PROCEEDINGS

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

Technical Programme
(2019-20)

held at

Chaudhary Charan Singh Haryana Agricultural University, Haryana
(07-09 April, 2019)

ICAR- Indian Institute of Seed Science
(Indian Council of Agricultural Research)
Mau 275 103 (UP), INDIA
(ISO 9001: 2008 Certified Institute)

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Session I

Inaugural Session

Date : 07.04.2019 **Time : 09:30-11:30**

Chief Guest	:	**Dr. T. Mohapatra** Hon'ble Secretary, DARE and DG, ICAR
Chairman	:	**Shri. Ashwani Kumar** Joint Secretary (Seeds), DoAC&FW, New Delhi
Guest of Honour	:	**Dr. D.K. Yadava** ADG (Seed), ICAR, New Delhi
Rapporteurs	:	**Dr. Govind Pal** Principal Scientist, ICAR-IISS, Mau **Dr. Siddaraju** SRO, UAS, Bengaluru

The joint 34th Annual Group Meeting of AICRP-NSP (Crops) with14th Annual Review Meeting of ICAR-Seed Project "Seed Production in Agricultural Crops"& Annual Breeder Seed Review Meeting has been organized by ICAR-IISS, Mau in liaison with CCSHAU, Hisar from 07th - 09th, April-2019. Inaugural session was graced by Hon'ble Secretary, DARE & Director General, ICAR, Dr. T. Mohapatra as the Chief Guest. Shri Ashwani Kumar, Joint Secretary (Seeds), DoAC & FW, Ministry of Agriculture & Farmers Welfare and Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi were also present on the occasion.

At the outset, Dr. Dinesh K. Agarwal, Director (Acting), ICAR-Indian Institute of Seed Science, Mau appraised about the progress made by AICRP-NSP (Crops) and ICAR Seed Project in increasing the breeder seed production and varietal replacement rate, reduction of varietal mismatch and also presented the research activities conducted in seed production and certification, seed physiology and storage, seed pathology, seed entomology and seed processing themes under STR component of AICRP-NSP (Crops). He highlighted that the breeder seed production during 2018-19 was 1.15 lakh quintal against indent of 0.84 lakh quintal, while in ICAR-Seed Project the total quality seed production was 4.8 lakh quintal.

Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi in his introductory remarks outlined the role played by AICRP-NSP (Crops) and ICAR Seed Project in catalyzing the seed production and research. He has highlighted the initiative taken by the Council in addressing the problem of soybean shortage through "Sub-Mission on Seed and Planting Material" and expressed concern on issues such as non-lifting of breeder seed, traceability of seed, and performance evaluation of co-operating centres.

Shri Ashwani Kumar, Joint Secretary (Seed), DAC & FW, New Delhi, speaking on the occasion complimented all the Scientists for their significant contribution in ensuring food

security in the country through quality seed production. He emphasized on issues such as development of software pertinent to seed traceability, effective mechanism for promotion of varieties in different platforms and need to focus for increasing the export of quality seed. Besides, he also suggested to ensure the quality assurance of breeder seed and development of robust molecular markers that aid in genetic purity testing of seeds.

During the inaugural function five publications pertinent to Indian seed statistics, working sheets on seed-borne diseases in tomato & onion and seed-industry management have been released. In addition, MPKV, Rahuri was awarded as the best performing center under Seed Technology Research component of AICRP-NSP (Crops). Under ICAR-Seed Project, IGKV, Raipur and ICAR-IARI, New Delhi were awarded as the best performing centersw.r.t university and ICAR Institute categories, respectively.

In his inaugural address, Hon'ble Secretary, DARE & DG, ICAR, Dr. T. Mohapatra congratulated the CCSHAU, Hisar on the occasion of Golden Jubilee year for its significant contribution towards welfare of farming community. He emphasized to develop a Self-Sustaining Seed System through channelization of Revolving Fund Scheme that address the issues of seed production, processing and storage and affordability of quality seed to the local farmers. Dr. Mohapatra further underlined the need to address the important areas such as prioritization of research in seed sector, reduction in varietal mismatch, augmenting informal seed systems, effective implementation of advance payment with indent of breeder seed, ensuring quality assessment of seed using molecular markers, strengthening of formal seed storage systems, development of standards for organic seed production including bio-fortified crops and diversification of seed systems with an impetus on local landraces.

Dr. Mohapatra also chaired the Annual Breeder Seed Review Meeting (ABSRM) and reviewed the status, shortfalls and non-lifting issues in breeder seed production during *Rabi* 2017-18 and *Kharif*-2018. He desired that breeder seed production indents needs to be further rationalized and exhorted the breeder seed production centres to implement a robust maintenance breeding programme to ensure the genetic purity.

The joint inaugural session was attended by nearly 170 delegates from various AICRP-NSP (Crops) and ICAR-Seed Project centres. The programme was also attended by Dean, Directors and faculty members of CCSHAU, Hisar and ICAR institutes. A good number of officials from National Seed Corporation and State Seed Corporation were also present on the occasion.

The inaugural session ended with formal vote of thanks proposed by Dr. K. S. Grewal, Dean, College of Agriculture, CCSHAU, Hisar.

Inaugural Session of Joint Annual Group Meeting of AICRP-NSP Crops, ARM of ICAR-Seed Project& Annual Breeder Seed Review Meeting held at CCSHAU, Hisar, Haryana

Technical Session II

Discipline wise presentation of Progress Report by Principal Investigators

Date: 07.04.2019 **Time: 3.00 – 7.00 PM**

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

Co-Chairman : **Dr. D.K. Yadava**
ADG (Seeds), ICAR, New Delhi

Rapporteurs : **Dr. T. Ramanadane**
Nodal Officer (Seeds), PAJANCOA & RI, Karaikal
Dr. H. P. Vijayakumar
Scientist, ICAR-IISS, Mau

The discipline wise presentation of progress report was made by respective Principal Investigators.

Sl.No.	Discipline	Principal Investigator
1	Seed Production & Certification	Dr. G.K. Koutu
2	Seed Physiology, Storage and Testing	Dr. S. K. Yadav
3	Seed Pathology	Dr. Karuna Vishnuvat
4	Seed Entomology	Dr. Amit Bera
5	Seed Processing	Dr. Ashwani Kumar

Some of the important issues deliberated in the Session are:

- The Chairman suggested that the Experiment on Integrated approach for enhancing seed yield and quality in various millets needs to be continued for one more year by including the State Government's recommended dose of fertilizer as Control. **(Action: PI, Seed Production & Certification and Concerned centres)**
- It was suggested that the Principal Investigators should make presentation with Statistical analysis for comparison of data. **(Action: All Principal Investigators)**
- The ADG (Seed) requested the Director, ICAR-IISS, Mau to write to the Vice Chancellors of centres about the Scientists who have not conducted / reported the results as well as centres who have not attended the Joint Annual Group Meeting.
- The ADG (Seed) also suggested that the recommendations of concluded experiments should be highlighted through Bulletins, Web sites, etc. **(Action: Director, IISS, Mau)**
- The Chairman desired that the Benefit Cost ratio must be calculated for all the experiments so that the techniques generated are beneficial to the farmers.

- All the centres are requested to provide Co-efficient of Variation (CV) as Standard Error and Critical difference (CD) are not sufficient to analyze the precision of the experiment carried over locations. **(Action: All STR and Voluntary Centres)**
- Centres should provide the data in the prescribed format being circulated by the concerned Principal Investigators. **(Action: All STR and Voluntary Centres)**
- All the centres are requested to submit the data before 15th of January, every year to the respective Principal Investigators so that the pooled data over locations or year is analyzed and submitted to the IISS, Mau for compilation. **(Action: All STR and Voluntary Centres)**
- All the Centres are requested to provide soil test report and meteorological data to analyze the environmental variations between the centres. **(Action: All STR and Voluntary Centres)**
- The Chairman suggested that to validate the results on Hybrid Purity Testing, same markers can be used by different centres. **(Action: PI, Seed Physiology, Storage & Testing and Concerned centres)**
- The ADG (Seed) desired that a Group Scientists should deliberate on the Biosafety issues, reason for germination improvement and the effectiveness of Nano particles as Seed priming agent. **(Action: Director, IISS, Mau)**
- He also desired to generate data for variety wise sieve size for seed grading in different crops as needed by the DoAC& FW, Govt. of India. **(Action: PI, Seed Processing and Concerned centres)**

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

Technical Session III: Centre-wise presentation of progress report

(NSP + ISP), 2018-19

Chairman	**Dr. R.R. Hanchinal** Former Chairman, PPV&FRA, New Delhi
Co-Chairman	**Dr. J.S. Chauhan** Former ADG (Seed),
Rapporteurs	**Dr. P.R. Chaudhary** Principal Scientist (Seed), Seed Division, ICAR **Dr. Uday Bhaskar, K.** Scientist, ICAR-IISS, Mau

In-toto 13 centres *viz.* South Zone I: UAS, Bangalore; UAS, Raichur; PJTSAU, Hyderabad; ANGRAU, Guntur; PAJANCOA&RI, Karaikal; KAU Thrissur; UAS, Dharwad, UAHS, Shimoga; North Zone I: SKUAST, Srinagar; SKUAST, Jammu; CSHPKVV, Palampur; PAU, Ludhiana & ICAR-VPKAS,

Almora; have presented progress reports pertinent to schemes AICRP-NSP (Crops) & ICAR Seed Project.

- With respect to UAS, Bengaluru centre, Chairman rendered remarks about the good progress achieved during 2018-19, but suggested for emphasis of centres should be in garnering external funds for seed infrastructure development. **(Action: All cooperating centres).**
- Regarding PJTSAU, Hyderabad, suggestions were made to enhance hybrid seed production and university should strive for garnering share in seed market and to be in competition with private seed companies. With reference to pending revolving fund seed money with the centre, imminent reimbursement was suggested. Directives regarding refund of unspent balance of previous years to ICAR-IISS, Mau were also given. **(Action: Nodal Officer, PJTSAU, Hyderabad).**
- In reference to KAU, Thrissur, it was advised for refund of revolving fund seed money and suggested for emphasizing the production under foundation and certified seed classes. **(Action: Nodal Officer, KAU, Thrissur).**
- With respect to UAS, Dharwad, it was suggested for increasing the total quantum of seed production and monitoring by ICAR-IISS for offseason sesame production was also suggested. **(Action: Nodal Officer, UAS, Dharwad).**
- Regarding UAS, Raichur & PAJANCOA&RI, Karaikal; The centres were lauded for excellent progress achieved.
- With respect to deliberations pertinent to North zone I, SKUAST, Kashmir centre, it was suggested for refund of leftover revolving fund seed money at an early date. **(Action: Nodal Officer, SKUAST, Kashmir)**.
- SKUAST, Jammu Centre was suggested for increasing quantum of quality seed production and also w.r.t breeder seed production of other institute varieties, nucleus seed should be obtained from parent organization with due written approval. **(Action: Nodal Officer, SKUAST, Jammu)**.
- PAU, Ludhiana centre was suggested for scheduling of training programmes in such way that temporal distribution throughout crop growing season should be maintained. **(Action: Nodal Officer, PAU, Ludhiana)**.
- Directives were issued for concerned cooperating centres under ICAR Seed Project for imminent refund of seed money under revolving fund scheme. **(Action: Concerned cooperating centres, ICAR Seed Project)**.
- ICAR Seed Project cooperating centres with left over unspent balances of previous years were instructed for refund of the same to ICAR-IISS, Mau at the earliest. **(Action: Concerned cooperating centres, ICAR Seed Project).**

Both chair & co-chair lauded the cooperating centres for significant progress achieved during 2018-19 under both the schemes AICRP-NSP (Crops) and ICAR Seed Project.

Technical Session IV: Centre-wise presentation of progress report

(NSP + ISP), 2018-19

Chairman	**Dr. R.R. Hanchinal** Former Chairman, PPV&FRA, New Delhi
Co-Chairman	**Dr. N.V. Naidu** Director of Research, ANGRAU, Guntur
Rapporteurs	**Dr. (Mrs.). Sharmila Dutta Deka** Principal Scientist, AAU, Jorhat **Dr. Sripathy K.V.** Scientist, ICAR-IISS, Mau

Session included presentations from centres of South Zone II (TNAU, Coimbatore; ICAR-SBI, Coimbatore; ICAR-IIOR, Hyderabad; ICAR-CCARI, Goa and ICAR-CIARI, Port Blair) and North Zone II (CCSHAU, Hisar; ICAR- IARI, New Delhi; ICAR- IIMR, Ludhiana; ICAR- IIWBR, Karnal).

Salient points emerged during the course of presentation and deliberations are given below;

- TNAU, Coimbatore and other centres implementing TSP programme under AICRP-NSP (Crops) and ICAR Seed Project shall organize seed distribution and other related activities of TSP well in advance before the commencement of sowing season i.e. April/ May for *Kharif* and September/ October for *Rabi* Season. **(Action: All TSP centres)**
- In light of expanding popularity of rice variety CO – 51 in eastern India and other major rice growing areas of the country, TNAU, Coimbatore was advised to include rice variety Co- 51 in its seed production programme and ensure its seed availability in the Tamil Nadu region.**(Action: Director (Seeds), TNAU, Coimbatore)**
- ICAR-CCARI, Goa and other centres has to refund the seed money under horticultural component to ICAR at an early date possible to avoid audit objections.**(Action: All concerned centres)**
- Considering the rising demand for quality seed in the Goa region specially for salinity tolerant rice cultivars, ICAR- CCARI, Goa was advised to upscale its seed production programme from current level of approx. 200 q in coming years and centre has to explore the possibility of production of foundation and certified seed by roping in the seed certification agencies from neighboring states.**(Action: Nodal Officer, ICAR- CCARI, Goa)**
- CCSHAU, Hisar was advised to fill the vacant positions under BSP and STR component on priority.**(Action: CCSHUA, Hisar)**
- In light of over production of breeder seed by GBPUAT, Pantnagar (5260q against the indent of 350.1q), owing to the receipt of private sector indents directly by university, centre has been advised not to encourage such practice and asked to suggest private sector indenters

to place indents through NSAI only (through DAC&FW). **(Action: Nodal Officer (BSP), GBPUA&T, Pantnagar)**

Chairman and Co-Chairman commended the achievements made by all centres in terms of quality seed production, seed technology research and tribal sub plan during 2018-19.

Session ended with the vote of thanks to Chair and Co-Chair and rapporteurs by Dr. Udaya Bhaskar, Scientist, ICAR-IISS, Mau.

Technical Session V & VI: Centre-wise presentation of progress report (NSP + ISP), 2018-19

Chairman	**Dr. N.V. Naidu** Director of Research, ANGRAU, Guntur, AP.
Co-Chairman	**Dr. S.N. Sinha** Former Head, IARI RS, Karnal
Rapporteurs	**Dr. R.K. Kapila** Principal Scientist & Nodal Officer (Seed), CSKHPKV Palampur (HP) **Dr. C. Vanitha** Asstt. Professor, SST TNAU Coimbatore, TN

A total of 23 presentations by the centres from East Zone I & II and Western Zone I & II were scheduled for presentations, out of which 20 centres, except 3 centres (ICAR –NRRI, Cuttack; RPCAU, Pusa and JAU, Junagarh) made their presentations on progress report (NSP+ISP) for the year 2018-19.During the presentations of 20 centres, the important points that emerged during the course of discussions are summarized below;

- NDUAT, Faizabad reported shortfalls in breeder seed production of wheat and barley varieties developed by university itself expected during Rabi 2018-19. Chairman asked Nodal Officer to implement necessary corrective measures for ensuring the production of commensurate quantities of breeder seed of these crop varieties against indents. **(Action: Nodal Officer, NDUA&T, Faizabad)**
- CSAUAT, Kanpur centre was advised to take up the issue of booking the salaries of permanent labours from the revolving fund with the competent authority of university for necessary rectification as the Revolving fund was already running in negative. **(Action: Nodal Officer, CSAUA&T, Kanpur)**

- BHU, Varanasi was asked to report the quantities of CS & TL seeds separately in the future. **(Action: Nodal Officer, BHU, Varanasi)**
- IIPR Kanpur centre was advised to enhance the seed production under ISP in addition to their Breeder seed production under Pulses Seed Hub.**(Action: Nodal Officer, IIPR, Kanpur)**
- SKRAU, Bikaner was asked to report the HRD programmes aspect- and date-wise as per the format in the future.**(Action: Nodal Officer, SKRAU, Bikaner)**
- ICAR- DRMR, Bharatpur requested funds to create seed storage for which the centre was advised to utilize Revolving fund for creation of the same.**(Action: Nodal Officer, ICAR-DRMR, Bharatpur)**
- OUAT, Bhubneshwar was asked to enhance Breeder seed production against the indents and to promote new varieties under ISP. **(Action: Nodal Officer, OUAT, Bhubneshwar)**
- BAU, Ranchi was asked to set targets for seed production and report the progress against those targets. Former ADG Seed, Dr. Chauhan also asked the centre to provide information on SRR. **(Action: Nodal Officer, BAU, Ranchi)**
- NDUAT, Faizabad and SKRAU, Bikaner centres were asked to refund the seed money of revolving fund, whereas SDAU, SK Nagar was asked to refund the unspent funds of XII plan, immediately. **(Action: Nodal Officer, Concerned Centres)**
- BHU Varanasi, SKRAU Bikaner, OUAT, Bhubneshwar, ICAR – CRIJAF, Barackpore and SDAU, SK Nagar centres were asked to expedite submission of data on farmer's seed quality survey allotted under ISP as soon as possible.**(Action: Nodal Officer, Concerned centres)**

The Chairman and Co-Chairman in their concluding remarks appreciated the excellent work done and reported by the most of the centres under NSP and ISP and hoped that the quality seed being made available shall have impact on overall food production in the country. They also called upon all the centres to make sincere efforts to produce the targeted quantities of quality seed.

The sessions ended with the vote of thanks to Chair and Co-Chair and rapporteurs by Dr. Udaya Bhaskar, Scientist, ICAR-IISS, Mau.

Technical Session VII: Centre-wise presentation of progress report (NSP + ISP), 2018-19

Chairman	**Dr. N.V. Naidu** Director of Research, ANGRAU, Guntur, AP.
Co-Chairman	**Dr. D.K. Agarwal** Director, ICAR-IISS, Mau

Rapporteurs

Dr. Ravi Hunje
Professor (SST), UAS, Dharwad
Dr. R.G. Parmar
ASRO (Pathology), AAU, Anand

During this session, concerned nodal officers (10 centres from Central Zone and 4 centres from North Eastern Zone) presented the progress reports.

- In this regard, MPKV, Rahuri centre achieved delineated targets of seed production. And also inferred that as an ITK, reported that wild pig problem was successfully controlled by using fencing with old sarees; a low cost technology (Rs.2,000/ha).
- W.r.t PDKV, Akola centre, there is short fall of more than 50% in soybean seed production was reported. In this regard, it was directed for fulfilling delineated targets with offseason seed production. Centre was also advised for rectifying the varietal mismatch issues.**(Action: Nodal Officer, PDKV, Akola)**
- Regarding VNMKV, Parbhani; it was advised earmarked targets should be achieved by giving due attention to participatory seed production**. (Action: Nodal Officer, VNMKV, Parbhani)**
- W.r.t JNKVV, Jabalpur, it was advised that delineated breeder seed production targets of soybean should be met without any shortfalls. **(Action: Nodal Officer, JNKVV, Jabalpur)**
- Regarding IGKV, Raipur, centre expressed concern over non-lifting of breeder seed by few agencies of Madhya Pradesh, hence, it was deliberated for raising the issue in appropriate forum. Director, IISS, Mau instructed that temporal spacing of capacity building programmes to be organized has to be followed for reaping desired benefits of training programmes. **(Action: Nodal Officer, IGKV, Raipur)**
- W.r.t. RVSKVV, Gwalior, centre was directed for attaining earmarked quantities of breeder seed without any shortfalls. **(Action: Nodal Officer, RVSKVV, Gwalior)**
- Nodal Officer of ICAR-CICR, Nagpur centre was advised for imminent refund of seed money of revolving fund to IISS, Mau.**(Action: Nodal Officer, ICAR-CICR, Nagpur)**
- Regarding AAU, Jorhat centre, it was advised that as breeder seed production is prioritized activity involving substantial cost, production should be against earmarked targets/indents. **(Action: Nodal Officer, AAU, Jorhat)**
- Director, IISS, Mau remarked that, as most of the centres have not submitted report on farmer survey 'Share of formal and informal sectors of quality seed domain', hence, instructed for submission of the same at the earliest. **(Action: Concerned centres)**
- Chairman rendered remarks on rationalization of indents and making the advance payment mandatory for avoiding the issues of non-lifting in this regard.

Plenary Session

Date : 09.04.2019 **Time : 12.00-2.30**

Chief Guest : **Dr. K. P. Singh**
Honorable Vice Chancellor, CCSHAU, Hisar

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

Rapporteurs : **Dr. Vijay R. Shelar**
SRO, MPKV, Rahuri
Dr. S.P. Jeevan Kumar
Scientist, ICAR-IISS, Mau

At the outset Dr. D. K. Agarwal, Director, IISS, Mau welcome Dr. K. P. Singh, Vice Chancellor, CCSHAU, Hisar and Dr. S. K. Sherawat, Director of Research, CCSHAU, Hisar welcome Dr. R. R. Hanchinal, former Chairperson, PPV& FRA, New Delhi. Dr. D.K. Agarwal, Director, IISS, Mau briefed progress of breeder seed production and seed technology research and quality seed production under ICAR Seed Project.

The proceedings of various sessions were presented by rapporteurs of respective sessions.

Session	Details	Name of rapporteur
I	Inaugural program	Dr. Govind Pal, Principal Scientist, IISS, Mau
II	Discipline wise presentation of progress report by PIs	Dr. Vijayakumar, Scientist IISS, Mau
III	Centre wise presentations of south zone I and North zone I	Dr. Uday Bhaskar, Scientist, IISS, Mau
IV	Centre wise presentations of south zone II and North zone II	Dr. Sripathi, Scientist, IISS, Mau
V &VI	Centre wise presentations of east zone I &II; West zone I &II	Dr. Rakesh Kapila, Nodal Officer, HPKVV, Palampur

Principal Investigators of five STR disciplines were presented finalized recommendations and technical program for 2019-20 of each discipline as below.

S No.	Discipline	Name of PI
1	Seed Production & Certification	Dr. G. K. Koutu,
2	Seed Physiology, Storage & Testing	Dr. S.K. Yadav
3	Seed Pathology	Dr. Karuna Vishnuvat

4	Seed Entomology	Dr Amit Bera
5	Seed Processing	Dr. Ashwani Kumar

Later, scientists superannuating from the seed group namely Dr. Karuna Vishnuvat from GBPUA&T, Pantnagar; Dr. V. P. Sangwan from CCSHAU, Hisar; Dr. Anil Kumar Sadhu from AAU, Anand; Dr. Vijay Kumar Salunke from VN MKV Parbhani and Dr. R. M. Kokate, VNMKV, Parbhani were felicitated by the dignitaries.

Dr. S. K. Sehrawat, Director of Research, CCSHAU, Hisar during his address informed that CCSHAU, Hisar is listed in top 100 universities of India. He stated that 350 varieties out of 1800 varieties in seed chain had mismatch. He also expressed that there are non-lifting problems of Indented seeds. He also emphasized that participatory seed production approach is very much essential for increasing the availability of quality seed. He also expressed that seed replacement rate and variety replacement rate in the country should be increased.

Dr. Hanchinal, during his address congratulated CCSHAU, Hisar for top ranking of University. He stated that India is the forefront runner in seed business. However, our export of seed is very less. In India, more than 600 companies are there and 55% seed demand is met by these private seed companies. He expressed that the Agricultural Universities which had good contribution in seed production and producing more than 1 lakh qtls of breeder seed should come up with old Glory. He also expressed that Seed Research has to be strengthened.

Dr. K.P. Singh, Honorable Vice Chancellor, CCSHAU, Hisar during his inaugural address expressed that the modern methods of varietal development should be emphasized. He stated that novel molecular breeding approaches should go hand in hand with classical breeding approaches for rapid progression of varieties in tune to global needs. He also stated that strengthening of seed production system should be done for reaping desired benefits of improved varieties.

The plenary session was ended with vote of thanks by Dr. V. P. Sangwan, Nodal Officer, NSP (Seed) and Head, Department of Seed Science and Technology, CCSHAU, Hisar

Finalization of Recommendations and Technical Programme Formulation for 2019-20

A. Seed Production and Certification

Date: 08.04.2019

Chairman	:	**Dr. R. R. Hanchinal** Former Chairperson, PPV&FRA, New Delhi
Co-Chairman	:	**Dr. J. S. Chauhan** Former ADG (Seeds), ICAR
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 2019-20 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 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 year of events given in the proceedings, should be strictly followed.
- Centers should provide cost benefit ratio and net monetary return.
- 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 validated through demonstration trials at centres where experiments had been conducted previously and ICAR Seed Project Centres with five demonstrations of one acre each.

- In Dhaincha (*Sesbania aculeata*), foliar application at flowering stage of DAP (20g/L water) incorporated with micronutrient mixture containing Zinc as Zinc sulphate (5g/L water) + Boron as Boric acid (3g/L water) + NAA (0.4g/10L water) and pinching at 60 days after sowing leads to enhancement in seed yield of 19% over control. The benefit cost ratio is 1.18.
- In Pillipesara (*Vigna trilobata*), foliar application at flowering stage of DAP (20g/L water) incorporated with micronutrient mixture containing Zinc as Zinc sulphate (5g/L water) + Boron as Boric acid (3g/L water) + NAA (0.4g/10L water) and pinching at 30 days after sowing leads to enhancement in seed yield of 48% over control. The benefit cost ratio is 1.83.
- In Sunhemp (*Crotolaria juncea*), foliar application at flowering stage of DAP (20g/L water) incorporated with micronutrient mixture containing Zinc as Zinc sulphate (5g/L water) + Boron as Boric acid (3g/L water) + NAA (0.4g/10L water) and pinching when main stem attains a height of 90 cm leads to enhancement in seed yield of 86% over control. The benefit cost ratio is 1.97.
- The best planting window period for off season sowing of soybean seed production is November 1st to 4th week in UAS, Dharwad, November 1st to 4th week in MAU Parbhani, September 3rd to 4th week in PJTSAU, Hyderabad, December 3rd to 4th week in JNKVV Jabalpur and January 3rd week in MPKV, Rahuri (excluding Kolhapur and Sangli region) and December Ist week in UAS Bengaluru.

Technical Programme for 2019-20

Experiment 1. 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): **05** **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 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.
- 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.

Treatment details

I. Main-Plot treatments (Nutrient management)

N1 – No fertilizer

N2 – 125 kg Neem + 1250 kg Vermi compost per ha or 12.5 tons FYM/ha

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 spray at flowering

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/ DS + 2% Borax spray at flowering

N5- State recommended dose of fertilizer

II. Sub-plot treatments (Priming)

P1 – Control - No priming		
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		
P3 – Seed priming with 2 % KH_2PO_4 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		
P4 – Seed priming with 20 % liquid *Pseudomonas fluorescens*		
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
Recommended dose of fertilizer (NPK)		75 kg P_2O_5 and 25 kg K_2O per ha or best recommended fertilizer dosage for your state, 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 @ 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}
- 1000 seed weight (gm)
- Seed recovery per cent
- Resultant seed quality - seed germination and vigour index
- Benefit Cost ratio
- Net monetary return

Experiment 2: Optimization of seed rate in Soybean (*Glycine max* L.)

Year of start: 2018-19

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 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: 3
- 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 Vigour; Dry matter production; Seed health)
11. Information on pests & diseases during crop growth.
12. Benefit Cost ratio

Experiment 3: Redefining isolation distance of IMSCS 2013 in Pigeonpea, Cotton, Maize, Mustard and Rice

Objectives: To redefine isolation distance from contaminants for foundation and certified seed production of Pigeonpea, cotton, mustard, rice hybrid & maize.

Year of start: 2018-19

Crop	Centers
Pigeonpea	PJTSAU, Hyderabad; MPKV, Rahuri; GBPUAT, Pantnagar
Cotton	PDKV, Akola; CICR, Nagpur; CCSHAU, Hisar; UAS, Dharwad; JAU, Jamnagar

Maize	IARI, New Delhi; UAS, Dharwad; PAU, Ludhiana; GBPUAT, Pantnagar; CSKHPKV, Palampur; OUAT, Bhubaneshwar
Rice Hybrid	TNAU Coimbatore; PJTSAU Hyderabad; KKV, Dapoli; UAS, Bangalore; ICAR-IISS, Mau
Mustard	IARI, New Delhi; PAU, Ludhiana; GBPUAT, Pantnagar; JNKVV, Jabalpur; NDUAT, Faizabad; SKNAU, Durgapura and ICAR- IISS, Mau

Methodology:

- **In pigeonpea,** pollinator (R 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,350m, 400m, 450 and 500m. Sufficient quantity of seeds of A line and pollinator (R line) should be **procured and supplied by Dr. Khandalkar from RVSKVV Gwalior, Mob. No.- 7999579251**. Plot size 2.5m (width) x 18 m (length) with spacing of 60 X 30 cm row to row and plant to plant distance should be maintained (R line). Pollen parent to be surrounded by two rows of female (CMS) line (of 2 meters length) at different distances mentioned above (as depicted in the diagram for maize). Precaution should be taken that other pigeonpea crop fields should not be there in the periphery of 500m.
- **In cotton**, pollen parent (R 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 (R line) and A line should be **supplied by Dr. Amrpali Atul Akhare, Mob No. 7020909738, E-mail- seed_technology@yahoo.co.in**. Plot size 2.5 m (width) x 8 m (length) with spacing of (75x45cm) row to row and plant to plant distance (R line). Pollen parent to be surrounded by two rows of female (CMS) line (of 2 meters length) at different distances mentioned above (as depicted in the diagram for maize). Precaution should be taken that other cotton crop fields should not be there in the periphery of 100m.
- **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 other maize crop fields should not be there in the periphery of 700m. Centre should use their own seed for execution of experiment. 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 two rows of female parent (of 2 meters length) at different distances mentioned above (as depicted in the diagram for maize).

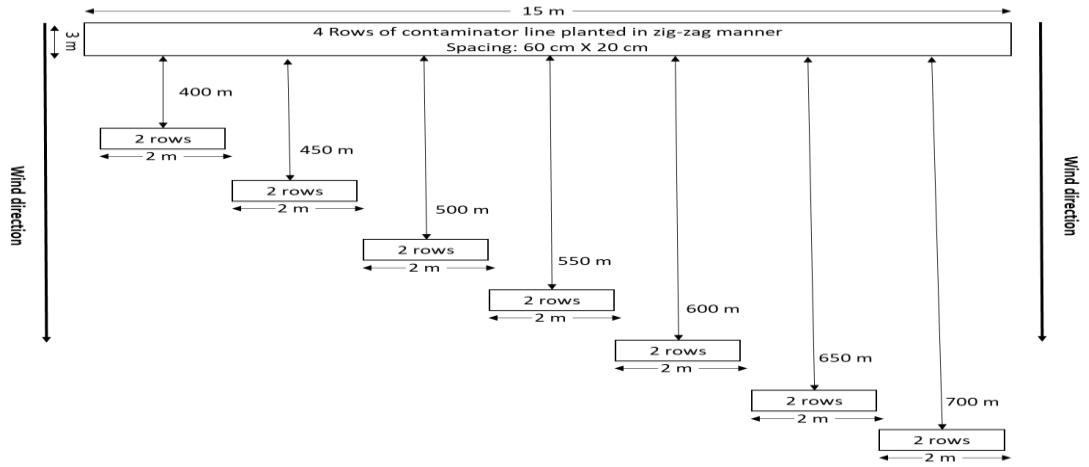

Fig.1 Schematic field layout for standardization of Isolation distance for maize

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

- **In Rice,** pollinator(R line) to be surrounded in one side (along the wind direction) by female parent (A line) at different distance for certified seed i.e., 50, 75, 100, 125, 150m. Seed of female parent (A line) and pollinator (R line) should be **supplied by Dr. C. Vanitha, Asst. Professor from TNAU, Coimbatore, Mob no. 9486442771** with 200 gm seed each of A line and R line. Plot size 1m (width) x 10 m (length) with spacing of 20 X 10 cm row to row and plant to plant distance should be maintained (R line). Pollen parent to be surrounded by two rows of female (CMS) line (of 2 meters length) at different distances mentioned above (as depicted in the diagram for maize). Precaution should be taken that other paddy crop fields should not be there in the periphery of 150m.
- **In Mustard**, 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 numbers of rows are 3). Pollen parent to be surrounded by the CMS line at different distances mentioned above with 2 rows of female line of 2m length. **Both pollen parent (R line) and female parent (CMS line) will supplied by Dr. Bhagirath Ram, Principal Scientist, Bharatpur, Rajasthan, Mob. No. 9660114965)** with 200 gm seed each of A line and R line. Precaution should be taken that other mustard crop fields should not be there in the periphery of 550m.

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

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

Rice (Certified seed: 100m as per IMSCS 2013 Norms)

Directions	% Seed Set				
	50m	75m	100m	125m	150m
Along the Direction of Wind					

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 4: 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; ANGRAU, Maruteru; UAS Bangalore; KKV Dapoli; RARI, Durgapura and SKUAST, Srinagar.

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 **(at least 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 **(at least 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 when compared to selected rice variety (but relatively of similar seed size as that of selected rice variety in each group *viz.,* small, medium & long)

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 5: 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.M.M.Sharma, SKRAU-Bikaner, Mobile No.:9414451910/ 7014149820 to the respective centers who will execute the experiment.

Crop	Centres
Chenopodium quinoa	HPKV, Palampur; SKRAU-Bikaner; JAU, Jamnagar; JNKVV, Jabalpur; IGKV, Raipur; AAU, Jorhat; VNMKV, Parbani; PDKV, Akola; SKUAST, Srinagar; ICAR-IISS Regional Station, Bengaluru; RARI, Durgapura

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 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- Recommended dose of NPK in the ratio of 60:40:20 or state recommendation dose of 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 + 10kg PSB per ha+10kg KSB per ha+ 10 kg Azospirillum per ha.

II. Sub-plot treatments (Priming)

P1- Control - No priming

P2- Seed priming with *T. harzianum* (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 % 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) Neem Cake (5 % N, 1% P and 2 % K) Vermicompost (2 % N, 1.5% P and 0.6 % K) PSB @ 10 Kg/ha (Compensate 20 kg P) KSB @ 10 Kg/ha (compensate 20 kg K) *Azospirillum* @ 10 Kg/ha (compensate 20 Kg N)

Observation

- Field emergence
- Plant height at 30 days and at harvest
- Days to first flowering
- Days to 50% flowering
- No. of branches plant^{-1}
- Seed yield plant^{-1}
- Seed yield ha^{-1}
- 1000 seed weight
- Seed recovery per cent
- Resultant seed quality - seed germination and vigour index
- Benefit Cost ratio
- Net monetary over investment

Experiment 6: Development of Organic Seed Production Technology for important crops

Objective: Standardization and Development of an Organic Seed Production Technology for important crops.

Centres	Crop
ICAR RC NEHR, Sikkim Centre (NOFRI),	Rice, Ragi & Black Gram
ICAR RC Meghalaya	Rice, Maize
ICAR RC NEHR Manipur Centre.	Black Rice, Maize

AAU, Jorhat	Rice
IGKV, Raipur	Rice
IISS, Mau	Rice
PJTSAU, Hyderabad	Rice & Maize
UAS Bangalore	Rice
VNMKV, Parbhani	Wheat & Maize
UAS, Dharwad	Wheat & Maize

TREATMENT DETAILS		
No. of treatments	**05**	
Sowing method		
Direct sowing – 30 x 10 cm for Rice and 45 x 15 cm for Maize – sown at 3-4 cm depth		
Treatment details (Common to rice, maize, wheat and ragi))		
T_1 – Control **(**No Fertilizer & Manure)		
T_2- State Recommended Dose of NPK Fertilizer (Inorganic)		
T_3-10% of RDN through Neem Cake+70% of RDN through FYM+20% of RDN through *Azospirillum* + 10kg PSB per ha+10kg KSB per ha		
T_4-10% of RDN through Neem cake+ 70% of RDN through Vermicompost+ 20% of RDN through *Azospirillum* +10kg PSB per ha+10kgKSB per ha		
T_5- 10% of RDN through Neem cake + 30% of RDN through Vermicompost+ 40% of RDN through FYM+ 20% of RDN through *Azospirillum* +10kg PSB per ha+10kgKSB per ha		
Note: *The doses of organic sources have to be calculated as per the N requirement of respective crop prescribed as per state package of practices.****(RDN – Recommended dose of Nitrogen)***		
Treatment details (for blackgram)		
T_1 – Control **(**No Fertilizer & Manure)		
T_2- State Recommended Dose of NPK Fertilizer (Inorganic)		
T_3-10% of RDN through Neem Cake+70% of RDN through FYM+20% of RDN through *Azospirillum* + 10kg PSB per ha+ Remaining Phosphorus through rock phosphate+10kg KSB per ha		
T_4-10% of RDN through Neem cake+ 70% of RDN through Vermicompost+ 20% of RDN through *Azospirillum* +10kg PSB per ha+ Remaining Phosphorus through rock phosphate + 10kgKSB per ha		
T_5- 10% of RDN through Neem cake + 30% of RDN through Vermicompost+ 40% of RDN through FYM+ 20% of RDN through *Azospirillum* +10kg PSB per ha+ Remaining Phosphorus through rock phosphate + 10kgKSB per ha		
Note: *Through application of Neem cake and FYM/vermicompost, some quantity of Phosphorus also will be supplied in addition to 'N' but remaining phosphorus needs to be supplied through Rock phosphate.*		
Design	Randomized block design (Fixed plot)	
No. of replications	Four	
Plot size	**Gross plot size**	3 m × 5.0 m (15.0 m^2) for rice, ragi, wheat and blackgram

		3.25 x 5=16.25m^2 for Maize
Space between plots (Plot Border)	One metre in all crops	
Cultivar	Any Local/traditional variety appropriate for seed production season	
Seed treatment	In case of cereals, seed treatment with biocontrol agents *viz., T. harzianum* or *Pseudomonas fluorescence*@10g/kg of seed; In black gram, seed treatment with *Rhizobium* @10gm/kg seed, shall be followed.	
Plant protection (As Prophylactic Measure)	Uniform application of botanicals i.e., Neem oil (@5ml/ L of water) to all the plots. Spray of commercially available *Trichoderma harzianum* Emulsifiable concentrate @ 2 ml/litre *or Pseudomonas fluorescence* Emulsifiable concentrate @ 5ml/litre or Combination of *Pseudomonas fluorescence* + Bacillus subtilis @ 5gm/litre water as a prophylactic measure. **Schedule of Application of *Pseudomonas fluorescence* in Rice** I. Boot Emergence stage II. 50% emergence of panicle stage III. Pre-harvest (15 days prior to harvest) stage **Schedule of Application of combination of *Pseudomonas fluorescence* + *Bacillus subtilis in wheat*** I. Boot Emergence stage II. 50% emergence of panicle stage III. Pre-harvest (15 days prior to harvest) stage **Schedule of Application of combination of *Pseudomonas fluorescence* + *Bacillus subtilis* in Maize and Ragi** I. 45 DAS II.60 DAS III. 90 DAS **Schedule of Application of combination of *Pseudomonas fluorescence* + Bacillus subtilis in Black Gram** I. 30 DAS II.50 DAS	
Source of Fertilizer	Farm Yard Manure (0.5%N, 0.2%P & 0.5% K) Neem Cake (5 % N, 1% P and 2 % K) Vermicompost (2 % N, 1.5% P and 0.6 % K) PSB @ 10 Kg/ha (Compensate 20 kg P) KSB @ 10 Kg/ha (compensate 20 kg K) *Azospirillum* @ 10 Kg/ha (compensate 20 Kg N)	

Observations to be recorded

Rice, Wheat & Ragi	**Maize**
• Field emergence • Plant height at 30 days and at harvest • Days to first flowering • Days to 50% flowering • No. of tillers plant^{-1} • Seed yield plant^{-1} • Seed yield ha^{-1} • 1000 seed weight • Seed recovery per cent • Resultant seed quality - seed germination and vigour index • C:B ratio	• Field emergence • Plant height at 30 days and at harvest • Days to first flowering • Days to 50% flowering • No. of cobs plant^{-1} • Seed yield plant^{-1} • Seed yield ha^{-1} • 1000 seed weight • Seed recovery per cent • Resultant seed quality - seed germination and vigour index • C:B ratio
Black Gram	
• Field emergence • Plant height at 30 days and at harvest • Days to first flowering • Days to 50% flowering • No of pods per plant • Seed yield plant^{-1} • Seed yield ha^{-1} • 100 seed weight • Seed recovery per cent • Resultant seed quality - seed germination and vigour index • C:B ratio	

Guidelines

1. The organic treatment plots have to be laid out in separate block (preferably in organically converted field) and inorganic treatments (RDF) are to be laid out in the adjacent inorganic/regular field having almost similar conditions to avoid the heterogeneity.
2. Care should be taken to avoid the flow of water from inorganic field to organic experimental site/field.
3. No other crop should be grown in subsequent season in the experimental site/field of organic seed production technology.
4. The organic sources of NPK *viz.,* Neem cake, FYM/vermicompost should be applied to experimental field as per treatment schedule at least 20 days before sowing. The

biofertilizers *viz.,* Azospirillum, PSB and KSB should be mixed with FYM/ vermicompost at the time of application to the field.

List of Participants

Sl. No	Name	Organization	Email	Mob. No.
1	Dr. G.K. Koutu	JNKVV, Jabalpur	gk_koutu@yahoo.co.in	9424676726
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B. Seed Physiology, Storage and Testing

Chairperson: Dr. A. K. Saxena, Director, ICAR-NBAIM, Mau, UP
Convener: Dr. Shiv K. Yadav, Principal Scientist, ICAR-IARI, New Delhi

A total of six experiments in Seed Physiology, Storage and Testing were conducted during 2018-19. Based on the deliberations with the scientists and experts present in the house, the following decisions were taken.

- In view of the problems in reporting it was decided that the complete report in all respects as per guidelines circulated last year (Experiment no. of discipline, Name of centre & Crop, Experimental details, Results w.r.t to each table, Conclusion and Suggestion(s), if any) on analysed data should be submitted in time. This year onwards, the experiments on crops harvested from January to May shall be reported on or before 31st July, the experiments on crops harvested from June to December and the experiments of continuous nature (e.g. storage) shall be reported latest by 31st January. The centres who reported for Rabi crops "Experiment is in progress" are requested to send the detailed reports by 31 July, 2019.
- For highlighting the Salient Finding(s) of respective centre by PIs in the workshop, it also desired that each centre shall submit 1-2 slides each for each crop in every experiment they are involved on or before 1st March. Reports submitted late shall not be included in proceedings of the workshop. Non sub-mission of reports shall be treated as non-conduct of experiments by the centre(s).
- It was directed to the PIs that they have to submit the details of late submission and or non-submission of reports by the centre(s) to the Director, IISS, Mau with a copy to the ADG (Seeds), ICAR, New Delhi for taking action(s) as deemed fit.
- It was suggested that non-reporting and or under executing centres (both regular and volunteer) should be recommended for performance based budget allocation(s) and or incessantly non-performing ones be dropped out from the list of regular centres. It was also suggested that continuously good performing voluntary centres may be considered for regularization.
- The scientists from various centres requested that there should be a specific mention in allotment letter from IISS, Mau about the contingency/funds allotted exclusively for chemicals and glassware so that these are not diverted to any other use.
- Each centre was requested to prepare head wise realistic requirement of funds for each experiment allotted to them under this discipline and submit to PI for further necessary action at his end.
- It was also recommended that respective centres may also use funds allotted under the head 'contingency' for need based payment to contractual(s) hired for these experiments, if

all other requirements for these experiments could be met from availability of funds under in-house and or externally funded projects with them.

- Standardization of seed testing protocol for Jatropha was done under experiment number 6 "Standardization of seed testing protocols and development of seed standards for *Jatropha*". In-spite of the best efforts by the participating centres, sufficient numbers of seed lots from all the growing areas required for the development of seed standards were not available hence, it was recommended that this experiment will be dropped for taking up further studies during 2019-20. However, the centres shall keep on trying to get as many as possible seed lots from different regions.
- Rest of the experiments will continue with some modifications.
- For better outcome of from experiment 1 "To validate the validity periods of certified seeds of field crops" it was decided that all the participating centres shall test the uniform seed lots being supplied by the earmarked centres for each crop.
- Under the experiment 2 "Hybrid purity testing using molecular markers in public sector hybrids of field crops" various centres have identified unique markers for purity testing of hybrids in some crops. While there are other markers identified by parent institute(s) for their own hybrids e.g. ICAR-CICR, Nagpur for Cotton, ICAR-IIOR, Hyderabad for Castor and PDKV, Akola for Sorghum, if any. It was decided that these markers (primer sequences), name of companies whose chemicals have been used, seeds of hybrids and their parental lines in sufficient quantities with exact protocol followed will be sent by the respective centre(s)/ institute(s) to other participating centres for that crop, including castor and cotton for validation. Respective centres shall also repeat the experiment for in-house validation with the same materials and methods in addition to exploring more markers in other hybrids.
- The availability of cotton hybrids and their parental lines in sufficient quantities to each participating centre shall be made by PDKV, Akola and ICAR-CICR, Nagpur from its Regional Station at Sirsa. The PDKV, Akola and ICAR-IIOR, Hyderabad shall make available Sorghum and Castor seeds, respectively of their own hybrids with parental lines in sufficient quantities to each participating centre.
- It was recommended that all the centres involved in experiment 2 should be strengthened with a minimum grant @ Rs. One and half lakh per crop as additional contingency exclusively for purchase of chemicals/glassware and maintenance/repair of equipments.
- Studies under the experiment 3 "Physiology studies and development of priming technologies for enhancing planting value of the seed in field crops under optimal and sub-optimal conditions" revealed that there were some treatments which had either deleterious or no effect on seed planting value in different crops. So it was decided to exclude these six treatments: Halopriming; Salicylic acid @800ppm, $MgNO_3$ @2%, $ZnSO_4$

@0.3%, $MnSO_4$ (@0.5% and Nitric oxide @0.25 mM and Bio-priming with *T. viride* (CFU – 2 X 10^9per gm) @ 10 g / kg seed.

- For ensuring uniformity in treatments with bio-agents in experiment 3, it was also decided that all the participating centres in this experiment shall be supplied with sufficient quantities of all the cultures including *T. harzianum* by ICAR-NBAIM, Mau. The AAU, Jorhat shall be given double the quantity for taking up an additional experiment under organic conditions.
- It was also decided that studies in stress conditions under the sub-experiment II "Validation of standardized priming technologies in pigeonpea for sub-optimal conditions" of experiment 3 will be taken up using any two local varieties with last recommended treatments. It was agreed that maintaining/creating/mimicking moisture stress under field conditions is very difficult, but any treatment which is effective under temperature stress could also do well under moisture stress. So, it was recommended to do staggered (early/late) sowings for temperature stress and for salinity/alkalinity stress, local soil conditions can be taken into consideration. For salinity/alkalinity conditions, any farmers' field, if available can also be selected for demonstrations.
- It was also suggested to conduct the experiment with thermo and photo sensitive varieties of maize and paddy under sub-experiment III "Development of seed enhancement techniques for low temperature stress during seedling establishment in maize and paddy" of the experiment 3.
- For standardization purpose, fresh seeds of soybean and onion under experiment 4 "Use of nano-particles in enhancing seed quality and storability of seeds" will be sent by ICAR-IARI, New Delhi to TNAU, Coimbatore for treatment and distribution to centres as mentioned in technical programme. It was decided that nano-particle(s) toxicity to roots will also be included in studies. The issues of bio-safety, if any, related to the use of nano-particles need to be discussed. The storage studies in all the crops with previously treated seeds shall continue.
- It was suggested that the experiment 5 "Influence of terminal heat stress on seed set, seed yield and quality in field crops" should be only be done at centres where crops either naturally experience elevated (appox. 5°C) temperature at terminal stage under normal/staggered sowing situations or has controlled growth chamber facilities. It was also recommended that each centre (in respective crop) in addition to the conduction of experiment as per technical programme. Each centre shall also compare untreated (control) with salicylic acid @400ppm in the demonstration plots of (minimum 100sqm each) to elucidate the impact of elevated temperatures.
- The issue of working of this group on vegetable seeds like; onion also figured in the discussions. It was decided to contact ICAR-IIVR, Varanasi and or ICAR-DOGR, Pune and ensure that these sorts of experiments are not being taken under AICRP on vegetable crops.

To avoid repetition of work, if any, it was suggested to drop these sorts of experiments in vegetable crops from AICRP-NSP (Crops).

- Cost effectiveness (C/B ratio) for the use of molecular markers as well for seed quality enhancement experiments have to be worked out and reported.
- It was reiterated that the information on ITK's being used by the farmers for seed/grain storage be collected with the work under the Seed Pathology experiment "Studies on seed health status of farmers own saved seeds" and reported to "Seed Physiology, Storage and Testing" group for taking up the validation studies.
- It was also decided that all the BSP, ISP and STR centres shall collect the weed seeds from the seeds of crops grown in all seasons from respective areas, take 3-4 pictures of individual seed as well as in group of 10-15 seeds and plants, if possible from different angles such that it depicts actual shape, size and color of weed seeds. Every centre should submit the seeds (appox. 50g), pictures and local and or scientific name to coordinating unit for developing weed seed atlas of India.

Recommendations:

- Standardization of seed testing protocol for Jatropha was done. It was recommended that a period of 7 days was found to be sufficient for taking 1st count while final count on the 12th day of putting was found better for evaluation of normal seedlings at a fixed temperature of 30^{0}C. With respect to viability test by employing tetrazoilum chloride, pre-moistening treatment of 26 hrs using whole seeds with seed coat cracked at opposite to the hilum and staining of embryo for 3 hrs can be followed.

Experiment 1: To validate the validity periods of certified seeds of field crops (as per the IMSCS 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 (25000)*	:	ICAR-IARI, New Delhi; GBPUAT, Pantnagar; VNMKV, Parbhani; RARI, Durgapura; MPKV, Rahuri; **HAU, Hisar***; NDUAT, Faizabad; CSAUAT, Kanpur; SKUAST, Kashmir, Srinagar; CSKHPKV, Palampur and ICAR-IISS, Mau
Paddy (25000)*	:	**ICAR-IARI, New Delhi***; PAU, Ludhiana; PJTSAU, Hyderabad; TNAU, Coimbatore; UAS, Bengaluru; **PAJANCOA&RI, Karaikal***; KAU, RARS, Pattambi; AAU, Jorhat; SKUAST, Kashmir, Srinagar; OUAT, Bhubaneswar and ICAR-IISS, Mau

Maize (25000)*	:	ICAR-IARI, New Delhi; TNAU, Coimbatore; **PAU, Ludhiana*** and ICAR-IISS, Mau
Sorghum (25000)*	:	ICAR-IIMR, Hyderabad; **PDKV, Akola***; VNMKV, Parbhani; MPKV, Rahuri and UAS, Dharwad
Cotton (25000)*	:	**ICAR-CICR, Nagpur***; PDKV, Akola; PJTSAU, Hyderabad and UAS, Dharwad
Soybean (20000)*	:	ICAR-IARI, New Delhi; GBPUAT, Pantnagar; JNKVV, Jabalpur; VNMKV, Parbhani; **MPKV, Rahuri*** and UAS, Dharwad
Chickpea (25000)*	:	ICAR-IARI, New Delhi; JNKVV, Jabalpur; VNMKV, Parbhani; **RARI, Durgapura***; CSAUAT, Kanpur and ICAR-IISS, Mau
Castor (25000)*	:	**PJTSAU, Hyderabad***; JAU, Jamnagar and AAU, Anand
Groundnut (20000)*	:	AAU, Anand; OUAT, Bhubaneswar; JAU, Jamnagar; MPKV, Rahuri; UAS, Bengaluru and **UAS, Dharwad***(both *Kharif* and *Rabi* harvest); RARI, Durgapura and BSKKV, Dapoli

*Minimum nos. of seeds of each variety to be immediately sent to every centre of that crop by the centres identified (in bold text)

Technical Programme:

Materials:

Seed lots: Sufficient quantities of fresh or revalidated (Once or twice, if available and the crop is expected to maintain the viability for the revalidated period) seeds of minimum two most popular varieties in each crop and seeds of same varieties, will be sent by the centres identified (in bold text above). Date of harvesting, Moisture content, Viability (Germination %), Date of test and validity period (in case of revalidated lots) should be noted and made known to all the participating centres. In cases where sufficient quantities of the fresh and or revalidated (Once or twice) seeds lots are already stored for this experiment at different centres, they may continue 'additionally' taking observations, if satisfied with the outcome in line of the rationale of the experiment.

Kindly note: For different crops, different **centres consented*** to timely post/send the seeds in moisture impervious package (700 gauge) the sufficient quantities (should be 25% more than the worked out; keeping in mind nature of crops and stored in 2 types of bags) of certified (one time tested with 9 months validity) lots of seeds of two most dominant/popular/latest varieties to all the participating centres for that particular crop. The centres responsible (as indicated below in bold) for sending seeds shall determine/test; Moisture content (may need to dry to bring down MC at recommended levels for each crop), indicate the age (date of harvest) and test the viability (above IMSCS) and share the details with participating centres. The

participating centres will get the seeds packed in 700 gauge polythene, shall divide the lot of each variety in two equal parts and store in Gunny bags and HDPE bags at ambient conditions of respective centres. The IISS, Mau will bear the cost of purchase of the seeds for this purpose and the postage, if required. The procured certified or revalidated seed lots if having viability at-least 5% more than IMSCS may save time. In cases, where certified lots are not available and or in crops where it is expected that it will not maintain the viability for the minimum prescribed period, fresh seed lots will be sent with details to participating centres. The very purpose of this experiment is to know how long the seeds lots can maintain viability over and above IMSCS.

Evaluation for Vigour:

The seed lots; fresh and revalidated or stored seeds will be periodically tested for First count and Germination and vigour indices at one month interval for at least 24 months from date of harvesting. The moisture content (MC) may be taken at three months interval. The seed lots will also be tested just before sowing time for field emergence, and final plant stand establishment **once in a year at sowing time.** The final plant stand establishment will be recorded/ taken after 6 weeks of sowing for cotton and all cereal crops, whereas it will be 3-4 weeks after sowing of groundnut and pulses. Following observations will be recorded;

Laboratory Observations (Monthly):

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

Laboratory Observations (Quarterly):

- Seed Moisture content (ISTA)

Field observations (Once in a year):

- Field emergence (%)
- Final plant stand establishment (%)

NB: Observations to be recorded on minimum four replications of 100 seeds each, except SMC, which will be estimated on dry weight basis as per ISTA recommendations. The experiment will be terminated once the germination % count reaches below IMSCS.

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

Year of Start: 2011- 2012

Objectives:

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

Crops		**Centres****
Paddy	:	PJTSAU, Hyderabad#; TNAU, Coimbatore; ICAR-IISS, Mau; JNKVV, Jabalpur#; AAU, Jorhat#; ICAR RC NEH Region - Manipur Centre and KAU, RARS, Pattambi
Maize##	:	UAS, Bengaluru#; CSKHPKV Palampur# and PAU, Ludhiana#
Pearl millet	:	RARI, Durgapura*, Raj.; CCS HAU Hisar* and NAU, Navsari
Sunflower	:	UAS, Bangalore#; JAU, Jamnagar and RAU, TCA, Dholi
Cotton	:	ICAR-CICR, Nagpur*#, PDKV, Akola*; AAU, Anand and MPKV, Rahuri
Castor	:	PJTSAU, Hyderabad; JAU, Jamnagar and AAU, Anand (ICAR-IIOR, Hyderabad#* - only to supply seed and details of markers/protocol)
Sorghum	:	PDKV, Akola*#; VNMKV, Parbhani and ICAR-IIMR, Hyderabad

*Centres will make immediately the available seeds with parental lines of hybrids released by their institute/university to every centre of that crop

**Additional funds as contingency to be provided

#Centres to supply seeds and share details of already identified markers/protocol with all other participating centres for validation, in addition to carrying out the proposed research

- Kindly keep the PI in the loop (pispnsp@gmail.com) for all the correspondences

##The participating centres of maize are requested to also follow ISTA recommended method of testing of hybrid purity using isozymes as available (Orman *et al.,* 1991).

Technical Programme:

Materials:

The details of identified markers, protocol followed and seeds of hybrids with parental lines shall be shared among the centres as indicated above. However, each centre will also try to take seeds of the available public sector released hybrids and their parental lines, preferably from the breeding institutes and may explore the possibility of taking private sector hybrids for the proposed 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. The details of markers identified by parent institute(s) for their own hybrids, if any and seeds of hybrids and their parents will be supplied by the ICAR-CICR, Nagpur (Contact person: Dr. P. R. Vijaya Kumari, 9822572302; rachelvk123@gmail.com) and PDKV,

Akola (Contact person: Dr. A.A. Akhare, 9881880083; atulakhare@yahoo.com) for cotton; by PDKV, Akola (Contact person: Dr. A.A. Akhare, 9881880083; atulakhare@yahoo.com) for Sorghum and by ICAR-IIOR, Hyderabad (Contact person: Dr. S.N. Sudhakara Babu, 9440847405; sudhakarababu.sn@icar.gov.in) for Castor.

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. Paddy- 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 the serial dilution of DNA as template DNA for PCR based detection.
4. The results of molecular marker analysis will be compared with the 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 rows, the 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 one 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. For validation studies two dimensional DNA sampling strategies is to be adopted for purity assay suggested by Nas *et al.* (2002). Thus, a total of 40 DNA bulks representing 20 rows and 20 columns can be used for comparison with GOT.
7. Every centre to work out cost effectiveness (C/B ratio) for GOT vis-à-vis molecular markers, taking all components of cost into account.

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

Year of start: 2014-15 (Merged in 2018-19)

Objectives:

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 pigeon pea for sub-optimal conditions
3. Development of seed enhancement techniques for low temperature stress during seedling establishment in maize and Paddy

Crops		**Centres**
Chickpea	:	ICAR-IISS, Mau and CCS HAU, Hisar
Kabuli Chickpea	:	PAU, Ludhiana; JNKVV, Jabalpur; UAS, Raichur; MPKV, Rahuri; RARI, Durgapura and PDKV, Akola
Paddy	:	UAS, Bengaluru; GBPUAT, Pantnagar; OUAT, Bhubaneswar; SKUAST, Kashmir, Srinagar and ICAR-IISS, Mau
Field pea	:	CSAUAT, Kanpur; JNKVV, Jabalpur and NDUAT, Faizabad
Lentil	:	JNKVV, Jabalpur; NDUAT, Faizabad; CSAUAT, Kanpur and ICAR-IISS, Mau
Mustard	:	ICAR-IARI, New Delhi; ICAR-CAZRI, Jodhpur and AAU, Anand
Cotton	:	ICAR-CICR, Nagpur; AAU, Anand and MPKV, Rahuri

Speciality Maize : ICAR-IARI, New Delhi and RAU and TCA, Dholi

For testing and validation

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

For low temperature stress

Maize : RAU, TCA, Dholi and CSKHPKV Palampur

Paddy : AAU, Jorhat* and ICAR RC NEH Region - Manipur Centre

* ICAR-NABIM, Mau to provide double the quantity of cultures for taking up an additional experiment under organic conditions.

NB: Every centre to work out the cost effectiveness (C/B ratio) for the best (one) treatment in comparison with control taking all components of cost into account.

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 centre 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. 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 standardised first in each crop by respective centre. While standardization, please take into due consideration the temperature at which seeds are being primed and amount of solution or water (Maximum volume of water/solution =

1.5 times the Wt. of seed is suggested. The period, temperature and drying specified above may be the same for all other priming treatments.

4. Halopriming- Soaking in KNO_3(@0.3%) solution and drying
5. Halopriming- Soaking in KH_2PO_4(@0.5%) solution and drying
6. Halopriming- Soaking in $ZnSO_4$ (@0.3%) + $MnSO_4$ (@0.5%) solution and drying
7. Seed coating (on dry 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.
8. Seed coating (on hydroprimed 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.
9. Seed coating (on hydro primed seeds) with BioNPK (containing 1 x 109 cfu)
10. Seed coating (on hydro primed seeds) with Biogrow (containing 1 x 109 cfu)
11. Seed coating (on hydro primed seeds) with Biophos (containing 1 x 109 cfu)
12. Seed coating (on hydro primed seeds) with Drought Alleviating Bacteria + BioNPK
13. Seed coating (on hydro primed seeds) with Drought Alleviating Bacteria + Biogrow
14. Seed coating (on hydro primed seeds) with Drought Alleviating Bacteria + Biophos

Note: The Microbial consortia (for treatment No. 7 to 14) will be supplied by ICAR-IISS, Mau. Method/dosage of treatment of microbial consortia: For the treatment with BioNPK, Biogrow, Biophos & Drought Alleviating Bacteria:

1. Dilute 50 ml of formulation in 500 ml water. Add sugar or sucrose @ 10%. This quantity is sufficient to treat seeds required for 1/2 acre (**kindly dilute required quantity of formulation as per plot size to 1:10 ratio in water and add sugar or sucrose @ 10 %)**
2. The bacterial suspension is then sprinkled on the seeds and the seeds are slowly but thoroughly mixed so as to have a uniform coating. Leave it for 30 minutes
3. Then the seeds are spread uniformly for drying on a gunny bag or cement floor in shade for 30-45 minutes avoiding direct sunlight

NB: Before drying care must be taken that seeds are wiped with tissue paper and or spread on germination paper so as there should not be any water remained adsorbed on the seed coat. Drying under fan must be done in shade by spreading seeds individually on germination paper.

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:

- Field emergence (%)
- 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 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 (abiotic stress) conditions

Materials:

For validation of standardized priming technologies in pigeonpea for sub-optimal conditions, each centre will use the seeds of any two most popular varieties in their region and treat them 2-3 days before sowing as per the details given below;

Treatments:

1. Control (Untreated).
2. Hydropriming (Soaking in water for 10h at 25°C) and **drying** (Prescribed for rainfed/limited irrigation conditions).
3. Exposure of seeds for 24 hr at 40°C (Prescribed for heat stress conditions).
4. Osmopriming (Soaking in PEG-6000 solution of 60% available water (-0.62MPa) for 11h at 25°C) and **drying**- (Prescribed for moisture stress conditions). For preparing a solution of 60% available water, 21g PEG-6000 per litre of water to be used. *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 hrs at 25^{0}C) and **drying** (Prescribed for salt stress conditions). For preparing solution of 6dSm^{-1} EC, use 1.7532g NaCl + 4.4106g $CaCl_2 2H_2O$ (Dihydrate) 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 (Treated seeds are to be tested Under Prescribed Stress Conditions) after drying:

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

Field observations (Under Prescribed Stress Conditions):

- Field emergence (%)
- 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.

Kindly be carefully about reporting the significance of a treatment over control, under normal growing/testing conditions the control may still give better results.

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

Year of start: 2018

Rationale: There are areas in our country where growing of paddy 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 was designed with the following objectives,

Objectives:

1. To attenuate low-temperature stress at seedlings stage with seed enhancement techniques in Paddy and Maize

2. To improve the tillering and synchronous flowering under low-temperature stress in Paddy and Maize
3. To study the effect of different seed enhancement techniques on field emergence and yield attributing traits in Paddy and Maize raised under low temperature conditions.

Technical Programme:

Materials:

Each centre will use the seeds of three most popular, rather photo and thermo insensitive 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 as per procedure given above
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
14. Microbial consortia (Drought Alleviating Bacteria + Biophos) for abiotic stress mitigation
15. Microbial consortia (As supplied and treatment method suggested by the ICAR-VPKAS, Almora - Contact Person: Dr. P. K. Misra, misrapank12@gmail.com (+91-9412589393).

Note:

The Microbial consortia (for treatment No. 13 & 14) will be supplied by ICAR-IISS, Mau. Method/dosage of treatment of microbial consortia: For the treatment with Biophos, Drought Alleviating Bacteria & cold adaptive PGPB:

1. Dilute 50 ml of formulation in 500 ml water. Add sugar or sucrose @ 10%. This quantity is sufficient to treat seeds required for 1/2 acre (**kindly dilute required quantity of formulation as per plot size to 1:10 ratio in water and add sugar or sucrose @ 10 %)**
2. The bacterial suspension is then sprinkled on the seeds and the seeds are slowly but thoroughly mixed so as to have a uniform coating. Leave it for 30 minutes.
3. Then the seeds are spread uniformly for drying on a gunny bag or cement floor in shade for 30-45 minutes avoiding direct sunlight

Observations:

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

Note: Observations (no. 3 to 9) have to be observed in a minimum of 5 randomly selected plants or panicles/cobs /rep/treatment.

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

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 Paddy

Crops	**Centres**
Pigeonpea	**:** TNAU, Coimbatore and UAS, Bengaluru
Onion	ICAR-IARI, New Delhi and TNAU, Coimbatore
Soybean	**:** ICAR-IARI, New Delhi; TNAU, Coimbatore; VNMKV, Parbhani and PDKV, Akola
Paddy	**:** PAU, Ludhiana and ICAR-IARI, New Delhi

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-particle x bulk x concentrations

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 &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 before and after treatment i.e. Before sowing
2. Seed germination (%) (ISTA)- First count, final count and T_{50} value
3. Seedling vigour index I and II (Abdul Baki and Anderson, 1973)
4. Electrical conductivity of seed leachate (µS/cm/g)
5. Total dehydrogenase activity (A_{480} nm)
6. Seed health (infection and infestation)
7. Field emergence %
8. Final plant stand establishment (%)

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 (At monthly interval):

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

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:

T0: Control (Untreated)
T1: Control (Location specific recommended seed treatment(s) as per package of practices)
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 the 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 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

Objective: To evaluate the adverse effect of heat stress during the 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; NDUAT, Faizabad and ICAR-IISS, Mau
Sorghum	:	ICAR-IIMR, Hyderabad; MPKV, Rahuri; VNMKV, Parbhani and PDKV, Akola
Paddy	:	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; CSAUAT, Kanpur and ICAR-IISS, Mau

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 (please ensure that *a.i.* concentration should not to exceed 1250ppm)

Spray Schedule:

1. Control (Without spray)
2. Vegetative stage (35-40 days after sowing or transplanting)
3. Anthesis stage (Vary from crop to crop and location to location)
4. Vegetative + 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 a 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 be estimated on dry weight basis as per ISTA recommendations.

Kindly Note for N/A:

1. 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 is being used by the farmers for seed/grain storage. The weed seeds from the same may also be taken out and submitted to ICAR-IISS, Mau with details and photographs.
2. Please discuss with your peers or mail (pispnsp@gmail.com) for any clarifications.

List of Participants

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C. Seed Pathology

Date: 08.04.2019

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

Convenor : **Dr. Atul Kumar,** Principal Scientist, IARI, New Delhi

Recommendations:

- RT- PCR based technique has been standardized for detection and characterization of seed-borne infection of PMMoV (Pepper mild mottle virus*)* in capsicum seed using viral Coat Protein (CP) specific primers for routine use. The seed samples crushed to a fine powder in chilled pestle and mortar using 750 µl Trizol reagent are used to extract the total RNA. The total RNA is checked on agarose gel and then subjected to cDNA synthesis using MMLV reverse transcriptase using oligodt $_{(10\text{-}18)}$ primer or PMMoV CP gene specific reverse primer. The cDNA is amplified using the viral coat protein specific primers (F5'CCAATGGCTGACAGATTACG-3' and R5'CAACGACAACCCTTCGATTT-3') with initial denaturation of 94°C for 4 min followed by 35 cycles of 94°C for 15 sec, 48°C for 40 sec and 72°C for 1 min and final extension of 7 min at 72°C. The PCR product resolved on 1.2% agarose gel result in the amplification of ~740 bp product in PMMOV infected seed samples.

- For detection of BCMV in mungbean and common bean seeds, a RT-PCR based method has been standardized for its detection using coat protein (CP) gene specific primer. Total RNA isolated from infected leaves, seed coat, cotyledons and embryos of susceptible cv. Jawala and Baspa (Infected and healthy seeds) by Trizol method is used to synthesize cDNA strand using oligo dT (dT_{18}) primer and reverse transcriptase enzyme (MMuLv-RT). RT-PCR amplification is carried out in a reaction volume of 12.5 µl using 1.75 µl of 10X Taq buffer, 0.5 µl of 25 mM $MgCl_2$, 1.75 µl of 2 mM dNTPs mix, 0.5 µl of 10 mM CP- gene specific primer pair (BCMV-pnsF (TGG CTG CTT GAG AGA GAT GA) and BCMV-pnsR (ATC ACT CTG CAT GTC CTC AC), 1.0 µl of cDNA, 0.1 µl of 5U/µl Taq polymerase (Merck Genei) and final volume was adjusted with nuclease free water. The amplification is carried out in GeneAmp PCR system 9700 (Applied Biosystems) with following PCR conditions: 1 cycle of 3 minutes at 94^0C; 35 cycles of 30 s at 94^0C, 90 s at 55^0C, 120 s at 72^0C and then cooled to room temperature. The resolution of the PCR product on 1.2% agarose gel generate an amplicon of ~1300 bp DNA fragment in the BCMV infected seed samples. The protocol, thus, developed may be used to detect the viral infection(s) even from a single seed in routine seed examination.

- In greengram / blackgram, seed obtained from seed production plots, dried up to 8-9% seed moisture content, treated with thiram @0.25% and stored in Poly-lined gunny bags

maintained the highest seed germination, field emergence and minimum percent seed mycoflora in storage up to 9 months.

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 2019-20

Centres : All centres (AAU, Anand; AAU, Jorhat; 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; RPCAU, Pusa and ICAR-IISS, Mau)

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.

b- |Monitoring of Brown spot disease in paddy (All centres)

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 2019-20

Centres: All Centres (AAU, Anand; AAU, Jorhat; 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; RPCAU, Pusa; SKNAU, Jobner and ICAR-IISS, Mau

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 saved seeds

Objective

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

Year of start : 2000

Status : Continued during 2019-20

Crop (a) : **Wheat**

Centres: PAU, Ludhiana; CCSHAU, Hisar; GBPUAT, Pantnagar; CSKHPAU, Palampur; SKNAU, Durgapura; ICAR-IARI, New Delhi; RPCAU, Pusa; MPKV, Rahuri and ICAR—IISS, Mau

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; PAJANCOA&RI, Karaikal; MPKV, Rahuri; ICAR-IARI, New Delhi; RPCAU, Pusa; PAU Ludhiana, PJTSAU, Hyderabad; AAU, Anand and ICAR-IISS, Mau

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; TNAU, Coimbatore;

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 2019-20

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; RPCAU, Pusa and ICAR-IISS, Mau)

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.*

IARI New Delhi will validate Hyderbad centre expt on standardization of methodology that they have developed.

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 2019-20

Crop : Bean (*Phaseolus* spp.)

Pathogen : *Colletotrichum* spp.

Centre : CSKHPAU, Palampur and SKUAST, Srinagar and Durgapura SKNAU, Jobner

Note:

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

Experiment 6: 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 2019-20

Crop : Tomato

Pathogen : *Alternaria solani*

Centre: AAU, Anand; PAU, Ludhiana; SKUAST, Srinagar; MPKV, Rahuri, GBPUAT, Pantnagar; ICAR-IISS, Mau and SKNAU, Jobner (Durgapura)

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. Treatments: 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 spray	1g/l	
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 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 2019-20
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: Impact of different storage conditions on longevity of *Macrophomina phaseolina, Colletotrichum dematium*, **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 2019-20
Crop : Green gram / Blackgram
Source of seed : (i) Farmer (ii) Seed production / Research Fields
Pathogen : *Macrophomina phaseolina, Colletotrichum dematium*,
Centre: TNAU, Coimbatore, PAJANCOA&RI, Karaikal; MPKV, Rahuri; OUAT, Bhubaneshwar; AAU, Jorhat and ICAR-IISS, Mau

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

- Basic seed dressing with Captan @ 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 9: 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 2019-20
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 10: Management of purple blotch and Stemphylium blight of onion through seed treatment by bio-agents and foliar sprays with plant products and fungicides

Objective: To determine the influence of bio-agents and foliar sprays with plant products and fungicides on yield and quality of harvested seed and disease control.

Year of start : 2016-2017
Status : To be continued during 2019-20
Crop : Onion
Pathogens : *Alternaria porri / Stemphylium vesicarium*
Centre : PAU, Ludhiana; SKUAST, Srinagar; IARI, New Delhi; MPKV, Rahuri and SKNAU, Jobner (Durgapura)

Methodology

1) Basic seed dressing with *Trichoderma viride*
2) Foliar applications of fungicides and plant products amended with sticker agent as soon as the disease appears and subsequent 3 applications at 10 days interval

Treatment: 6 fungicides+ 3 plant products+ 1 untreated check
Design: RBD

		Periodicity
T:01	Sprays of Mancozeb @0.3%	at 10 days interval after first application
T:02	Sprays of Metiram 55% + Pyraclostrobin 5% @0.3%	-do-
T:03	sprays of Difenconazole @0.1%	-do-

T:04	sprays of Zineb75% WP @0.2%	
T:05	sprays of Tebuconazole @0.1%	-do-
T:06	sprays of Kitazine 48% EC @ 0.2%	-do-
T:07	sprays of *Lantana camara* @ 5 %	-do-
T:08	sprays of *Pongamia pinnata*@ 5%	-do-
T:09	spray of crude leaf extract of *Azadirachta indica* @ 5%	-do-
T:10	Check (No spray)	-

Observations : Disease development; yield; impact on seed quality parameters including seed germination, root length, shoot length and seeding vigour index

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 11: 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.

Information regarding working sheet to be given by the TNAU centre and conclude the experiment.

Experiment 12: 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; GBPUA&T, Pantnagar
Methodology : would be supplied by PJTSAU, Hyderabad `

Treatments :

	Treatments	Mode of treatment	Doses
T_1	Carboxin + 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.

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D. Seed Entomology

Date: 08.04.2019

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

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

Recommendations:

1. *Acorus calamus* TNAU formulation @ 10 ml/kg seed can be used for management of storage insects up to 6 months without affecting seed germination in Wheat, paddy, blackgram, green gram, chickpea and pigeonpea seeds.
2. Pre-harvest spraying of emamectin benzoate (5 SG) @ 0.3ml/L or profenofos (50EC) @ 1ml/L at 50% pod maturity and maturity stage can be used for controlling field infestation of pulse bruchid and subsequent adult emergence during storage.

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 solarization on bruchids (pulse beetle) infestation and quality of pulse seeds (Modified)

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; ICAR-IISS, Mau

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

A. 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 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 °C		Inside Temperature °C		Remarks
	Before solarization	After solarization	Before solarization	After solarization	
01					
02					
03					
04					
05					
06					
Cumulative heat					

Experiment 3: 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. Bioassay will be conducted by following film method. 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.

1. Batches of 20 insects are exposed (24h) 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.

New Experiment: 4 Efficacy of commercially available neem products on storage pest management during storage under ambient condition

Crop	Centre
Wheat	MPKV, Rahuri; CSAUAT, Kanpur; NDUAT, Faizabad; SKUAST, Jammu
Paddy	AAU, Jorhat; OUAT, Bhubaneswar; PJTSAU, Hyderabad; PAJANCOA, Karaikal; SKUAST, Jammu
Cowpea	UAS, Bangalore; TNAU, Coimbatore
Green gram	SKNAU, Jobner
Chickpea	IISS, Mau; UAS, Dharwad; PDKV,Akola

Objectives

- To evaluate commercial available neem formulations against major storage insect-pests damaging seeds.
- Study of the storability of treated seeds.

Treatment

B. Insecticides/botanicals

1. Neemazal T/S (Azadiractin 10,000 ppm) @25 ppm (2.5 ml formulation/kg seed)
2. Neemazal T/S (Azadiractin 10,000 ppm) @50 ppm (5.0 ml formulation/kg seed)
3. Neemazal T/S (Azadiractin 10,000 ppm) @75 ppm (7.5 ml formulation /kg seed)
4. Neemoz - Gold (Azadiractin 10,000 ppm)@25 ppm (2.5 ml formulation/kg seed)
5. Neemoz - Gold (Azadiractin 10,000 ppm)@50 ppm (5.0 ml formulation/kg seed)
6. Neemoz - Gold (Azadiractin 10,000 ppm)@75 ppm (7.5 ml formulation/kg seed)
7. Deltamethrin @ 1ppm (2.8EC @0.04 ml/kg of seed)
8. Untreated control

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

Replications: 3 **Design:** CRD

Method: One kg of freshly harvested and untreated certified seed with very high percentage of germination and low moisture content (<10%) will be taken for each treatment. Required quantity of neem formulations in case of 2.5ml formulation/kg seed may be diluted in 2.5 ml water to treat 1 kg of seed for proper coating if required. Other doses (5ml or 7.5ml/kg) should not be diluted in water. Deltamethrin should be diluted in 5 ml water to treat 1 kg of seed. 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)

Observations will be made on every 3 months for a total period of 12 months or loss of germination below IMSCS, whichever is early

New Experiment 5: Evaluation of pre-harvest spraying of insecticides and botanicals 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; NAU, Navsari
Chickpea	ICAR-IISS, Mau; MPKV, Rahuri; SKNAU, Jobner and NDUA&T, Faizabad
Black gram	TNAU, Coimbatore; PAJANCOA, Karaikal and AAU, Jorhat
Cowpea	IISS Regional Station, Bengaluru

Treatments

A. Insecticides/Botanicals

1. Emamectin benzoate 5SG @ 0.3g/L
2. Neemazal T/S 10000ppm @2ml/L
3. Neemazal T/S 10000ppm @4ml/L
4. Neemazal T/S 10000ppm @6ml/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: Count no. of exit holes and express into percentage based on actual number of seeds observed.

New experiment 6: Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition.

Objectives:

- To evaluate newer molecules against major storage insect-pests damaging seeds.
- Study of the storability of treated seeds.

Year of start: 2019

Crop	Centre
Wheat	IISS, Mau; CSAUAT, Kanpur
Paddy	AAU, Jorhat; PJTSAU, Hyderabad; PAJANCOA, Karaikal
Pigeonpea	NDUAT, Faizabad; PDKV, Akola
Cowpea	UAS, Bangalore; TNAU, Coimbatore
Mungbean	SKNAU,Jobner; OUA&T, Bhubaneswar
Chickpea	MPKV, Rahuri; JAU, Jamnagar

Treatment:

A. Chemical

1. Spinetorum @ 1ppm (Delegate 11.7%SC @8.5mg /kg seed
2. Spinetorum @ 2ppm (Delegate 11.7%SC@ 17mg/kg seed
3. Spinetorum @ 4ppm (Delegate 11.7%SC @25.6mg /kg seed
4. Flupyradifurone @2 ppm (Sivanto prime 200SL @0.01ml/kg seed)
5. Flupyradifurone @4 ppm (Sivanto prime 200SL @0.02ml/kg seed)
6. Flupyradifurone @8 ppm (Sivanto prime 200SL @0.04ml/kg seed)
7. Emamectin benzoate @2ppm (Proclaim 5SG @40.0 mg/kg seed)
8. Deltamethrin @ 1.0 ppm (Deltamethrin 2.8EC@ 0.04 ml/kg seed)
9. 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 pesticides will be diluted in water to make total volume of 5 ml for treating 1 kg of seed for proper coating (if required). 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)

Proceedings of the meeting held at CCSHAU on 8th April, 2019 to finalize technical programme of Seed Entomology for the year 2019-20

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. 14 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 concluded 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 concluded with recommendation.
- Experiment No. 4 "Evaluation of pre-harvest spraying of insecticides for management of pulse beetle (*Callosobruchus* sp)" will be concluded with recommendation.
- Experiment No. 5 on 'Effect of solarization on bruchids (pulse beetle) infestation and quality of pulse seeds' will be continued. **Solarization period has been modified as 4hr in place of 3hr per day.**
- Experiment No. 6 on '**Survey and monitoring of insecticide resistance in storage insect pests infesting seeds in storage godowns'** will be continued in existing format.
- **New Experiment on 'Efficacy of commercially available neem products on storage pest management during storage under ambient condition'** will be conducted at various centres.
- **New Experiment on 'Evaluation of pre-harvest spraying of insecticides and botanicals for management of pulse beetle (*Callosobruchus* sp.)' for evaluating neem products will be conducted.**
- **New experiment on 'Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition' will be conducted at various centres**

The meeting ended with thanks to the delegates.

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15.	Dr. T R Shashidhar	Asst. Prof.	Seed unit, UAS, Dharwad	

E. Seed Processing

Date: 08.04.2019

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

Co-Convener : **Dr. Sripathy K.V.**
Scientist, ICAR-IISS, Mau

Special mention:

All centres conducting seed processing experiment no. 1 (Standardization of seed sieve size) shall procure SIEVE GRADER. The fund for the same may be met from either contingencies or seed revolving fund of concerned centres. ICAR-IISS, Mau will coordinate the purchase of sieve graders at each centre.

Centres *viz.,* NDUAT, Faizabad; MPKV, Rahuri; TNAU, Coimbatore; PDKV, Akola; PAU, Ludhiana and GBPUAT, Pantnagar have not attended the session for finalization of technical programme for year 2019-20.

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

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
Wheat	:	ICAR- IARI, RS, Karnal and CSAUAT, Kanpur
Chickpea	:	CSAUAT, Kanpur; MPKV, Rahuri; UAS Dharwad and UAS, Raichur; PDKV, Akola
Blackgram	:	PAJANCOA&RI, Karaikal
Pigeonpea	:	UAS, Bangaluru; UAS, Raichur and PDKV, Akola

Soybean	:	UAS, Dharwad; UAS, Raichur and MPKV, Rahuri
Paddy	:	ICAR-IARI, RS, Karnal; UAS, Raichur; TNAU, Coimbatore, PDKV, Akola and PAJANCOA&RI, Karaikal
Maize	:	TNAU, Coimbatore and UAS, Raichur
Mustard	:	CSAUA&T, Kanpur
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 maximize the processing efficiency

Crop		Centres
Wheat	:	ICAR-IARI RS, Karnal; PAU Ludhiana

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.

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Joint Monitoring Team for 2019-20

Kharif season: Sept. / Oct. 2019; *Rabi* season: Feb. / Mar. 2020

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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 experiment to centres	15th May	
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- *Kharif* field and storage experiments	31st January	
	Rabi field experiments	31st July	
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	