAUAT, Kanpur	Convener	clmaurya@csauk.ac.in	09453479077
	Dr. H.D. Mohan Kumar, UAHS, Shimoga	Member	soseedshimoga@gmail.com	09480838991
	Dr. Ravi Hunje, UAS, Dharwad	Member	ravihunje@gmail.com	09448301595
	Dr. K.M. Boraiah, IISS, Mau	Member	bors_km@yahoo.co.in	08005258190
Central Zone I IISR, Indore, PDKV, Akola; MAU, Parbhani; MPKV, Rahuri, VSI, Pune; KKV, Dapoli	Dr. M.V. Nagesh Kumar, PJTSAU, Hyderabad	Convener	srtcpjtsau@gmail.com	08008404874
	Dr. Ashwani Kumar, IARI RS, Karnal	Member	ashakmash@gmail.com	09416251530
	Dr. T. Ramanadane, PAJANCOA&RI, Karaikal	Member	raman_nadane@yahoo.com	09443875443

	Dr. B.V. Patoliya, JAU, Jamnagar	Member	patoliyabv@jau.in	08238040604
Central Zone II JNKVV, Jabalpur; CICR, Nagpur; IGKVV Raipur; OUAT, Bhubaneswar; NRRI, Cuttack	Dr. Basave Gowda, UAS, Raichur	Convener	so.seeduasr@gmail.com	09480696343
	Dr. D.P. Saini, MPUAT, Udaipur	Member	adseedfarms@yahoo.co.in	09461118470
	Dr. Meghachandra Singh, ICAR RC NEH, Manipur	Member	meghais@rediffmail.com	09436027223
	Dr. Udaya Bhaskar, IISS, Mau	Member	udaya9252@gmail.com	09557935499
North Eastern Zone UBKV, Pundibari; AAU, Jorhat; ICAR RC NEH, Barapani; Meghalaya (Manipur, Barapani & Tripura centres) and CAU, Imphal	Dr. Sharad Tiwari, JNKVV, Jabalpur	Convener	shtiwari@gmail.com	09424658241
	Dr. Rakesh Kapila, HPAU, Palampur	Member	rkkapila@gmail.com	09418101452
	Dr. D.T. Deshmukh, PDKV, Akola	Member	ddrseed@yahoo.com	09923585117
	Dr. Ramesh K.V., IISS, Mau	Member	rameshiari@gmail.com	08005202098
Southern Zone I ICAR-CCARI, Goa; UAHS, Shimoga; UAS, Dharwad/ Raichur; PJTSAU, IIRR, IIMR, IIOR, Hyderabad	Dr. Karuna Vishnuvat, GBPUAT, Pantnagar	Convener	karuna_vish@yahoo.co.in	07500241408
	Dr. C.B. Salunke, MPKV, Rahuri	Member	csseed.mpkv@yahoo.co.in	09404112240
	Dr. R. Siddaraju, UAS, Bengaluru	Member	srostrc@gmail.com	09880047284
	Dr. Sripathy K.V., IISS, Mau	Member	kudekallu2@gmail.com	08005202449
Southern Zone II UAS, Bangalore; TNAU, Coimbatore; SBI, Coimbatore; CICR, RS, Coimbatore; PAJANCOA & RI, Karaikal and KAU, Thrissur / Pattambi	Dr. S.K. Yadav, IARI, New Delhi	Convener	skysst@gmail.com	09868273684
	Dr. R. K. Sahu, NRRI, Cuttack	Member	rabinksahu@yahoo.com	09437386275
	Dr. V.K. Choudhary, RPCAU, Pusa	Member	vkchoudharypat12@gmail.com	09973252475
	Dr. Vijayakumar H.P., IISS, Mau	Member	vijayhpm@yahoo.com	09845613176

Address and Details of Principal Investigators of AICRP-NSP (Crops)

Name / Address of Principal Investigators	Office	Mobile	Fax No.
Seed Production & Certification **Dr. Ganesh Kumar Koutu** Principal Scientist, Dept. of Genetics & Plant Breeding JNKVV, Jabalpur, 482004, Madhya Pradesh E-mail: gk_koutu@yahoo.co.in	0761- 2681021	09424676726	02426- 243302
Seed Physiology, Storage and Testing **Dr. Shiv Kumar Yadav** Principal Scientist, Div. of Seed Science & Technology, ICAR- IARI, New Delhi 110012 E-mail: pispnsp@gmail.com / skysst@gmail.com	011-25841428	09868273684	011-25841428
Seed Pathology **Dr. Karuna Vishnuvat** Professor& Head , Dept. of Plant Pathology, GBPUAT, Pantnagar,263415, Uttarakhand E-mail: karuna_vish@yahoo.co.in	05944-234403	07500241408	05944-233473
Seed Entomology **Dr. Amit bera** Senior Scientist, ICAR- CRIJAF, Barrackpore 743 101 Email: amitbera.iari@gmail.com	0343-2512255	09732709874	0343-2512255
Seed Processing **Dr. Ashwani Kumar** Senior Scientist, ICAR- IARI, Regional Station, Karnal 132001, Haryana	0184- 2267169	09416251530	0184- 2266672

Calendar of Events for BSP & STR

S. No.	Event	Last date for completion of action	
Calendar of Events for Breeder Seed Production		***Kharif***	***Rabi***
1.	Placement of breeder seed indents to Director of Agriculture by the State Government & State Public Seed Producing Agencies.	15th December of previous year	31st May of year
2.	Submission of indents to DoAC&FW & SAU's	15th January	15th June
3.	Communication of indents by DoAC&FW to ICAR Headquarters.	28th February	15th July
4.	Communication of Breeder Seed Production Plan in BSP-1 by Project Coordinator (Crop) to DoAC&FW and ADG (Seed), ICAR	15th may	15th October
5.	Communication of the BSP-2 by the concerned Breeder to DoAC&FW and ADG (Seed), ICAR	After 15 days of the actual planting	After 15 days of the actual planting
6.	Communication of the BSP-3 by the concerned breeder to DoAC&FW and ADG (Seed), ICAR	After 15 days of actual inspection by the Joint Monitoring team	After 15 days of actual inspection by the Joint Monitoring team
7.	Communication of the final production figures of breeder seed by the ICAR in BSP-4 to DoAC&FW	15th February	15th July
8.	Communication of the Allocation of Breeder seed by DoAC&FW to Director of Agriculture and concerned indentors	31st March	15th September
9.	Lifting of Breeder Seed Production by indenters	30th May	30th October
10.	Communication of the lifting details of breeder seed against the GOI allotment to DoAC&FW by states and other agencies	After 15 days of the cut-off-date	After 15 days of the cut-off-date
11.	Submission of Breeder Seed Production activity to ICAR-IISS, Mau	30th June	30th January
12.	Monitoring of Breeder Seed Production by ICAR-IISS team	Month of Sept. / Oct.	Month of Feb. / Mar.
13.	Submission of Monitoring Team Report to ICAR-IISS, Mau	31st March	
14.	Communication of yearly Breeder Seed Production status to ICAR-IISS, Mau (production, shortfall / mismatch & non-lifting)	30th December	
15.	Annual Breeder Seed Review Meeting by ICAR Seed Division	3rd week of January	
Calendar of Events for Seed Technology Research Experiments under AICRP-NSP (Crops)			
1.	Communication of technical programme for STR	15th May	

	experiment to centres		
2.	Submission of status report of experiments	15th of August	15th of December
3.	Monitoring status of experiments by ICAR-IISS team	Month of Sept. / Oct.	Month of Feb. / Mar.
4.	Submission of yearly experimental results to PI's and ICAR-IISS, Mau	30th December	
5.	Submission of Monitoring Team Report to ICAR-IISS, Mau	First week of March	
6.	Annual Group Meeting of AICRP-NSP (Crops)	2nd or 3rd week of April	