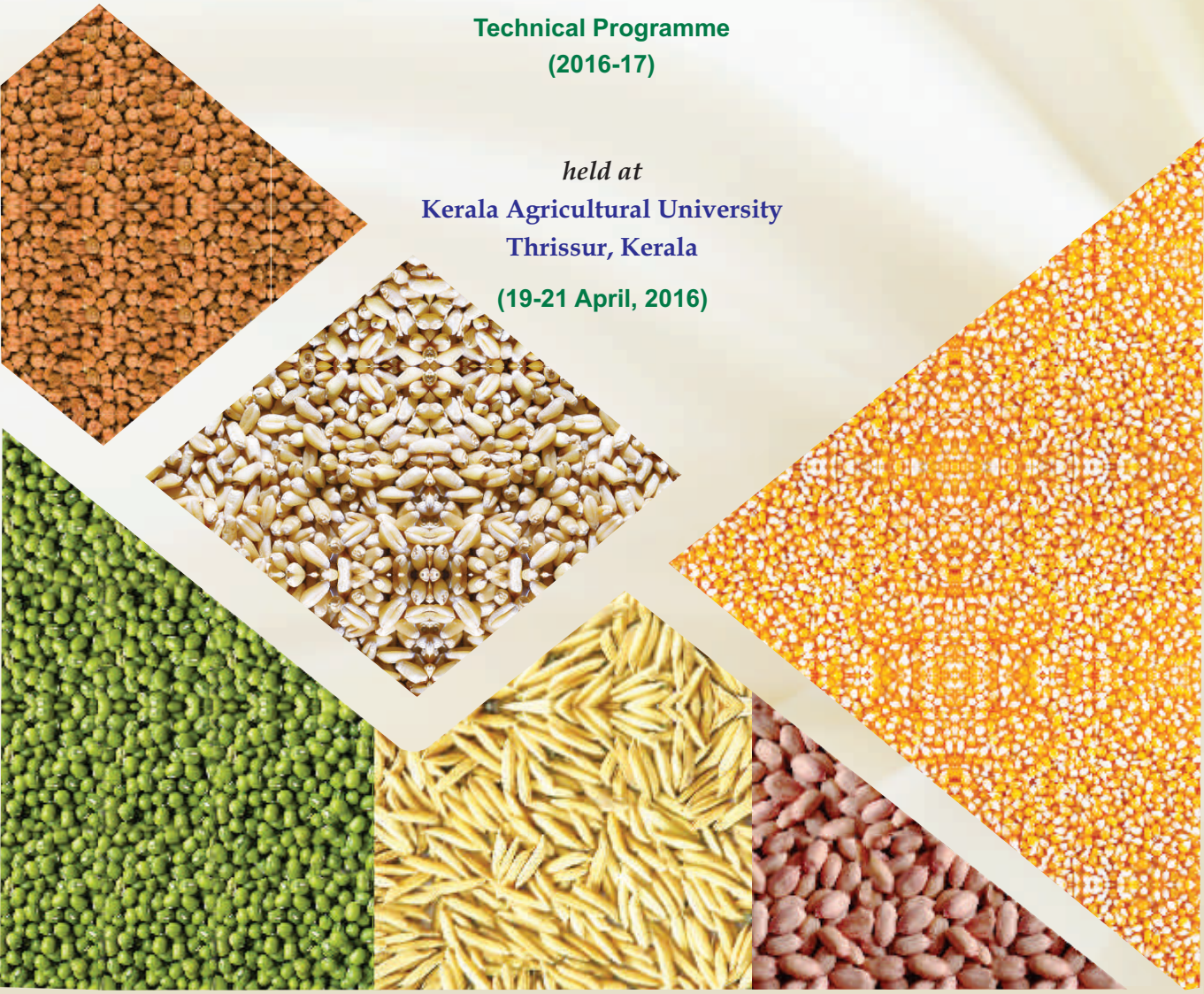
# PROCEEDINGS

## XXXI Annual Group Meeting of AICRP- National Seed Project (Crops)

**Technical Programme**
**(2016-17)**

*held at*
**Kerala Agricultural University**
**Thrissur, Kerala**
**(19-21 April, 2016)**




**ICAR-Indian Institute of Seed Science**
**(Indian Council of Agricultural Research)**
Mau 275103, Uttar Pradesh, India
**(ISO 9001:2008 Certified Institute)**

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# Session I

## Inaugural Session

**Date : 19.04.2016** **Time : 09:00-10:45 am**

| | | |
|---|---|---|
| **Chief Guest** | : | **Dr. Trilochan Mohapatra,** Secretary, DARE & DG, ICAR, New Delhi |
| **Chairman** | : | **Dr. P. Rajendran,** Vice Chancellor, KAU, Thrissur |
| **Co-chairman** | : | **Dr. J.S. Chauhan,** ADG (Seed), ICAR, New Delhi |
| **Rapporteurs** | : | **Dr. K. Rathinavel,** PS, ICAR - CICR RS, Coimbatore |
| | | **Dr. Geeta Bassi,** PS, PAU, Ludhiana |

The inaugural session started with prayer / ICAR song followed by a warm welcome by Dr. Sajan Kurian, Director of Research, Kerala Agricultural University, Thrissur. He welcomed Honorable Secretary, DARE and DG ICAR Dr. Trilochan Mohapatra; Dr. P. Rajendran, Vice Chancellor, KAU, Thrissur; Dr. J.S. Chauhan, ADG (Seed), ICAR, New Delhi; Dr. S. Rajendra Prasad, Director, ICAR - IISS, Mau and all other delegates of AICRP-NSP (Crops) who have come from length and breadth of the Country.

Dr. J.S. Chauhan, ADG (Seed), ICAR, New Delhi in his introductory remarks, emphasized the need of quality seed which is the basic input for productive agriculture. He also pointed out that the turning point in Indian Agriculture that happened in 1960's & 1970's, an era of green revolution necessitated the use of quality seed. In the light of growing population and shrinking of cultivable land coupled with limited farm resources, quality seed plays a vital role in enhancing productivity. He also pointed out that systematic storage and hygienic seed production practices are required to meet the growing demand of seed, procurement of seed on tender basis by the state government must be relooked and tax exemption for quality seed production must be considered for up-scaling the spread of new varieties at faster rate.

Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau presented overall the progress of Breeder Seed Production and Seed Technology Research made by AICRP-NSP (Crops) cooperating centers during 2015-16. He emphasized the attainment of seed security is a must for attaining the food security and nutritional security. During the course of presentation of highlights, he pointed that breeder seed production reached 1.25 lakh quintals mark during 2014-15, barcoding/QR coding of seeds is a must for efficient management of quality seed production / distribution system and urged the centers for immediate implementation and also highlighted about offseason quality seed production in soybean during 2014-15 in the era of disruptive climate. He also presented the highlights of research achievements made under different disciplines of AICRP – NSP (Crops) under Seed Technological Research component and also pointed some key constraints observed under project *viz.* insufficient staff in many AICRP NSP centers, diversion of manpower and use of revolving fund for other activities by many cooperating centres.

Dr. P. Rajendran, Hon'ble Vice Chancellor, KAU, Thrissur in his presidential address pointed out that Indian population growth would be 141 crores in 2025 and 164 crores in 2050, to meet the food requirement of growing population, productivity of food grains must be increased up to 50% and this can be achieved only by supply of quality seeds to the farmers.

The chief guest of the function, Dr. Trilochan Mohapatra, Secretary, DARE and DG, ICAR, New Delhi emphasized that the following aspects needs to be relooked immediately.

- Sufficient breeder seed production to meet our seed requirement is a satisfying situation; however, in some crops varietal mis-match is observed which needs to be rectified.
- Mapping of seed requirement of the country and creation of seed production hub to meet the seed requirement.
- A mechanism to monitor the indenters, who are indenting more than his requirement, must be developed.
- Ensure sufficient production of quality seed in pulse crop, for which ICAR-IISS, Mau can initiate a dialogue among the major pulse growing state government.
- AICRP should stick to the mandate and work on it for achievement.
- Seed availability governs the varietal replacement, therefore ensure the seed availability of newly released varieties.
- Seed Replacement Rate must be encouraged in major crops in coming years
- Development of alternate method of varietal purity must be encouraged, since traditional method i.e., grow out test is consuming more time.

The session ended with formal vote of thanks by Dr. V.S. Devadas, Associate Director of Research (Seed), KAU, Thrissur.

# Session II

## Discipline-wise Presentation of Progress Report

**Date: 19.04.2016** **Time: 11:00- 02:00 pm**

| | | |
|---|---|---|
| **Chairman** | : | **Dr. J.S. Chauhan**, ADG (Seeds), ICAR, New Delhi |
| **Co-chairman** | : | **Dr. M. Bhaskaran**, Vice Chancellor, TNOU, Chennai |
| **Rapporteurs** | : | **Dr. T. Ramanadane**, Professor (SST), PAJANCOA & RI, Karaikal |
| | | **Dr. Sripathy KV**., Scientist, ICAR-IISS, Mau |

The discipline wise presentations were made by the respective Principal Investigators.

### 1. Seed Production and Certification: Dr. Vilas A. Tonapi, Director, ICAR-IIMR, Hyderabad

The total numbers of experiments conducted were 12, out of which 10 were completed and recommendations were made. Two experiments have been carried forward and seven more new experiments proposed. The P.I. expressed that the experiments on standardization of isolation distance for hybrid seed production in castor was not properly conducted in some of the centres and hence proposed to continue the experiment for one more year. In this context, the Dr. J.S. Chauhan, ADG (Seed) suggested to get acceptance letter from each centre before allotment of experiments. For the experiment on validation of UTLIEF based genetic purity, the P.I. informed the house that results have not yet been received from INCOTEC for comparison. Dr. M.A. Shankar, Former Director of Research, UAS, Bengaluru suggested studying the economic feasibility as well as mechanisms of various treatments used in STR experiments. Dr. M. Bhaskaran, Hon'ble Vice Chancellor, TNOU also emphasized to study the mechanisms involved in various polymer coating treatments, since they vary with crops. It was suggested to uniformly follow the stage of pinching in green manure crops to get uniform results across the centres. The ADG (Seeds) also suggested to study the effect of temperature on crop productivity considering the climate change and rise in temperature across the country. After a detailed discussion in the experiment on planting window for quality seed production of soybean in off-season, the Director, ICAR-IISS, Mau requested the centres to test the performance in off-season with different dates of sowing in different varieties. The ADG (Seeds) opined that offseason sowing needs to be studied specifically from October – January. The P.I. also pointed out that seed encrustation reduced germination in crops like onion, mustard, rape seed and carrot, which needs to be studied.

### 2. Seed Physiology, Storage and Testing: Dr. P.C. Nautiyal, Pr. Scientist, DSST, ICAR-IARI, New Delhi

There were total of six experiments including one product testing experiment and one demonstration on priming. Seeding length, primary and secondary root length, root volume, root and

shoot weight and root density were identified as the vigour traits in rice hybrid. The P.I. requested the centres to give seed storage data for comparison in the experiment on seed vigour traits. So far, 13 SSR markers have been identified for eight rice hybrids viz., JRH 5, JRH 8, JRH 9, KRH 2, KRH 4 and DRRH 3. The ADG (Seed) suggested planning an experiment with hydrogel for seed invigoration in different crops. He also requested to rework on Seed Multiplication Ratio in order to fix the cost of breeder seeds including the cost of land value, nucleus seeds and other cost of production in crops like groundnut, chickpea, soybean and rice.

### 3. Seed Pathology: Dr. Mohan S. Bhale, Professor, JNKVV, Jabalpur

There were 15 main experiments and 6 sub experiments conducted in 9 field crops and 3 vegetables. Survey was conducted for monitoring of diseases ( false smut and bunt in rice) to find out emerging new diseases of seed borne nature and also to study seed health status of farmer own saved seeds of wheat, rice, soybean, groundnut and chickpea. In this context, the Director, ICAR-IISS, Mau insisted to get farmers own saved seeds for analysis instead of seeds supplied by different agencies. Correlation of various levels of seed infection by seed borne fungi on seed germination was studied in chilli, rice, groundnut, sunflowers, sesame, pearlmillet and cumin. In this regard, the ADG (Seed), New Delhi directed to give 'r' values tested for significance and also requested not to use downloaded images of pathogens and their symptoms. The Director, ICAR-IISS, Mau requested to work out the benefit cost ratio for different seed treatments and foliar applications advocated in various experiments. He also suggested verifying the data for three years before making any recommendations. Dr. M.A. Shankar, Ex-Director of Research, UAS, Bengaluru opined that majority of diseases can be easily managed with nutrient management. Dr. N.V. Naidu, Director of Research, ANGRAU requested to conduct basic study on YMV by AAU, Anand.

### 4. Seed Entomology: Dr. Amit Bera, Scientist, ICAR-CRIJAF, Barrackpore

A detailed review was undertaken by the ADG (Seed), New Delhi and Director, IISS, Mau on number of experiments conducted by each centre and also analysed the reasons for not conducting the same by few centres. The Director, IISS, Mau also suggested to use fresh/high vigor seeds for storage experiments and the data should be supported with seed moisture content, temperature and RH of storage environment. In addition, he insisted that all the centers should submit weather data for both lab and field experiments and requested the PI to conclude the experiment on super grain bags and give suitable recommendations. He also suggested combining the experiment on survey on seed health status of farmers' saved seeds in different crops and hereafter the experiment should be reported under Seed Pathology. The ADG (Seed), New Delhi requested the GBPUAT, Pantnagar and CCS HAU, Hisar centres to take up an experiment on insect pollination in Berseem in collaboration with entomologist. He also emphasized to have a detailed study on chemical composition, active ingredients and mechanism involved in the insecticidal properties of botanicals used against storage insects.

## 5. Seed Processing: Dr. K.V. Sripathy, Scientist, IISS, Mau

The progress report of seed processing was presented by Dr. Sripathy K.V., Scientist, ICAR-IISS, Mau. Under seed processing, there were three experiments. Suitable sieve sizes have been standardized for different crops like wheat, pigeonpea, mungbean, chickpea and sunhemp. The ADG (Seed), New Delhi observed that the drying time (duration) needs to be mentioned in the results of drying experiments. It was also suggested that the drying process is influenced by initial moisture content and hence it needs to be considered while finalizing the results and recommendations.

The Session ended with thanks to the Chairman and Co-Chairman by the Director, ICAR-IISS, Mau.

# Session III

## Expert Talk and Seed Stakeholders-Scientists Interaction and Inter Project Linkages

**Date : 19.4.2016** **Time : 02:15-06:30 pm**

| | | |
|---|---|---|
| **Chairman** | : | **Dr. Vilas A. Tonapi,** Director, ICAR-IIMR, Hyderabad |
| **Co-chairman** | : | **Dr. N.V. Naidu,** Director of Research, ANGRAU, Hyderabad |
| **Rapporteurs** | : | **Dr. P.K. Katiyar,** Principal Scientist, ICAR-IIPR, Kanpur |
| | | **Dr. Dinesh K. Agarwal,** Principal Scientist, ICAR-IISS, Mau |

Session started with the talk by Dr. M.A. Shankar, Former Director of Research, UAS, Bengaluru on "Harnessing dry land ecosystem for seed security through technological interventions". He pointed that considering the total acreage under dryland farming and its importance in earning livelihood for nearly 60 % of rural population in the country, devising technological interventions for exploitation of dry land ecosystem for seed security holds a great potential. There are certain inherent problems associated with rainfed farming that could be tackled with a combination of skillful management practices. Conservation of traditional seed crops could be a very important strategy to face frequent crop failures. Dr. M.A. Shankar proposed two strategies *i.e.* Community Seed Banks (CSBs) and Innovative seed delivery models (Sustaining viability of dryland seed systems). He further proposed five alternate village based seed delivery models which are; 1. Individual farmer as seed bank 2. Village based seed banks 3. SHG- mediated system 4. NGO-mediated system and 5. KVK- mediated system. He also proposed the abiotic stress management under dryland farming through techniques such as *in situ* moisture conservation micro-nutrient application, seed priming, water conservation and deploying land configuration technologies *viz*., BBF and FIRBS.

Dr. R. C. Agarwal, Registrar General, Protection of Plant Varieties and Farmers Rights Authority, New Delhi delivered an interactive talk on varietal registration and conservation of plant genetic resources namely land races and traditional cultivars through farmers and community based approach. Year 2016 being the International Year of Pulses, he informed the house on the special emphasis authority is putting on registration of remaining species of pulses crop varieties. He solicited the support from delegates from different SAUs and ICAR institutes to promote the concept of genome saviour initiatives in their respective areas. He also requested all the delegates to go through the recent amendments in plant variety registration process so as to harness the benefit arising out of those.

Dr. John Vasanthan Paul from Vestergaard gave a talk on packaging material with new chemistry for safe storage. He talked about the various components and properties of their commercial product "Zerofly bags" and its importance and utility in safe storage of seeds. Dr.

Subramanian Perumal from Agrinos India Pvt. Ltd. talked about their product *i.e.* HYT (High Yielding Technology). He listed the potential areas of utilization of this technology under various farming situations.

Dr. S. K. Jain, Professor, Division of Seed Science and Technology, ICAR-IARI, New Delhi gave a presentation on the flower seed scenario in the country. He presented the statistics related to flower trade in the country and underlined the potential held by this industry in the export market. He further presented seed testing protocols for different flower species and the work that has been carried out on different aspects of seed technological research *i.e.* seed development and maturation, storage and value addition among flower species.

Participating in the interactions, Dr. M. Bhaskaran, Hon'ble Vice Chancellor, Tamil Nadu Open University, Chennai opined that any village or community based seed model to succeed, availability of credit and financial support is a prerequisite. He said that seed industry among crops which are backbone of food and nutritional security of the country are of high volume and low value in nature, and are being supplied mostly by public sector. Role of private participation is very less in this area which needs to be enhanced. Emphasis should also be given to provide end to end technologies to dryland farmers. He also stressed upon the need to collect and compile relevant technologies that are available for dryland agriculture in the form of a practicable module by a nodal agency such as ICAR-Indian Institute of Seed Science, Mau.

Co-chairman of the session, Dr. N.V. Naidu in his concluding remarks said that all the models proposed by Dr. M.A. Shankar for ensuring the seed security under dryland farming are good but at the same time he underlined the need for having enough number of godowns for storage of seeds under these models. He also highlighted the importance of short duration, drought tolerant varieties of various crop species under rainfed farming. On insecticide impregnated bags, he opined that the technology is good and suggested to further explore the similar technology that has been developed by ICRISAT, Hyderabad.

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

# Session IV-A

## Centre-wise Presentation of Progress Report for Seed Technological Research

**Date : 20.04.2016** **Time : 09:00-11:30 am**

| | | |
|---|---|---|
| **Chairman** | : | **Dr. J.S. Chauhan**, ADG (Seed), ICAR, New Delhi |
| **Co-chairman** | : | **Dr. S. K. Varshney**, Dean (Agriculture), RAU, Pusa |
| | | **Dr. S. Rajendra Prasad**, Director, ICAR-IISS, Mau |
| **Rapporteurs** | : | **Dr. Rakesh Seth**, Principal Scientist, ICAR-IARI RS, Karnal |
| | | **Sh. G. Somasundaram**, Scientist, ICAR-IISS, Mau |

The nodal officers from 14 centres representing 7 centres from south zone and 7 centres from north zone presented the progress made in Seed Technological Research component of AICRP-NSP (Crops) during 2015-16. The salient points which emerged are listed below.

The Director (Seeds), PJTSAU, Telangana presented the experiment-wise results in nutshell and expressed the difficulty in producing soybean seeds during the off-season as the yield was very low and not economical. Hence, Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau suggested to screen the varieties which are suitable for off-season seed production before the start of actual seed production programme. Dr. Vilas A. Tonapi, Director, ICAR-IIMR, Hyderabad advised to develop the complete agronomic practice for off-season seed production as the condition is totally different from normal season. Dr. J.S. Chauhan, ADG (Seeds), ICAR, New Delhi advocated to develop one best method to identify seed borne diseases and also suggested to provide CD & CV values to clearly understand the influence of treatments over control.

The nodal officer, ANGRAU informed that 500 acres of land has been allotted by Govt. of Andhra Pradesh to construct a new agricultural university and presented a proposal for approval as regular centre instead of voluntary centre under AICRP - NSP (Crops). The chairman enquired about the reason for production of huge quantity of breeder seed than the requirement and Co-chairman Dr. S.K. Varshney, Dean (Agri.), RAU, Pusa suggested supplying only the certified / TFL seeds to the farmers, not breeder seeds. The Director, ICAR-IISS, Mau advocated to develop a model seed technological laboratory as the establishment of new university is in progress.

In PAJANCOA&RI, Karaikal, eight experiments were completed except one due to non-availability of $CO_2$ analyzer which will be completed in the coming year. The Director, ICAR-IISS, Mau appreciated the efforts made by the centre in establishing lab and other facilities despite the centre being approved very recently.

The nodal officer, UAS, Dharwad expressed the paucity of man power to take-up large scale seed production and non-availability of seed testing facility at regional level. The nodal officer,

UAS, Raichur articulated that lack of indent and non-availability of subsidy were the major problem faced by the centre. ADG (Seeds), New Delhi suggested to motivate the state government to place the indent. The Director, ICAR-IISS, Mau advised to use only the chemical name, not the trade name of any company / organization in STR experiments.

The Special Officer (Seeds), TNAU, Coimbatore stated that the centre completed all the 29 experiments allotted. Dr. S. Rajendra Prasad suggested to drop the experiment to store pods under cold (10°C) storage condition as it is not practically feasible and economic to the farmers. The ADG (Seeds) advised to mention the type of sieve while mentioning the sieve size in the processing experiments and also enquired about the duration and yield of a TNAU released rice variety COR 51 and suggested to conduct demonstrations in all centres as it is 105-110 days duration giving yield of almost 8 t/ha.

The Director, ICAR-IISS, Mau suggested the centres to utilize the funds completely as revalidation is very difficult in the coming year and congratulated the seed pathologist of HPKVV, Palampur for the initiatives taken to use molecular detection of seed borne pathogens and also requested the centres having the facility to conduct molecular studies to take-up similar studies. ADG (Seeds), New Delhi suggested to submit fresh proposals under extra mural project to crop science division to meet the fund requirement to conduct molecular studies.

The SKUA&T, Srinagar identified Septoria blotch in Kashmir valley which is the first report in the state. The nodal officer expressed the lack of full-fledged lab facility to conduct seed research. Director, ICAR-IISS, Mau appreciated the efforts made by the centre in organizing Tribal Sub Plan (TSP) program in Leh and Ladakh region.

Director, ICAR-IISS, Mau suggested all the centres to develop specific markers to identify the varieties and hybrids of the respective centres. He also enquired about the influence of karnal bunt on seed yield of wheat as most farmers' saved seeds has > 40-50% incidence. The PI, Seed Pathology replied that the seed treatments were not effective in controlling karnal bunt, so only the foliar spray is recommended. The Director, ICAR-IISS, Mau informed that the TA grant will be reduced for centres having high unspent balance under TA head and suggested HAU, Hisar to gear-up the number of experiments undertaken as the centre has full strength. ADG (Seeds), New Delhi advised to reduce the fund according to the number of scientists involved and experiments carried out.

The chairman suggested for changing the crop from petunia to marigold in seed testing protocol experiment undertaken by ICAR-IARI, New Delhi as the petunia seed were not available. The co-chairman suggested to take care of statistical requirements viz. no. of treatments and replications while designing experiments.

The session ended with the vote of thanks to all.

# Session IV-B

## Centre wise presentation of Progress Report for Seed Technology Research

**Date : 20.4.2016** **Time : 11:35 – 01:45 pm**

| | | |
|---|---|---|
| **Chairman** | : | **Dr. R.C. Agrawal,** Registrar General, PPV&FRA , New Delhi |
| **Co-chairman** | : | **Dr. S.M. Hussain,** PS, ICAR-IISR, Indore |
| **Rapporteurs** | : | **Dr. Vijay Shelar,** SRO,STR Unit, MPKV, Rahuri |
| | | **Dr. V. Vakeswaran,** Asst. Professor (SST), TNAU, Coimbatore |

There were 13 presentations from Western, Eastern and Central zone and one presentation was by Dr. Jyoti Kaul, PS, ICAR-IIMR, New Delhi. Some significant observations made by the dais during the course of discussion were as under:

1. It was suggested to RARI Durgapura to give recommendations on markers for varietal identification of pearl millet.
2. The Director, ICAR-IISS, Mau advised all the centres to timely utilize the funds completely under recurring contingencies, HRD and TA.
3. The ADG (Seed), ICAR, New Delhi directed ICAR-CAZRI, Jodhpur and NDAUT, Faizabad to return the unspent balance from XI plan period i.e., Rs. 40 and Rs. 50 lakhs, respectively to ICAR-IISS, Mau immediately.
4. The funds under recurring contingencies, HRD and TA will be allotted in proportion to the post filled in at respective centres.
5. The scientist from NDAUT, Faizabad were not present, when called for clarification during the discussion for which letter in this regard may be given to the University authorities.
6. House proposed that, each scientist should take at least 4 to 5 experiments.
7. The entire scientist working under the AICRP-NSP (Crops) along with the unit Head must attend the AGM.
8. The vacant post of Technical Assistant should be filled immediately at VNMKV, Parbhani.
9. JNKVV, Jabalpur should submit the markers for varietal identification to IISS, Mau.
10. Chairman expressed that a session on statistical parameters to impart in-depth knowledge on statistical tools may be arranged before next AGM.
11. Principal Investigator of seed production and certification suggested the additional funding for the centres involved in experiment of elevated temperature for the purchase of costly chemicals.
12. ADG (Seeds), ICAR, New Delhi suggested that the Research Publications from NSP experiments should be encouraged in good NASS rated journals.

# Session V

## Finalization of Recommendations / Technical Programme Formulation for 2016-17

### A. Seed Production and Certification

| | | |
|---|---|---|
| **Chairman** | : | **Dr. Vilas A. Tonapi,** Director, ICAR-IIMR, Hyderabad |
| **Convener** | : | **Dr. Rakesh Seth,** Principal Scientist, ICAR-IARI RS, Karnal |

The scientists involved in conduction of experiments in seed production and certification participated in the deliberations. The progress, bottlenecks and performance of centres along with experiments conducted were discussed and points for improvement were also suggested. The observations, decisions, recommendations and technical programme for 2016-17 were finalized and are reported hereunder:

**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 sent in time. The deviations and vitiations in conduction of experiments including difficulties should be communicated well in advance to the concerned PI and Director, ICAR-IISS, Mau.
- The designated crop specific leaders may be named to coordinate the experiments in specific crops to improve coordination and monitoring mechanism to ensure the quality of experimentation and comprehensive reporting of results.

**Following decisions were taken**

- Chemicals (Glycine betaine and Brassinolides) being expensive may be procured by Director, IISS, DSR Mau and provided to the centres conducting exp. 6 (mitigating the effect of elevated temperatures). Dr. Vijay Shelar (MPKV, Rahuri) and Dr. Shantharaja (CAZRI, Jodhpur) will estimate the cost and provide it to Director, IISS, Mau. It is necessary to look for field grade chemicals than the lab grade chemicals to economize on the cost.
- Incotec will be asked to provide the germination report for both original and encrusted seed.
- Incotec should provide UTILEF DNA finger print data to correlate with field GOT results.
- Letters to the VC, SDAU, SK Nagar and Director, ICAR-IIOR, Hyderabad regarding the non-conduction of experiment on castor isolation (Expt. No. 1) may be written by Director, ICAR-IISS, Mau.
- Letters may be written to VC / Director, JAU, Jamnagar; CIMAP, Anand; SDAU, SK Nagar regarding the non-conduction of cumin isolation distance (Expt. No. 1) by these centres.

- Experiment on wheat isolation distance (Expt. No. 1) will be conducted for one more year and will be concluded in next year.

**New experiments (Starting from 2016-17)**

- Efficacy of hydrogels (Pusa hydrogel and herbal hydrogel) on seed yield, quality and water use efficiency on wheat will be formulated by DSST, IARI New Delhi centre by Drs. Sudipta Basu, Monika Joshi and Sandeep Lal. Experiment will be formulated jointly in collaboration with PI, Seed Physiology. The experiment may be finalized and communicated by 10th May 2016. The experiment will be conducted at ICAR-IARI, N. Delhi and ICAR-IISS, Mau.

**Experiment 1: Standardization of isolation distance for hybrid seed production of castor, cumin and wheat**

**Year of start:** 2013-14

## CASTOR

### Objective

1. To determine isolation distance for hybrid seed production in castor
2. To verify isolation distance of male parent for foundation seed production up to 300m

| Crop | Centre |
|---|---|
| *Castor (New Hybrid)* | *SDAU, SK Nagar; ARS, Ladol and ICAR-IIOR, Hyderabad* |

***(SDAU, SK Nagar is requested to send the requisite seed sample to the above centres)***

### Treatment

Contaminator: SKP 1

Parental Lines: Male parent (V 19) and Female parent (VP 1)

Isolation distances: 100, 150, 200, 250 and 300 m

Directions: North, South, East and West

Male parent JI 96 of castor having mogni stem colour being dominant genetic marker will be planted in the center in a plot size of 25 m x 25 m with 90 cm inter row spacing. Both green stem female parent (VP 1) and male parent (JI 35) of castor hybrid GCH 2 (green stem) will be planted in the ratio of 3:1 in the plot size of 1.8 m x 6.0 m at the interval of 50 m from starting from 100 m from JI 96 up to 300 m in all four directions (NSEW). Care should be taken in laying out the experiment so that the plot at every 50 m interval would not be a barrier for next plot for pollen flow from JI 96. The random samples will be collected from harvest of individual treatment in summer seasons in both the seed lots. Rouging will be made in JI 96, VP 1and JI 35 before and after spike initiations.

### Observations to be recorded

1. Flowering and pollen dispersal behaviour of male parent

   **From VP 1 samples**

2. Off- type plants (%)
3. Selfed plants (%)
4. True type plants i.e. GCH 2 (%)

   **From JI 35 sample**

5. Off- type plants (%)
6. True type plants i.e. JI 35 (%)

***(Seed will be supplied by SKDAU, Gujrat: Cost of seed may be reimbursed)***

## WHEAT

***(All the centres should conduct isolation distance experiments for both hybrid and variety. A line may please be obtained from IARI: Dr. Monika Joshi, Sr. Scientist, DSST, ICAR-IARI; Mobile: 09910026346)***

**Year of start:** 2013-14

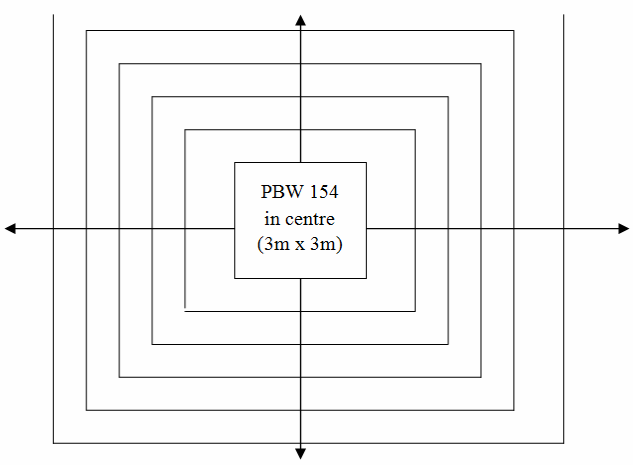
**Centres:** IARI, New Delhi and JNKVV, Jabalpur (to be concluded next year)

**Methodology:** Cultivar with dominant morphological marker to be used as pollen parent / contaminator and to be surrounded on all four sides by the female parent with recessive trait at different distances.

**Treatments: 1.** PBW 154; red glumed variety (*seed to be provided by Dr. Monika A. Joshi, ICAR-IARI, New Delhi; Mob: 09910026346*). 2. Any female / CMS line (of the respective centres) with white glume colour.

### Methodology

- PBW 154 to be grown in the centre; plot size of 3 m x 3 m.
- To be surrounded by any white glumed CMS line (as depicted in the diagram below).
- Different distances: 1 m, 2 m, 4 m, 6 m, 8 m and 10 m.




## Observations

1. Evaluation of sterility in the female line by selfing.
2. Recording pollen flow at different distances by hanging slides smeared with glycerine and estimating pollen at 10x magnification.
3. Seed setting percentage to be recorded from all four directions at all distances.
4. Seed harvested from the female parent to be sown next year for final observation on glume colour; in the format below:
5.

| Direction | % plants in a row | | | | | |
|---|---|---|---|---|---|---|
| | 1 m | 2 m | 4 m | 6 m | 8 m | 10 m |
| West | | | | | | |
| East | | | | | | |
| North | | | | | | |
| South | | | | | | |

# CUMIN

**Centers:** JAU, Jamnagar; CIMAP, Anand; AAU, Anand; SDAU, SK Nagar and MPKV, Rahuri.

**Objectives:** To standardize isolation distance in cumin.

**Methodology:** Cultivar with dominant morphological marker to be used as pollen parent / contaminator and to be surrounded on all four sides by the female parent with recessive trait at different distances.

## Treatments

(Seed for the experiment to be provided by Dr. D. Chaudhari. Mob: 09825251963 or Dr. R.M. Chauhan, Mob: 0942704744; SDAU, SK Nagar)

## Pollen parent

White flower genotype: ACC 52

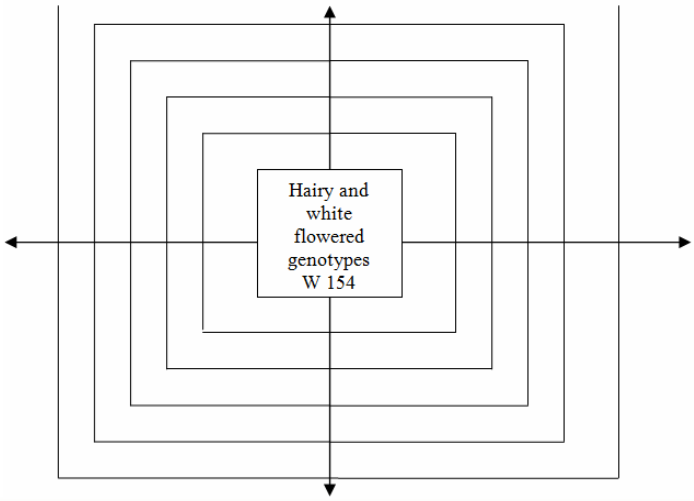
Hairy genotype: ACC 53

## Recipient

Pink flower and non-hairy genotypes

## Methodology

- White flowered and hairy genotpyes to be grown in the centre; plot size of 3 m x 3 m (*as in diagram below*)
- To be surrounded by any pink flowered and non-hairy genotypes at different distances *viz.* 1 m, 10 m, 20 m, 30 m, 40 m, 50 m, 60 m, 70 m, 80 m, 90 m and 100m.



**Treatment Details:** a. Pollen parent – 1. Cumin variety with white flower – ACC 52
2. Cumin variety with hairiness – ACC 53
b. Recipient - 1. Cumin variety with yellow flower - GC 4

**Plot Size:** a. Contaminator - 1 x 3 m
b. Recipient - 1 x 1 m

**Row to row distance:** 30 cm

**Isolation distance at all directions from contaminator:** 50 m, 60 m and 70 m

**Observations:** Seed is to be harvested from all sides up to 70 m and to grow next year for recording contamination at different distances.

**Experiment 2: Seed quality, health, yield, storability as affected by pre-sowing seed priming treatments in kabuli chickpea, vegetable pea and lentil**

**Year of proposed start:** 2014-15

| **Crops and Centres** | |
|---|---|
| Kabuli Chickpea | PAU, Ludhiana; JNKVV, Jabalpur; UAS, Raichur; MPKV, Rahuri; RAU, Durgapura and PDKV, Akola. |
| Field pea | CSAUA&T, Kanpur; JNKVV, Jabalpur; ICAR-IISS, Mau and ICAR RC NEH - Barapani |
| Lentil | JNKVV, Jabalpur; NDUA&T, Faizabad and ICAR RC NEHR - Barapani |

***(Dr. Basave Gowda, UAS Raichur will send the common protocol for wilt / blight treatment to all the centres for conducting this experiment on kabuli chickpea)***

## Objective

- Standardization of seed priming of kabuli chickpea for assured field emergence.
- Standardization of seed priming of field / vegetable pea for assured field emergence.
- Seed priming of lentil to reduce seed rate with assured field emergence in utera system.

## Treatments

1. Seed Priming with *Trichoderma harzianum* @ 1.5 %
2. Seed Priming with Vitavax Power @ 0.25 %
3. Seed Priming with Gibberalic Acid @ 50 ppm

4. Seed Priming with Gibberalic Acid @ 50 ppm + Seed coating with *T. harzianum* @ 15 g / kg seed
5. Seed Priming with Sodium Molybdate @ 500 ppm
6. Seed Priming with Sodium Molybdate @ 500 ppm + Seed coating with *T. harzianum* @ 15 g / kg seed
7. Seed Priming with leaf extract of *Lantana camara* @ 10 %
8. Seed hydration for 8 hrs.
9. Chemical check – seed treatment with Bavistin @ 3g/ kg seed
10. Control

**Observations**

**(A) Seed physiology**

I. Root nodulation

II. Seed quality parameters

III. Root and shoot length

IV. Biomass

**(B) Seed pathology**

I. Incidence of wilt / root rot

II. Incidence and severity of ascochyta blight

III. Seed mycoflora

**(C) Seed production**

I. Biomass

II. No. of pods / plant

III. 100 seed weight

IV. Seeds / pod

V. Seed yield

VI. Harvest Index

## Experiment 3: Validation of UTLIEF based genetic purity as an acceptable tool to ascertain genetic purity in certified seeds

**Year of start:** 2015-16

**Objective:** The goal is to validate proof of concept of protein based genetic purity diagnostic system as an accurate tool to ascertain genetic purity in a short time.

**Crops and Centres**

a. **Hybrid Rice:** TNAU, Coimbatore, UAS, Bangalore, ANGRAU, Hyderabad, RARS Pattambi and JNKVV, Jabalpur (Certified seed of leading hybrid - KRH 2 / KRH 4 will be procured from KSSC by Dr. Rame Gowda, Nodal Officer (Seeds), UAS, Bangalore and supplied to centres for GOT and also send seeds to INCOTEC for UTILEF technology validation by 15th June)

b. **Hybrid Sorghum:** MPKV, Rahuri and PDKV, Akola (Certified seed of leading hybrid CSH 14 to be procured from MSSC by Dr. Vijay Shelar, MPKV, Rahuri, for GOT and supplied to centres for GOT and also send seeds to INCOTEC for UTILEF technology validation by 15th June)

c. **Hybrid Sunflower:** UAS, Bangalore and UAS, Raichur (Certified seed of leading hybrid KBSH 53 to be procured from KSSC by Dr. Rame Gowda, Nodal Officer (Seeds), UAS Bangalore and supplied to centres for GOT and also send seeds to INCOTEC for UTILEF technology validation by 15th June)

d. **Hybrid Bt Cotton**: CICR, Nagpur and UAS, Dharwad (Seed of leading Bt hybrid to be procured by Dr. Rame Gowda Nodal Officer (Seeds), UAS, Dharwad and send to all centres for GOT and also send seeds to INCOTEC for UTILEF technology validation by 15th June)

**Note:** The seeds to be procured from the leading Seed Corporations specializing in the said cultivars and popular in the country. This will give us edge in identifying the maximum benefit to the farmers for getting the diagnosis done in time.

- GOT to be conducted as per standard practice
- Seed quantity: 10 lots - minimum 10 kg each to be procured and sent to centres and INCOTEC at following address for treatment

***Mr. Khiraj Bhalsing, Manager, Integrated Product Research, Integrated Coating & Seed Technology India Pvt. Ltd., 47-Mahagujarat Industrial Estate, Opp. Pharmalab, Sarkhej Bavla Highway, A.t: Moraiya, Ta.: Sanand, Ahmedabad – 382 213, Gujarat***

***Phone: +91-9998980334, Fax: +91-7838 654679,***
***Skype: khiraj.bhalsing, Email: khiraj.bhalsing@incotec.com,***
***Website: www.incotec.com***
***N.B. Centre's conducting this exp. may remain in touch with Mr. Khiraj Bhalsing***

## NOTE

For UTLIEF validation, in addition to the above, parental line seeds of above crops to be sent to INCOTEC by the respective scientists from designated centers as indicated above

**Requirement of seed in validation test: sample size for the combined inbred test is:**

- Male Line : 500 seeds (minimum) - Send 200 gm to INCOTEC
- Female Line : 500 seeds (minimum) - Send 200 gm to INCOTEC
- Hybrid (F1) : 500 seeds (minimum) - Send 200 gm to INCOTEC
- Pass GOT lots : 3 lots with Genetic purity more than 98 % - Send 200 gm to INCOTEC
- Fail GOT lots : 3 Lot with Genetic purity less than 80 % - Send 200 gm to INCOTEC

**NB. Seed of both accepted and rejected lots need to be used**

**INCOTEC Role**

a. After receipt of the hybrid and parental seeds of these crops, Incotec will run its protocol

**NSP Work**

a. To source the parental and hybrids from different sources and 10 hybrid lots of these hybrids.

b. To conduct field GOT of these 4 x 10 lots and compile the results.

c. Statistically correlate the Field and ***UTLIEF*** Data

**Basic Plan: Treatment Matrix**

| Treatment | Crops |
|---|---|
| UTILEF based genetic purity testing | Hybrid Rice |
| UTILEF based genetic purity testing | Hybrid Sorghum |
| UTILEF based genetic purity testing | Hybrid sunflower |
| UTILEF based genetic purity testing | Hybrid cotton |

**Grow Out Test - procedure to be followed by the centres**

**Objective: To estimate the genetic purity of a seed lot on the basis of morphological characters of the plants produced by the seeds under test.**

The seed sample of a seed lot is to be sown with authentic sample. Genetic purity is determined on the basis of observations made on plant morphological characters with reference to authentic sample.

## Sampling

Submitted sample - sample drawn simultaneously with samples for other tests.

## Recommended size of submitted sample

| Crop | Size of sample |
|---|---|
| Pearl millet and genera with similar seed size | 100 gm |
| *Beta vulgaris* and genera with similar seed size | 250 gm |
| Sorghum, rice, wheat and other genera with similar seed size | 500 gm |
| Maize, cotton, groundnut, soybean and other genera with similar seed size | 1000 gm |

If genetic purity has to be worked out by ODV and grow out test, size of submitted sample is doubled.

## Working sample

Size of sample, depends on the test weight and germination percentage of the crop, to observe the permissible off-type plants prescribed as minimum seed certification standards in the optimum population i.e. minimum 400 plants.

| Maximum permissible off-type plants (%) | No. of plants required |
|---|---|
| 0.10 | 4000 |
| 0.20 | 2000 |
| 0.30 | 1350 |
| 0.50 | 800 |
| 1.00 and above | 400 |

**Location of the grow out test:** Conduct in the area where crop can express its marker characters without any variation due to the influence of environment even in off season or under controlled conditions in glass house.

**Authentic sample:** It is the official sample of the variety obtained from the originating institute and grown in identical situation with sample under test for comparison.

**Land requirement:** Land is free from other crops, weed and volunteer plant seeds with adequate fertility and irrigation facility.

**Raising of the crop:** Standard and recommended cultural practices are adopted for raising the crop in four replications but the row length, plant to plant, row to row and plot to plot distances have to be altered as per recommendations. Proper care should be taken to avoid admixture and to maintain optimum plant population. Subsequent thinning and transplanting is not recommended. Authentic sample is grown with same cultural practices at suitable interval.

**Observations:** Each and every plant is examined throughout the growing season with emphasis on the marker characters and time of their expression. The plants showing deviation in expression of the characters against control are tagged and examined thoroughly to confirm their genetic purity. The number of off type plants and total population is counted and recorded.

### Recommended specifications to raise the crop for grow out test

| Crop | Plant to plant distance (cm) | Space between rows (cm) | Row length (m) | Space between plot (cm) |
|---|---|---|---|---|
| Cowpea, pea, soybean | 10 | 45 | 6 | 90 |
| Paddy | 15 | 20 | 6 | 45 |
| Maize | 25 | 60 | 10 | 90 |

**Genetic purity calculation:** Percentage of genetic purity is calculated on the basis of number of off-types and total plant population up to first decimal place. Result is interpreted by using the reject number for prescribed standards with reference to sample size.

| Genetic purity (%) | Reject number for sample size (number of plants) of | | | |
|---|---|---|---|---|
| | 100 | 400 | 800 | 2000 |
| 99.5 | 0.5 | 2 | 6 | 10 |
| 99.0 | 1.0 | 8 | 16 | 20 |
| 95.0 | 5 | 24 | 48 | 100 |
| 90.0 | 10 | 44 | 88 | 200 |
| 85.0 | 15 | 64 | 128 | 300 |

**Reporting of genetic purity percentage:** The impurity is not reported by name but by percentage.

### DUS / Morphological characters of genotypes to ascertain genetic purity

1. **Hybrid Rice: KRH 2:** Plant height: mean 102 cm; kernel colour: white; grain type: long slender; pigmentation: no pigmentation in any part of the plant; ligule shape: two cleft; ligule length: medium; panicle type: compact; node base colour: pale green; flag leaf angle: erect; no. of tillers per plant: 14; no. of panicles per $m^2$: 568; flowering duration: 95; panicle exertion: compact; awning: awnless; apiculus colour: green; 1000 grain weight: 25.5 g; kernel length: (mm): 6.58; kernel breadth (mm): 2.27; l/b ratio: 2.91; kernel appearance: translucent; hulling recovery (%): 78.6; milling recovery (%): 72.6; head recovery (%): 56.5; alkali value: 2.2; amylose content : 27.5. Name of the breeder sponsoring the variety: Dr. B. Vidyachandra, Professor (hybrid rice), RRS, VC Farm, Mandya, Karnataka.

2. **Sunflower: KBSH 53**

   **Specific morphological characters:** Petiole pigmentation: green; Leaf serration: medium; Head size and shape: medium & convex; Plant type - mono head.

**General morphological characteristics:** plant height: 180-200 cm; days to 50% flowering: 65-70 days; days to maturity: 95-100 days; maturity group: medium duration; lodging resistance: resistant; pigmentation: light green stem with sparse hairiness.

### 3. Sorghum: CSH 14

| Characteristics | Remarks |
|---|---|
| Seedling: anthocyanin colouration of Coleoptile | Grayed purple |
| Leaf Sheath: anthocyanin Colouration | Grayed purple |
| Leaf: midrib colour (5th fully developed leaf) | yellow green |
| Plant: Time of panicle emergence (50% of the plants with 50% anthesis) | early |
| Plant: natural height of plant up to base of flag leaf | short |
| Flag leaf: Yellow colouration of midrib | Absent |
| Lemma: arista formation | Absent |
| Stigma: anthocyanin colouration | Present |
| Stigma: Yellow colouration | Present |
| Stigma: length | Medium |
| Flower with pedicel : length of flower | long |
| Anther: Length | Short |
| Anther: colour of dry anther | Grayed orange |
| Glume : colour | Grayed orange |
| Plant: total height | medium |
| Stem : diameter ( at lower one third height of plant ) | small |
| Leaf: length of blade (the third leaf from top including flag leaf) | long |
| Leaf: width of blade(the third leaf from top including flag leaf) | Very broad |
| Panicle : length without peduncle | medium |
| Panicle : length of branches (middle third of panicle) | medium |
| Panicle : density at maturity (ear head compactness) | semi loose |
| Panicle : shape | symmetric |
| Neck of panicle : visible length above sheath | medium |
| Glume : length | short |
| Threshability | partly threshable |
| Caryopsis : color after threshing | yellow white |
| Grain : weight of 1000 grains | medium |
| Grain: shape (in dorsal view) | circular |
| Grain: shape in profile view | circular |
| Grain: size of mark of germ | medium |
| Grain: texture of endosperm (in longitudinal section) | half vitreous |
| Grain: colour of vitreous albumen | grayed yellow |
| Grain : lustre | lustrous |

## Experiment 4: Recognition of seed film coating polymers for efficient and health friendly seed treatment operations for certified seeds of cereals and legumes

**Year of start:** 2015-16

**Objective:** The seed certification agencies in India do not allow any polymer treatments in certified seeds. We agriculturists know the benefits of polymer coating in terms of zero dust off, saving the chemicals, eco-friendly seed treatment and efficient release of chemicals to the root zones. This project wishes to demonstrate the *already known* benefits of film coating polymers with a goal to validate use of polymers for approval by the seed certification agencies to accept the polymer treatments.

**Minimum seed quantity to be sent to Incotec:** 40-80 kgs (@ 5kg per centre) be sent to INCOTEC immediately for polymer coating. Scientist mentioned in the following table will send seeds to INCOTEC and after treatment and receipt from INCOTEC, the treated seeds will be sent by them to other centers

### Basic plan: Treatment matrix

| Crop | Variety / Hybrid | Seed will be supplied to INCOTEC by | Treatments | Centre |
|---|---|---|---|---|
| Rice | MTU 1010 | Dr. T. Pradeep, PJTSAU, Hyderabad 7 Centres: 40 kgs | No treatment or water + Thiram only | TNAU, Coimbatore; ANGRAU, Hyderabad; BCKV, Nadia; PAJANCOA, Karaikal; RARS, Pattambi; NDUA&T, Faizabad; ICAR RC NEHR - Manipur Centre; ICAR RC NEHR – Barapani. |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Carboxine | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat ** | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots **/ mycorrhiza | |
| Wheat | GW322-central India<br><br>HD 2967 Northern India | Dr. G. K. Koutu, JNKVV, Jabalpur: 80 kgs<br><br>Dr. Sanjay Kumar, Head, Seed Production Unit, IARI, N. Delhi: 70 kgs | No treatment or water + thiram only | ICAR-IISS, Mau; JNKVV, Jabalpur; PAU, Ludhiana; CCSHAU, Hisar; GBPUAT, Pantnagar; RARI, Durgapura; CSAUA&T, Kanpur |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram+Carboxine | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat ** | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots **/ mycorrhiza | |

| Crop | Variety / Hybrid | Seed will be supplied to INCOTEC by | Treatments | Centre |
|---|---|---|---|---|
| Maize | Hema | Dr. Rame Gowda Nodal Officer (Seeds) UAS, Bangalore 4 Centres: 40 kgs | No treatment or water + thiram only | ANGRAU, Hyderabad and UAS, Bangalore; RAU, Dholi; ICAR RC NEHR-Manipur Centre; ICAR RC NEHR-Barapani, Meghalaya |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram+ Carboxine | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat ** | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots **/ mycorrhiza | |
| Sorghum | CSH 14 | Dr. Vijay Shellar, MPKV, Rahuri 4 Centres: 40 kgs | No treatment or water + thiram only | IIMR, Hyderabad; MAU, Parbhani; PDKV, Akola |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram+ Carboxine | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat ** | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots **/ mycorrhiza | |
| Pigeon pea | Asha | Dr. T. Pradeep PJTSAU, Hyderabad 3 Centres: 40 kgs | No treatment or water + thiram only | ANGRAU, Hyderabad; CSAUAT Kanpur |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram+ Carboxine | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat ** | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots **/ mycorrhiza | |
| Soybean | JS 335 (Or available variety) | Dr. G. K. Koutu JNKVV, Jabalpur 8 Centres: 70 Kgs | No treatment or water + Thiram only | UAS, Dharwad; JNKVV, Jabalpur; MPKV, Rahuri; IISR, Indore; UAS, Raichur; ANGRAU, Hyderabad; HPKVV, Palampur; ICAR RC NEHR -Manipur Centre; ICAR RC NEHR –Barapani. |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Carboxine | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat ** | |
| | | | Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots **/ mycorrhiza | |

## Mode of action and anticipated benefits from treatments

| | | | | |
|---|---|---|---|---|
| **Quick roots, BS154** | 5.09.157 | Biological product, combination of *Trichoderma virens* and *Bacillus subtilis var. amyloliquefaciens* | Colonizes roots in symbiotic relationship - produces enzymes which release soil nutrients<br>Has been shown to increase NPK uptake by increasing the volume of roots | A. Increased root volume<br>B. Better established, more vigorous plants<br>C. Yield increase |
| **Genius coat, GC172** | 5.06.172 | A balanced level of Organic and Naturally occuring substances | Activates metabolic processes in the developing embryo of the plant<br>Increases root development and mass, maximizing plants ability to utilise nutrients<br>Improves stress tolerance and crop vitality | 1. More developed root system<br>2. Stress tolerance<br>3. Increased biomass during vegetative stages<br>▪ Yield increase |
| **FBS 1065** | 5.06.250 | Derived from natural organic matter, a miniscule molecule systemically active in the plant | · Induces gene expression resulting in enhanced nutrient uptake and mobility | ▪ Improved stress tolerance |

## Seed to be sent for treatment to the following INCOTEC address:

***Mr. Khiraj Bhalsing, Manager, Integrated Product Research, Integrated Coating & Seed Technology India Pvt Ltd., 47-Mahagujarat Industrial Estate, Opp. Pharmalab, Sarkhej Bavla Highway, A.t: Moraiya, Ta.: Sanand, Ahmedabad - 382 213, Gujarat Phone: +91-9998980334, Fax: +91-7838 654679, Skype: khiraj.bhalsing, Email: khiraj.bhalsing@incotec.com, Website: www.incotec.com***

**INCOTEC Role:** Incotec will treat the seeds with the polymers and recommended general plant protectants / additives and send back to centres to do lab tests and field plantings.

## NSP Work

a. To source the seeds and send them to Incotec.

b. To plant the field trails and take observations

c. The field trials to happen with RCBD model.

d. To do 1 year storability studies with the treated seeds.

**Treatments** : 5

**Replications** : Four

**Plot size** : 5 m x 5 m

## Observations

1. Lab germination - (Viability) tests at 2 month interval (7 readings)
2. Vigour rating in laboratory (vigour index) and field
3. Field emergence % (early (30 days) and late (50 days))
4. Plant height at vegetative (30 days) and flowering stage
5. Disease / pest incidence scores
6. Final plant stand at maturity
7. Yield attributing characters - crop wise
    a. **Sorghum:** Plant height, days to flowering, days to 50% flowering, days to maturity, panicle length, number of primary branches per panicle, number of grains per panicle, 100 grain weight, seed setting percentage, grain yield per plant and harvest index
    b. **Rice:** Plant height, days to flowering, days to 50% flowering, days to maturity, internode length, panicle length, number of branches per panicle, number of grains per panicle, seed setting percentage, 100 seed weight, seed yield per plant and harvest index.
    c. **Maize:** Plant height, days to flowering, days to 50% flowering, days to silking, days to maturity, internode length, cob length, girth of the cob, cob weight, seeds per cob, 100 seed weight, seed yield per plant and harvest index.
    d. **Pigeon pea:** Plant height, number of primary branches per plant, secondary branches per plant, days to maturity, no. of pods per plant, days to maturity, seeds per pod, seeds per plant, 100 seed weight, seed yield per plant and harvest index.
    e. **Soybean:** Plant height, number of primary branches per plant, days to 50 per cent flowering, number of pods per plant, 100 seed weight, grain yield per plant and harvest index.
8. Seed storability studies - Seed germination, seed vigour and viability parameters

***Note:*** Recommended region/location specific fertilizer doses should be applied for field study. For storage studies cloth bags should be used

## Experiment 5: Standardization of seed production technology in green manure crops

*(Dr. Naidu from ANGRAU will procure seeds of Dhiancha, Pillipesara and Sunhemp from NSC / IFFCO and send to centres)*

| Crops and centres | |
|---|---|
| Daincha (*Sesbania aculeata*) | TNAU, Coimbatore; AAU, Jorhat; MPKV, Rahuri; UAS, Dharwad; ANGRAU, Hyderabad; RAU, Dholi; BCKV, Nadia, PAJANCOA&RI, Karaikal; JAU, Jamnagar; OUA&T, Bhubneswar; AAU, Jorhat; HPKV, Palampur |
| Sunhemp (*Crotolaria juncea*) | TNAU, Coimbatore; AAU, Jorhat; MPKV, Rahuri; UAS, Dharwad; ANGRAU, Hyderabad; RAU, Dholi; BCKV, Nadia, PAJANCOA&RI, Karaikal; JAU, Jamnagar; OUA&T, Bhubneswar; AAU, Jorhat |
| Pillipesara (*Vigna trilobata)* | TNAU, Coimbatore; AAU, Jorhat; MPKV, Rahuri; UAS, Dharwad; ANGRAU, Hyderabad; RAU, Dholi; BCKV, Nadia, PAJANCOA&RI, Karaikal; JAU, Jamnagar; OUA&T, Bhubneswar; AAU, Jorhat |

### Objectives

- To study the influence of nipping or pinching of terminal buds on the number and intervals of pod pickings, seed shattering loss, seed yield and quality.
- To study the influence of phosphorous application on seed yield and quality.
- To study the effect of DAP 2% as foliar spray to enhance seed yield and quality.

### Methodology

1. Nitrogen application: 30 kg/ha
2. Phosphorous application : 50 kg/ha as basal
3. Foliar spray: Two sprayings of the following nutrients as detailed below.
4. Effect of nipping or pinching of tendrils

- Being an indeterminate crop, pinching or nipping of terminal buds may have influence on seed yield and quality. Nipping should be done on *Sesbania aculeata* at 60 DAS, *Vigna trilobata* between 20 and 40 DAS. In sunhemp, the main stem of sunhemp when attains a height of 90 cm to break apical dominance and more branching.
- However a control may be maintained without nipping and cutting in all crops.

### Treatments

**Main plot: Pinching**

$M_1$: With pinching

$M_2$: Without pinching

**Sub plot: Foliar application**

$T_1$ - Foliar spray with DAP @ 2%

$T_2$ - Foliar spray with MN Mixture ($ZnSO_4$ @ 0.5% + Boric acid @ 0.3%)

$T_3$ - Foliar spray with NAA @ 40 ppm

$T_4$ - Foliar spray with DAP 2% + MN Mixture (Zn+B) + NAA @ 40ppm

$T_5$ – Control

- The total fertilizer application be split into two, one as basal and other as top dressing.
- Foliar spray should be done at flowering. In addition, the recommended agronomic packages and plant protection practices should be followed.

| | | |
|---|---|---|
| **Design** | : | Split plot |
| **Replications** | : | 4 |
| **Spacing** | : | Daincha - 60 x 20 cm<br>Sunhemp - 30 x 30 cm<br>Pillipesara - 60 x 30 cm |
| **Plot size** | : | 20 $m^2$ ( 5 x 4 $m^{2)}$ |

## Observations to be made

1. No. of pods / plant
2. No. of seeds / pod (excluding shrivelled and under developed seeds)
3. Pod yield / plant & plot
4. Seed yield / plant, plot and ha.
5. Seed recovery (%)
6. No. of pods shattered / plant before each pickings (Shattering loss)
7. No. of pickings made
8. 100 seed weight (g)
9. Seed germination (%)
10. Seedling vigour (length, dry weight and vigour index)

## Experiment 6: Development of technologies to mitigate the effect of elevated temperatures on seed set, yield and quality

### Objectives

- To standardize the techniques to mitigate the effect of elevated temperatures on seed set, yield and quality.
- To study the impact of heat stress on various crop phenological parameters, pollen and stigmatic character / floral behavior and seed set percentage.
- To study the effect of heat stress on seed quality (germination, viability, vigour and seed health) of both freshly harvested as well as stored seeds under both stressed and non-stressed environments.

| Crop | Centre |
|---|---|
| **Wheat** | IARI, New Delhi; JNKVV, Jabalpur; PAU, Ludhiana; GBPUA&T, Pantnagar; HAU, Hisar; RAU, Dholi; MAU, Parbhani; RARI, Durgapura; CSAUA&T, Kanpur; and JNKVV, Jabalpur |
| **Sorghum** | MPKV, Rahuri; MAU, Parbhani and PDKV, Akola |
| **Rice** | IIRR, Hyderabad; ANGRAU, Hyderabad; UAS, Bengaluru; TNAU, Coimbatore; ICAR RC NEHR - Manipur Centre; OUA&T, Bhubneswar and KKV, Dapoli |
| **Mustard** | CAZRI, Jodhpur; IARI, New Delhi and CSAUA&T, Kanpur |

**Varieties / hybrids:** Region specific varieties / hybrids of different maturity group.

**Sowing dates:** Two dates of sowing to be adopted in such a way that one set will not be caught in heat stress and another set will have flowering and seed setting taking place in heat stress.

The following chemicals will be used for the foliar spray to mitigate the effect of elevated temperatures on seed set. This experiment will be conducted on heat susceptible variety / hybrid in Randomized Block Design under field condition preferably March - June with three replications by following all the recommended package of practices.

### Treatments

| Treatments | | Stages of application | |
|---|---|---|---|
| $T_0$ | Control | ---- | |
| $T_1$ | Glycine betaine (600 ppm) | Vegetative | Seed filling |
| $T_2$ | Salicylic acid (800 ppm) | Vegetative | Seed filling |
| $T_3$ | Salicylic acid (400 ppm) | Vegetative | Seed filling |
| $T_4$ | Ascorbic acid (10 ppm) + Citric acid (1.3%) | Vegetative | Seed filling |
| $T_5$ | α-Tocopherol (150 ppm) | Vegetative | Seed filling |
| $T_6$ | KCl 1% | Vegetative | Seed filling |
| $T_7$ | Brassinolides (0.3 ppm) | Vegetative | Seed filling |
| $T_9$ | Brassinolides (10 ppm) | Vegetative | Seed filling |

**Replications:** 3

**Plot size:** 20 $m^2$ (5 x 4 $m^2$)

## Observations

Both field and 5 $^0$C enhanced elevated temperature condition, the following observations will be recorded.

1. Chlorophyll index before and after spray
2. Radical content of leaf before and after spray
3. Pollen viability
4. Seed set percentage
5. 100 seed weight
6. Seed yield per plant
7. Seed yield per plot
7. Germination and vigour of seed
8. Storability of seeds as tested by Accelerated ageing test at 40 $^0$C and 90% RH for 7 days
9. Germination and seedling vigour after ambient storage for 6 and 9 months

## Biochemical quality

1. Quantification of accumulation of reactive radicals in leaves 2 days after treatments
2. Radical estimation in seeds
3. Lipid peroxidation of Seed (Malondialdehyde content of seed)
4. Electrolyte leachate from seed before storage (just after harvest) and after storage
5. Respiratory system: Dehydrogenase activity of seed

***(For Biochemical analysis: Dr. Vijay Shellar, MPKV, Rahuri will send the protocols to the centres conducting this experiment)***

### Experiment 7: Integrated approach for enhancing seed yield and quality in millets.

## Objectives

- To standardize suitable seed quality enhancement techniques to enhance the production potential of millets.

**Crops and centres**

1. **Finger millet:** UAS, Bangalore; ANGRAU, Hyderabad; UAS, Dharwad; KKV, Dapoli; HPKV, Palampur and IGKV, Raipur.
2. **Foxtail millet:** ANGRAU, Hyderabad; TNAU, Coimbatore and UAS Dharwad.
3. **Kodo millet:** JNKVV, Jabalpur; TNAU, Coimbatore and ANGRAU, Hyderabad.
4. **Proso millet:** ANGRAU, Hyderabad and UAS, Bangalore.
5. **Little millet:** JNKVV, Jabalpur and TNAU, Coimbatore.

| **SMALL MILLETS TREATMENT DETAILS** | |
|---|---|
| **No of treatments** | **Main plots** (Sowing methods and spacing): **02**<br>**Sub-plots** (Nutrient management): **04** |
| **Treatment details** | |
| **I. Main Plot treatments (Sowing methods)** | |
| $S_1$ – 30 x 10 cm – sown at 3-4 cm depth | |
| $S_2$ – Transplanting with spacing of 30 x 10 cm (raising a nursery and transplanting at 21 days in wet field capacity of soil) | |

**Note**

A. For raising seedlings to plant one ha of main field, select 12.5 cents (500 $m^2$) 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 3 m 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.

B. 4-5 days before removing plants, spray the nursery with the fungicide Mancozeb 75 % W.P. @ 2 gm / liter ♣ Transplant the seedlings from the nursery into the main field when they are only 15-25 days old. ♣ Before transplanting, irrigate 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 10 x 10 inches by using a rope or a marker. ♣ Transplant the seedlings at a shallow depth in the pits; do not press or injure the roots while placing the seedlings at the intersection of planting lines.

C. 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 or 25-30 days after transplantation by sprinkling.

| | |
|---|---|
| **II. Sub-Plot treatments** (Nutrient management) | |
| $N_1$ – No fertilizer | |
| $N_2$ – 125 kg Neem + 1250 kg Vermi compost per ha or 12.5 tons FYM/ha | |
| $N_3$ – 50 kg Urea + 50 kg Super phosphate and 50 kg Muriate of potash per ha + Top dressing urea at 3-4 weeks after transplanting + 2% Borax spay at flowering | |
| $N_4$ - 125 kg Neem + 1250 kg Vermicompost (or) 12.5 tons FYM/ha + 50 kg Urea + 50 kg super phosphate and 50 kg Muriate of potash per ha + Top dressing urea at 3-4 weeks after transplanting + 2% Borax spay | |
| **III. Sub-sub-plot treatments** (Priming) | |
| $P_1$ – Control - No priming | |
| $P_2$ - 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 in 2.5-3 gm / kg of Carbendazim (Bavistin) with the seeds and leaving the mixture for 24 hours before sowing | |
| $P_3$ – 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 in 2.5-3 gm / kg of Carbendazim (Bavistin) with the seeds, and leaving the mixture for 24 hours before sowing | |
| $P_4$ – Seed priming with 20 % liquid *Pseudomonas fluoresces* | |
| **Design** | Split Plot Design |
| **No. of replications** | 2 |
| **Plot size** – **Gross plot size** | 1.2 m × 5.0 m (6.0 $m^2$) |
| **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**

A. **Blast:** Seed treatment, mixing 2.5 gm/kg of Carbendazim (Bavistin) for at least 30 minutes.

B. **Seedling blight:** Spray Mancozeb 75 % WP @ 2 gm per liter in the nursery 15 days before sowing or 15 days after transplantation.

C. **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.

*D.* **Stem borer:** Use regent granules or its liquid form in the amount of 7 kgs / acre. 1 ml of the 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
- No. of branches
- Panicle weight plot$^{-1}$
- Seed yield plant$^{-1}$
- Seed yield plot$^{-1}$
- Seed yield per Acre
- 100 seed weight
- Seed recovery percent
- Resultant seed quality - seed germination and vigour index

### Experiment 8: Planting windows for quality seed production of soybean in offseason

**Centres and varieties**

1. UAS- Dharwad (Dharwad and Haveri) - DB 21 (Oct. to January end)
2. UAS, Bangalore - JS 335 (Mandya) (in paddy fallows Nov. to Jan.)
3. MAU, Parbhani - MAUS 162 (Oct. to January end)
4. PJTSAU, Hyderabad - JS 335 (Andhra and Telangana) (Oct. to January end)
5. UAS, Raichur - JS 335 and DSV 21 (Nov. to January)
6. JNKVV, Jabalpur - JS 20-34 and JS 20-29 (Nov. to Jan. End)
7. MPKV, Rahuri - JS 335 and MAUS 162 (Sept. to January)

***(Include climatological data in it and one sowing in normal season and remaining in off season with 5-6 plantings every fortnight)***

## Objectives

1. To standardize best planting date off season soybean seed production and to assess seed quality

## Experimental details

| | | | | | |
|---|---|---|---|---|---|
| **Design** | **:** | **FRBD** | **Replication** | **:** | **Three** |
| **Plot size** | **:** | **3.6 m × 5.0 m** | **Sowing** | **:** | **Ridges and furrow sowing** |
| **Spacing** | **:** | **45×5 cm** | | | |

## Fertilizer & Micro nutrients

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

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

## Observations to be recorded

### A. Growth and yield parameters

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

### B. Pod characteristics

1. Days to 1$^{st}$ flower bud
2. Days to 1$^{st}$ flower
3. Days to pod maturity

4. Length of pods (cm)
5. Diameter of pods (cm)
6. Shattering (%)

**C. Seed Morphometry (Image Analysis)**

1. Length of seed (mm)
2. Width of seed (mm)
3. Area of seed ($mm^2$)
4. Seed Diameter (mm)
5. Seed perimeter (mm)
6. Seed roundness

**D. Biochemical parameters**

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

### Storage study

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

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

## Experiment 9: Encrustation enabled direct seeding technology of small seeded crops

### Crops and centres

***(Note: Those who are supplying the seeds are requested to calculate the seed requirement for 5 m X 4 m plots in 3 replications for requisite no. of centres mentioned against each crop)***

1. **Onion (Pusa red):** IARI, New Delhi; UAS, Dharwad; JNKVV, Jabalpur and RARI, Durgapura (Seeds for encrustation will be sent by Dr. Sanjay Kumar, Head, Seed Production Unit, IARI, New Delhi to INCOTEC and to the centres after encrustation)

2. **Carrot (Pusa rudhira):** IARI, New Delhi and UAS, Dharwad **(**Seeds for encrustation will be sent by Dr. Sanjay Kumar, Head, Seed Production Unit, IARI, N. Delhi to INCOTEC and to centres after encrustation)

3. **Sesame (DS 5):** UAS, Dharwad; JNKVV, Jabalpur and OUA&T, Bhubaneshwar **(**Seeds for encrustation will be sent by Dr. T.A. Malabasari, Seed Unit, UAS, Dharwad to INCOTEC for encrustation and to the centres after encrustation)

4. **Mustard (Pusa vijay)**: SKNAU, Durgapura; NDUA&T, Faizabad; CSAU&T, Kanpur; IARI, New Delhi, HAU, Hisar and ANGRAU, Hyderabad (Seeds for encrustation will be sent by Dr. Sanjay Kumar, Head, Seed Unit, IARI, New Delhi to INCOTEC and to the centres after encrustation)

   (In addition, Dr. Selvaraju, TNAU, Coimbatore will pellet the seeds and send to any of the two centres mentioned above)

5. **Berseem (JB 1 or Wardan)**: ANGRAU, Hyderabad and JNKVV, Jabalpur (Seeds for encrustation will be sent by Dr. G.K. Koutu, JNKVV, Jabalpur to INCOTEC and to the centres after encrustation)

6. **Rapeseed (TS 44):** AAU, Jorhat and ICAR RC NEHR - Manipur Centre (Seeds for encrustation will be sent by Dr. Prakash Borah, Pr. Scientist (PBW) & I/c NSP (Crops) Unit, AAU, Jorhat, Mob: 09435095462 / Dr. Umesh Kalita, Principal Scientist, AAU, Jorhat to INCOTEC and to the centres after encrustation)

**Seed to be sent for treatment to following INCOTEC address:**

***Mr. Khiraj Bhalsing, Manager, Integrated Product Research, Integrated Coating & Seed Technology India Pvt Ltd. 47-Mahagujarat Industrial Estate, Opp. Pharmalab, Sarkhej Bavla Highway, Ta: Sanand, Ahmedabad - 382 213, Gujarat***
***Phone: +91-9998980334, Fax: +91-7838 654679, Skype: khiraj.bhalsing***
***Email: khiraj.bhalsing@incotec.com, Website: www.incotec.com***

## Objectives

1. To study efficacy of direct seeding of encrusted small seeded vegetable crops.
2. Evaluation of seed encrusting and seed pelleting with applied additives & actives.

## Treatments

1. Control (no treatment - for nursery rising)
2. Control - no treatment - for seed drill direct sowing
3. Encrusted 1:1.2 buildup with Thiram - for seed drill direct sowing
4. Encrusted 1:1.2 buildup with Thiram and Mycorrhiza - for seed drill direct sowing

5. Encrusted 1:1.2 buildup with Thiram and Genius coat TM - for seed drill direct sowing

Note: Standard fertilizer doses shall be applied to the plots.

**Sowing Plan**

1. Seeds will be sown in approx. 5 m x 4 m plots in 3 replications in RCBD.
2. Nursery sowing (only for onion and carrot) will be done at the same time and transplanted in the plots designated in case of onion and carrot
3. In case of Mustard, Sesame, Berseem and Rapeseed - usual normal practice of sowing be kept as control for comparison to direct seeding.
4. The other direct sowing treatments to be sown by seed drill at 15 cm plant spacing and 30 cm row spacing.

**Observations**

1. Emergence after 15 days and 45 days
2. Plant height
3. Seedling vigour in field
4. Phonological parameters
5. Disease and pest rating
6. Fruit and seed yield parameters
7. All the yield attributing characters

| | | |
|---|---|---|
| **Onion** | : | No. of branches, bulb weight, bulb diameter and bulb yield |
| **Carrot** | : | Plant height, no. of leaves, root diameter, root length, fresh weight of roots / plant and yield / plant |
| **Sesame** | : | Days to 50 % flowering, days to maturity, plant height, no. of capsules, no. of seeds / capsule, 1000 seed weight and seed yield / plant |
| **Mustard** | : | Plant height, no. of branches, siliqua per plant, seeds per siliqua, test weight of 100 seeds and seed yield / plant |
| **Berseem** | : | Plant height, no. of tillers / plant, plant height, days to 50 % flowering (from cut date), days to maturity, no. of flowers / inflorescence, no. of seeds / inflorescence, ovule to seed ratio, no. of seeds, length of inflorescence, 1000 seed weight and seed yield (q/ha) |
| **Rapeseed** | : | Plant height, no. of primary branches at harvest, no. of secondary branches at harvest, silique / plant, seeds / silique, seed yield / plant and test weight of 100 seeds |

8. Final plant stand
9. Seed quality
10. Economics and Benefit : Cost ratio

**Experiment 10 (New Exp.): Efficacy of hydrogels (Pusa hydrogel and herbal hydrogel) on seed yield, quality and water use efficiency on wheat will be communicated separately after finalization.**

**Centre-wise experiments Taken: 2016-17**

| S. No. | Name of the center | Crop | Experiments Taken | Total experiments Taken |
|---|---|---|---|---|
| A. | SDAU, SK Nagar | Castor | Exp. 1 | 2 |
| | | Cumin | Exp. 1 | |
| B. | HAU, Hisar | Wheat | Exp. 4 | 3 |
| | | Wheat | Exp. 6 | |
| | | Mustard | Exp. 9 | |
| C. | OUAT, Bhubaneshwar | Dhaincha | Exp. 5 | 3 |
| | | Rice | Exp. 6 | |
| | | Sesame | Exp. 9 | |
| D. | IARI, New Delhi | Wheat | Exp. 1 | 7 |
| | | Wheat | Exp. 6 | |
| | | Mustard | Exp. 6 | |
| | | Onion | Exp. 9 | |
| | | Carrot | Exp. 9 | |
| | | Mustard | Exp. 9 | |
| | | Hydrogel | New Exp. | |
| E. | JNKVV, Jabalpur | Wheat | Exp. 1 | 14 |
| | | Chickpea | Exp. 2 | |
| | | Fieldpea | Exp. 2 | |
| | | Lentil | Exp. 2 | |
| | | Rice | Exp. 3 | |
| | | wheat | Exp. 4 | |
| | | Soybean | Exp. 4 | |
| | | Wheat | Exp. 6 | |
| | | Kodo Millet | Exp. 7 | |
| | | Little Millet | Exp. 7 | |
| | | Soybean | Exp. 8 | |
| | | Onion | Exp. 9 | |
| | | Sesame | Exp. 9 | |
| | | Berseem | Exp. 9 | |

| | | | | |
|---|---|---|---|---|
| F. | JAU, Jamnagar | Cumin | Exp. 1 | 4 |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| G. | DMAPR, Anand | Cumin | Exp. 1 | 1 |
| H. | AAU, Anand | Cumin | Exp. 1 | 1 |
| I. | MPKV, Rahuri | Cumin | Exp. 1 | 9 |
| | | Chickpea | Exp. 2 | |
| | | Sorghum | Exp. 3 | |
| | | Soybean | Exp. 4 | |
| | | Daincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| | | Sorghum | Exp. 6 | |
| | | Sybean | Exp. 8 | |
| J. | ARS, Ladol | Castor | Exp. 1 | 1 |
| K. | PAU, Ludhiana | Chickpea | Exp. 2 | 3 |
| | | Wheat | Exp. 4 | |
| | | Wheat | Exp. 6 | |
| L. | UAS, Raichur | Chickpea | Exp. 2 | 4 |
| | | Sunflower | Exp. 3 | |
| | | Soybean | Exp. 4 | |
| | | Soybean | Exp. 8 | |
| M. | RARI, Durgapura | Chickpea | Exp. 2 | 5 |
| | | Wheat | Exp. 4 | |
| | | Wheat | Exp. 6 | |
| | | Onion | Exp. 9 | |
| | | Mustard | Exp. 9 | |
| N. | NDUA&T, Faizabad | Lentil | Exp. 2 | 3 |
| | | Mustard | Exp. 9 | |
| | | Rice | Exp. 4 | |
| O. | TNAU, Coimbatore | Rice | Exp. 3 | 9 |
| | | Rice | Exp. 4 | |
| | | Rice | Exp. 6 | |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| | | Foxtail Millet | Exp. 7 | |
| | | Kodo Millet | Exp. 7 | |
| | | Little Millet | Exp. 7 | |

| | | | | |
|---|---|---|---|---|
| P. | UAS, Bangalore | Rice | Exp. 3 | 7 |
| | | Rice | Exp. 6 | |
| | | Sunflower | Exp. 3 | |
| | | Maize | Exp. 4 | |
| | | Finger millet | Exp. 7 | |
| | | Proso millet | Exp. 7 | |
| | | Soybean | Exp. 8 | |
| Q. | ANGRAU, Hyderabad | Rice | Exp. 3 | 16 |
| | | Rice | Exp. 4 | |
| | | Rice | Exp. 6 | |
| | | Maize | Exp. 4 | |
| | | Pigeon pea | Exp. 4 | |
| | | Soybean | Exp. 4 | |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| | | Finger millet | Exp. 7 | |
| | | Foxtail millet | Exp. 7 | |
| | | Kodo millet | Exp. 7 | |
| | | Proso millet | Exp. 7 | |
| | | Soybean | Exp. 8 | |
| | | Mustard | Exp. 9 | |
| | | Berseem | Exp. 9 | |
| R. | RARS, Pattambi | Rice | Exp. 3 | 2 |
| | | Rice | Exp. 4 | |
| S. | PDKV, Akola | Sorghum | Exp. 3 | 3 |
| | | Sorghum | Exp. 4 | |
| | | Sorghum | Exp. 6 | |
| T. | UAS, Dharwad | Cotton | Exp. 3 | 11 |
| | | Soybean | Exp. 4 | |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| | | Finger millet | Exp. 7 | |
| | | Foxtail millet | Exp. 7 | |
| | | Soybean | Exp. 8 | |
| | | Onion | Exp. 9 | |
| | | Carrot | Exp. 9 | |
| | | Sesame | Exp. 9 | |

| | | | | |
|---|---|---|---|---|
| U. | PAJANCOA, Karaikal | Rice | Exp. 4 | 4 |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| V. | IIMR, Hyderabad | Sorghum | Exp. 4 | 1 |
| W. | MAU, Parbhani | Sorghum | Exp. 4 | 4 |
| | | Wheat | Exp. 6 | |
| | | Sorghum | Exp. 6 | |
| | | Soybean | Exp. 8 | |
| X. | CSAUA&T, Kanpur | Field pea | Exp. 2 | 6 |
| | | Pigeon pea | Exp. 4 | |
| | | Wheat | Exp. 4 | |
| | | Wheat | Exp. 6 | |
| | | Mustard | Exp. 6 | |
| | | Mustard | Exp. 9 | |
| Y. | IISR, Indore | Soybean | Exp. 4 | 1 |
| Z. | HPKV, Palampur | Soybean | Exp. 4 | 4 |
| | | Finger millet | Exp. 7 | |
| | | Dahincha | Exp. 5 | |
| AA. | AAU, Jorhat | Dahincha | Exp. 5 | 4 |
| | | Pillipesara (*Vigna trilobata* ) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| | | Rapeseed | Exp. 9 | |
| BB. | RAU, Dholi | Maize | Exp. 4 | 5 |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| | | Wheat | Exp. 6 | |
| CC. | BCKV, Nadia | Rice | Exp. 4 | 4 |
| | | Dahincha | Exp. 5 | |
| | | Pillipesara (*Vigna trilobata*) | Exp. 5 | |
| | | Sunhemp | Exp. 5 | |
| DD. | GBPUA&T, Pantnagar | Wheat | Exp. 4 | 2 |
| | | Wheat | Exp. 6 | |
| EE. | ICAR-IIRR, Hyderabad | Rice | Exp. 6 | 1 |
| FF. | ICAR-IISS, Mau | Field pea | Exp. 2 | 3 |
| | | Wheat | Exp. 4 | |
| | | Hydrogel | New Exp. | |

| | | | | |
|---|---|---|---|---|
| GG. | CAZRI, Jodhpur | Mustard | Exp. 6 | 1 |
| HH. | KVV, Dapoli | Finger Millet | Exp. 7 | 2 |
| | | Rice | Exp. 6 | |
| II. | IGKV, Jagadalpur | Finger Millet | Exp. 7 | 1 |
| JJ. | SKNAU, Jobner | Mustard | Exp. 9 | 1 |
| KK. | ICAR RC NEHR - Manipur Centre | Field Pea | Exp. 2 | 7 |
| | | Lentil | Exp. 2 | |
| | | Rice | Exp. 4 | |
| | | Mize | Exp. 4 | |
| | | Soybean | Exp. 4 | |
| | | Rice | Exp. 6 | |
| | | Rape seed | Exp. 9 | |
| LL. | ICAR-IIOR, Hyderabad | Castor | Exp. 1 | 1 |
| MM. | ICAR RC NEHR - Barapani Centre | Field pea | Exp. 2 | 4 |
| | | Lentil | Exp. 2 | |
| | | Maize | Exp. 4 | |
| | | Soybean | Exp. 4 | |
| **Grand Total** | | | | **166** |

## List of experiments undertaken for 2016-17

### Experiments started from 2013-14

Experiment 1: Standardization of isolation distance for hybrid seed production of castor, wheat and cumin (Separate experiments as existed earlier on castor, wheat and cumin are clubbed in this experiment).

### Experiments started from 2014-15

Experiment 2: Seed quality, health, yield, storability as affected by pre-sowing seed priming treatments in chickpea.

### Experiments started from 2015-16

Experiment 3: Validation of UTLIEF based genetic purity as an acceptable tool to ascertain genetic purity in certified seeds.

Experiment 4: Recognition of seed film coating polymers for efficient and health friendly seed treatment operations for certified seeds of cereals and legumes.

Experiment 5: Standardization of seed production techniques in green manure crops.

Experiment 6: Development of technologies to mitigate the effect of elevated temperatures on seed set, yield and quality.

Experiment 7: Integrated approach for enhancing seed yield and quality in millets.

Experiment 8: Planting windows for quality seed production of soybean in offseason.

Experiment 9: Encrustation enabled direct seeding technology of small seeded crops.

**New Experiment(s): (Year of start: 2016-17)**

Experiment 10: Efficacy of hydrogels (Pusa hydrogel and Herbal hydrogel) on seed yield, quality and water use efficiency on wheat will be communicated separately after finalization.

**IMPORTANT NOTE: In addition, the ongoing modified experiments on summer moong and other ongoing experiments will continue for completion and submission of results and conclusions**

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# B. Seed Physiology, Storage and Testing

| | | |
|---|---|---|
| **Chairman** | : | Dr. Sajan Kurien, Director of Research, KAU, Thrissur |
| **Convener** | : | Dr. P. C. Nautiyal, Principal Scientist, ICAR-IARI, New Delhi |

Technical session started with the introduction of the Chairman by Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau. Chairman, in his opening remarks emphasized the need to work on weed seed control, dormancy versus viability and maintenance of genetic purity. Various ongoing experiments were discussed and technical programme was prepared accordingly. Ongoing experiments were reviewed thoroughly and some of the experiments were re-designed, while some new experiments were included based on the recommendation from different technical sessions.

## Recommendations

- Electromagnetic priming of 50 Hz and 100 Hz improved seed quality in aged seed lot of green gram.
- SSR Primer RM 206 & RM 276 for KRH 2 and RM 552 for RNR 2458 have been identified as specific molecular markers for varietal identification and genetic purity assessment.
- Groundnut seed as kernel can be stored upto five months with desired seed quality as per the IMSCS in 700 gauge thick polythene bags.

### Experiment 1 : Identification of seed vigour traits in field crops

**Date of Start** : 2014

## Objective

1. To understand seed vigour traits in hybrid and inbred crop plants, i.e., rice, maize, sunflower and pearl millet

| Crops | | Centres |
|---|---|---|
| **Paddy** | : | ANGRAU, Hyderabad; AAU, Jorhat; UAS, Bengaluru; ICAR-IISS, Mau; PAJANCOA, Karaikal; JNKVV, Jabalpur; ICAR- RC NEH, Tripura |
| **Maize** | : | PAU, Ludhiana; NDUAT, Faizabad; HPKVV, Palampur |
| **Pearl millet** | : | RAU, Durgapura; CCSHAU, Hisar; MPKV, Rahuri |
| **Sunflower** | : | PDKV, Akola |
| **Cotton** | : | VNMKV, Parbhani |

## Technical Programme

Plot size 5 x 5 m, however, statistical analysis may be conducted as per requirement of individual center in consultation with statistician, in general experimental design is recommended in RBD or CRBD.

## Crops: Rice and Maize

### Observations to be recorded

1. Initial seed moisture content and germination test following ISTA rules including initial and final counts.
2. Speed of germination [Mugnisjah and Nakamura (1984)].
3. SVI-I and SVI- II following ISTA rules.
4. Observations on 30 day old seedlings (Replicate each measurement atleast three times).
   (i) Chlorophyll and carotenoid contents by following standard procedure.
   (ii) Leaf area per plant.
5. Primary root length.
6. Secondary root length.
7. Shoot length.
8. Root volume (measuring cylinder method).
9. Root dry weight.
10. Shoot dry weight.
11. Root shoot ratio.
12. 1000 seed weight.
13. Grain yield (kg $ha^{-1}$) / (Plot $m^{-2}$).
14. Number of tillers (Pre-anthesis) $plant^{-1}$, followed by counting number of tillers at harvest having panicle (in rice only).
15. In pearl millet and sunflower, standard methods of seed vigour testing need to be followed by the respective centre as followed in previous year.

**Experiment 2 : Identification of variety and hybrid specific SSR makers in field crops**
**Date of Start : 2011- 2012**
**Objective :** To identify unique marker for varietal identification and maintenance of genetic purity.

| Crops | | Centres |
|---|---|---|
| Rice | : | ANGRAU, Hyderabad; UAS, Bangalore; TNAU, Coimbatore; HPKVV, Palampur; ICAR-IISS, Mau; JNKVV, Jabalpur, AAU, Jorhat, ICAR-RC NEH, Tripura |
| Maize | : | UAS, Dharwad; PAU, Ludhiana; UAS, Raichur |
| Pearl millet | : | RAU, Durgapura |
| Soybean | : | UAS, Raichur; MPKV, Rahuri; VNMKV, Parbhani |

**Methodology:** Crop varieties which are present in seed chain and available at the respective Centers may be studied for DNA fingerprinting and electrophoresis/PCR analysis for identification of polymorphic markers unique for hybrid/ cultivar/ variety/ parental lines using SSR microsatellite marker.

**Note:** *For hybrid seeds please use complete set of plants such as A, B and R lines, data with missing lines have no meaning.*

| | | |
|---|---|---|
| **Experiment 3** | **:** | **To prolong groundnut seed (off-shell, kernel) longevity by storing in polyethylene bags (700 gauge)** |
| **Objective** | **:** | A. To store and transport groundnut seeds (off-shell) in the form of kernel.<br>B. To know the storage potential of groundnut kernel. |
| **Date of start** | **:** | 2014 |
| **Centres** | **:** | ANGRAU, Hyderabad; OUA&T Bhubaneswar; TNAU, Coimbatore; PDKV, Akola; MPKV, Rahuri; UAS, Raichur; RARI, Durgapura (Jaipur); KKV, Dapoli; ICAR-RC NEH, Manipur. |

## Methodology

1. Select at least two local varieties one having seed dormancy and other do not such as TAG 24 (non-dormant) and ICGS 44 (dormant) both Spanish, Virginia type may also be included in place of dormant ICGS 44).
2. After harvest dry the pods with vine under shade in open floor or under tree in the field for 5-6 days. Followed by drying of pods in thin layer in threshing floor for 2-3 days to bring the moisture content to safe level for storage i.e. around 7-8%.
3. Divide the total produce in two sets, store the first set in-shell (pods) as followed by the local farmers, in polyethylene bags replicated three times with 10 kg pods each. The bag should be air tight and may be stored at safe storage conditions. Store another set of pods off-shell (kernel) in polyethylene bags of 10 kg capacity, store under similar storage conditions in replicated trials as mentioned above.
4. Record pod and kernel moisture percentage immediately before storage.
5. Record the temperature ($^{o}$C) and RH (%) of storage environment from starting until end of the experiment.
6. Arrange the storage bags in such a way that you open at least 3 bags independently with pods and kernels at each storage period i.e. 3 months, 6 months, 9 months and 12 months.
7. Record initial and final germination percentage at each observation period by following ISTA rule and calculate the SVI I and SVI II.
8. Measure the electrical conductivity of seed leachate following standard procedure.

9. Tabulate the replicated data in EXCEL file and analysis shall be done with the help of suitable statistical programme, calculate the CD, SEM and CV%. The EXCEL file should be communicated to the PI at the time of reporting while results need to be presented in tabulated form with average values in word file (follow these guideline in case of each experiment).
10. Observations need to be continued until germination goes below 50%.

**Replication:** Three or more as per statistical requirement.

### Treatment

1. Control: Pod as such (in-shell)-Farmers conventional method ($T_1$)
2. Treatment: Kernel (off-shell)-Unconventional method ($T_2$)

***Note: Please do not club any other treatment with this experiment***

### Observations to be recorded

1. Note down the details about seed harvest and drying procedures as mentioned above.
2. Initial seed germination and moisture content before storage as well as during storage i.e. at the time of observation.
3. Seed germination test during storage (initial germination, final germination counts, SVI I and SVI II).
4. Root, shoot, epicotyls and hypocotyls lengths in 9 days old seedling incubation at 28±2°C or follow ISTA rules.
5. Seedling vigour test following ISTA rules or take all vigour measurements after 9 days of incubation.
6. Field emergence at the time of normal sowing after 3 or 6 or 9 or 12 months after storage.
7. At this stage seedling vigour in 30-days-old seedling may be determined by measuring leaf area plant$^{-1}$, chlorophyll content, root components and root and shoot dry weights by sampling at least 6-7 plants (0.30 m$^{-2}$ land area).

## New Experiments

| | | |
|---|---|---|
| **Experiment 4** | **:** | **Storage of soybean and groundnut seeds with desiccant i.e. silica gel and/or calcium chloride ($CaCl_2$, Anhydrous)** |
| **Objective** | **:** | To maintain storability in groundnut and soybean seeds employing desiccants in high humidity regions. |
| **Date of start** | **:** | 2016 |
| **Centres** | **:** | ICAR-RC NEH, Tripura and Manipur – Soybean and Groundnut<br>GBPUAT, Pantnagar - Soybean |

*(Note: Detailed technical programme will be worked out in consultation with concern scientist)*

## Background information

The RH of the storage environment may be reduced with the help of dehumidifiers or use of desiccants like silica gel or calcium chloride (anhydrous or fused). For example the produce may be stored in sealed polyethylene bags with desiccant ($CaCl_2$, anhydrous). It is reported that pod dried under shaded conditions and stored with the desiccants helped it to maintain seed viability in the regions like Bhubaneswar, where ambient RH in the months between June and September remains around 90%. Attempts were also made at the BCKV, West Bengal to develop practicable storage technique to prolong viability of groundnut seed by following the NRCG (now DGR) and DOR technology (pod drying in shade), highest seed viability was recorded in seed stored in polyethylene lined gunny bag containing $CaCl_2$ and confirmed the utility of the DGR storage method in the eastern part of the country, where loss of seed viability in the seed harvested in *Rabi* or summer season is a serious problem. Such experiments were also conducted in Tamil Nadu and viability could be retained for a prolonged period following the storage and drying techniques developed at the DGR.

## Methodology

### Drying Methods

### For Groundnut

1. Conventional farmer's method as followed in the NEH region ($D_1$).
2. **Shade drying**: Plants after harvest tied in bundles of 0.5 m diameter and kept in open shaded floor in an inverted position i.e. pods upside and shoot part downward ($D_2$).

### For Soybean

1. Conventional method of drying may be followed.

### Storage treatments

1. With desiccant in polyethylene bags (700 gauge thick) ($S_1$).
2. Without desiccant in polyethylene bags (700 gauge thick) ($S_2$).

### Combination of treatments (*For Groundnut only*)

1. $D_1S_1$ ($T_1$)
2. $D_1S_2$ ($T_2$)
3. $D_2S_1$ ($T_3$)
4. $D_2S_2$ ($T_4$)

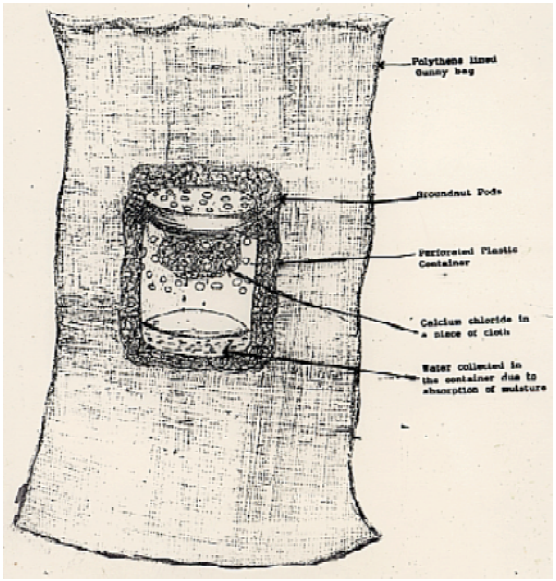


***Figure 1:*** *DGR storage method. Groundnuts after through drying are stored with $CaCl_2$ in a polyethylene lined gunny bag in a perforated plastic container as shown in the figure (*sectional view*).*

## Steps to be followed for groundnut seed storage with desiccant

1. After five days of drying in shade, strip the pods and dry them in thin layer for two days to bring them to a moisture level between 6.5-7.5%.
2. The pods after drying need to be stored with conventional storage method, and using desiccant (silica/$CaCl_2$, Anhydrous).
3. In conventional method pods need to be stored without using desiccant and following the farmer's method.
4. While another set of pods may be stored in polyethylene bag with desiccant $CaCl_2$ (laboratory grade or commercial grade if available).
5. In this method 250 g $CaCl_2$ (anhydrous) may be used to store 30 kg of pods in polyethylene bag as shown in figure 1 and illustrated below:
6. Take a plastic container of 1/2 kg capacity and make perforation in upper half only and top of the lid with the help of hot iron pointed rod.
7. Take a muscline cloth and put the 250 g $CaCl_2$ over it, while handling don't touch the $CaCl_2$ with bare hands.
8. Now spread the muscline cloth over the mouth of the plastic container after removing the lid in such a way that it gets into the mouth of the pot along with $CaCl_2$ and spread the margins of muscline cloth over the rim of the container, so that it hangs properly inside the container as shown in figure.

9. Tie the lid with making sure that some of the portion of the cloth still remains outside of the rim.
10. Take the plastic bag of 30 kg capacity or adjust the amount of $CaCl_2$ based on size of bag available with you, it needs at least 10 kg of pods stored with or without desiccant.
11. Fill the bag half with groundnut seed (pods) and keep the plastic container with $CaCl_2$ in the middle portion of the bag in vertical position (lid portion up side).
12. Fill the bag with groundnut seed and make it air tight or seal it.
13. Store in triplicate for recording the observation at 3, 6, 9 and 12 months after storage.
14. Keep the storage bags up-right (see figure 1) so that $CaCl_2$ inside box after absorbing moisture do not get mixed with seed.

**Note**

*(i) In case of soybean follow same procedure for storage with $CaCl_2$ and drying treatment remains as conventional drying only.*

*(ii) If you use silica gel, keep 300 g of silica gel for 30 kg seed in muslin cloth for both groundnut and soybean at the centre of storage bag, the total treatments will change accordingly.*

## Observations to be recorded

1. Note down the details about seed harvest and drying procedures as followed.
2. Initial seed germination percentage and moisture content before storage as well as during storage i.e. 0, 3, 6, 9, and 12 months.
3. Seed germination test during storage following ISTA rules.
4. Root, shoot, epicotyls and hypocotyls lengths in 9 days old seedlings (incubation at 28±2°C) in case of groundnut.
5. In case of soybean, follow ISTA rules exclusively.
6. Seedling vigour test following ISTA rules or record all vigour parameters 9 days after incubation in case of groundnut.
7. Field emergence at the time of normal season sowing after 3 or 6 or 9 or 12 months after storage in case of both groundnut and soybean.
8. After recording field emergence, record seedling vigour in 30 days-old seedling may be determined by measuring leaf area $plant^{-1}$, chlorophyll content, root components and root and shoot dry weights by sampling at least 6-7 plants (0.30 $m^{-2}$ land area) in both groundnut and soybean.

9. During storage and before storage of seed measure lipid peroxidation in groundnut and soybean seeds by the method of Heath and Packer (1968).

10. Similarly, analyze the seeds of both the species for enzymatic antioxidants such as SOD activity following Beyer and Fridovich (1987), APX activity (Nakano and Asada, 1981) and catalase (Aebi, 1884).

11. Similarly, analyze non-enzymatic antioxidants such as Ascorbate content following methodology suggested by Law *et al.* (1983).

**Example:** For analysis of enzyme expression, 50 seeds shall be used for each replication and from these, the duplicates for the gels were withdrawn. For such analysis, the seeds were treated with Carbendazim + Thiram and then ground by adding liquid nitrogen and poly vinyl pyrrolidone (PVP) antioxidant, and were then stored at -86 ºC. Before extraction, the samples were washed for oil removal. For that purpose, 600 µL of a solution with 50 % diethyl ether + 50 % water was used, with homogenization and a 30 minute rest in ice, later centrifuging at 14,000 rpm for 30 min at 4 ºC, discarding the supernatant. After extraction and discontinuous electrophoresis, the gels were revealed for the enzymes isocitrate lyase (ICL; EC 4.1.3.1), according to Martins et al. (2000) with modifications, esterase (EST; EC 3.1.1.1), malate dehydrogenase (MDH; EC 1.1.1.37), alcohol dehydrogenase (ADH; EC 1.1.1.1), superoxide dismutase (SOD; EC 1.15.1.1) and peroxidase (PRX; EC 1.11.1.7), according to Alfenas *et al.* (2006).

| | | |
|---|---|---|
| **Experiment 5** | **:** | **Storage of groundnut seed in modified environment with $CO_2$ gas** |
| **Objective** | **:** | To maintain storability in groundnut seeds with the help of modified environment. |
| **Date of start** | **:** | 2016 |
| **Centre** | **:** | TNAU, Coimbatore |

## Methodology

1. Select a groundnut variety which is very much prone to loss of viability during storage or preferably from Spanish type but should not be the old one as (TMV 2).

2. Follow the conventional drying methods and note down the harvest and before storage seed moisture content.

3. Store the seed in-shell (pods) and off-shell (kernel) as $T_1$ and $T_2$, at least 10 kg pods or kernel need to be stored with $CO_2$ gas in the air tight container [$CO_2$ concentration might have already worked out (20 % v/v) otherwise see the literature for safe storage. To my knowledge in previous experiment conducted to control insects seed germination might have affected with higher concentration of $CO_2$. Thus work out the right concentration of $CO_2$ from literature.

4. Maintain a control set for $T_1$ and $T_2$ separately by using conventional storage method.

## Observations to be recorded

1. Note down the details about seed harvest and drying procedures as followed use one groundnut variety cultivated locally.
2. Record moisture content before storage as well as during storage i.e. 0, 3, 6, 9, and 12 months. Mention ambient storage conditions (Temperature and RH).
3. Record initial seed germination percentage by following ISTA rules.
4. Root, shoot, epicotyls and hypocotyls lengths in 9 days old seedlings (incubation at 28±2°C) or follow ISTA rule.
5. Seedling vigour test following ISTA rules or record all vigour parameters 9 days after incubation but follow a uniform procedure.
6. Field emergence at the time of normal season sowing after 3 or 6 or 9 or 12 months storage.
7. After recording field emergence record seedling vigour in 30-days-old seedling by measuring leaf area plant$^{-1}$, chlorophyll content, root components and root and shoot dry weights by sampling at least 6-7 plants (0.30 m$^{-2}$ land area).

| | | |
|---|---|---|
| **Experiment 6** | **:** | **Basic studies for developing priming technology in crop plants** |
| **Objective** | **:** | To improve crop establishment under sub-optimal conditions in different field crops. |
| **Crop** | **:** | Pigeon pea, Chickpea, Rice |
| **Centre** | **:** | **Pigeon pea:** IARI, New Delhi<br>**Chickpea:** ICAR-IISS, Mau; UAS, Bengaluru; GBPUAT, Pantnagar<br>**Rice:** AAU, Jorhat and, ICAR- RC NEH, Manipur |
| **Date of start** | **:** | 2016 |

**Note:** Since, this is basic study, each Centre need to work out details of the methodology or technical programme on their own, however this may be submitted to the PI for information with copy to Director, IISS, Mau as soon as it is finished

## Technical programme at IARI, New Delhi

### Year I (2016-17)

1. Standardization of optimum duration and amount of water for priming at 25 $^0$C temperature (Germination and vigour testing after priming at ISTA recommended conditions)
2. Standardization of the optimum temperature and duration of priming/hardening - (Germination and vigour testing after priming at ISTA recommended conditions (control) and different temperature conditions)

**Year II (2017-18)**

3. Standardization of priming under moisture stress/excess conditions (PEG) (Germination and vigour testing after priming at ISTA recommended conditions (control) and different moisture stress/excess conditions)

4. Standardization of priming under salinity conditions (Germination and vigour testing after priming at ISTA recommended conditions (control) and different salinity conditions)

**Year III (2018-19)**

5. Standardization of nutri-priming/halopriming with salts containing Zn, Mo, Mn, B *etc.*; (Germination and vigour testing after priming at ISTA recommended conditions).

**Year IV (2019-20)**

6. Field evaluation of all the above standardized priming protocols at different centers.

7. Recommendation of "the priming technology" for improvement of crop establishment under sub-optimal conditions in pigeonpea.

### Experiment 7: Use of nanotechnology for enhancing seed quality

**Centres:** TNAU, Coimbatore; UAS, Bengaluru; UAS, Dharwad & AAU, Anand (Dr. Kalyanrao Patil will execute the experiment at AAU, Anand)

**Date of start :** 2016

**Note:** Detailed technical programme will be worked out by the respective Centre. Details need to be worked out with regard to seed vigour enhancement by nano-technology. Details regarding speed of germination, initial germination and final germination, total biomass and yield need to be recorded. Parameters of seedling vigour may be recorded in 30-day-old-seedling.

### Demonstration of technology: On farm demonstration of seed priming technology

**Year of Start :** 2008-09

**Objective :** To demonstrate seed priming technology in the farmers field for easy adoption.

| Crop | | Centre |
|---|---|---|
| **Wheat** | : | NDUA &T, Faizabad; RAU, Dholi; PAU, Ludhiana; GBPUA &T, Pantnagar; HPKVV, Palampur; CCS HAU, Hisar; CSAU&T, Kanpur |
| **Pearl millet** | : | RAU, Durgapura; CCS HAU, Hisar |
| **Sorghum** | : | ANGRAU, Hyderabad; UAS, Dharwad; MPKV, Rahuri, ICAR-RC NEH, Manipur; VNMKV, Parbhani |
| **Chickpea** | : | JNKVV, Jabalpur |

**Note**:

*(i) Since there is no standard method for priming in pulses, ICAR-IARI, Division of Seed Science and Technology may develop protocol for seed priming in pigeonpea which will be followed by other pulse crops.*

*(ii) Each Centre is requested to report the yield data of previous year and other related data of current year in the next report (2016-17).*

## Methodology

1. Seed priming in wheat will be followed by shocking for 12 hours and drying under shade.
2. In case of millets priming could be performed by soaking in 2.5% $KNO_3$ solution for 6 hours followed by shade drying.
3. The priming treatments may be tested under rain dependent agriculture system at different locations.

**Plot size:** 1/2 acre (or may be modified as per need, but not less than 10x10m.)

**Replication:** 3

## Observations to be recorded

1. Seed moisture at the time of sowing along with field moisture content.
2. A control set may also be maintained which may receive irrigation based on the farmers practice (unprimed seed only).
3. Record weather data of the location, especially temperature and rainfall during crop growth period.
4. Field emergence and days to 50% flowering, flower initiation etc.
5. Final crop stand, biomass and grain yield with HI.
6. In crops where number of tillers is major component of yield it should be measured, along with number of panicle and grain per panicle.
7. 100- or 1000-seed weight (Test weight).
8. Additional information on seedling vigour (root and shoot growth) may be collected, for example, leaf area index during pre-anthesis, chlorophyll content etc.

# List of Participants

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# C. Seed Pathology

| | | |
|---|---|---|
| **Chairman** | : | **Dr. Karuna Vishunavat,** GBPUA&T, Pantnagar |
| **Convener** | : | **Dr. M. S. Bhale,** JNKVV, Jabalpur |

## Significant observations

- Chilli seed associated three anthracnose fungi can be detected by Polymer Chain Reaction based technique using the specific primers with known sequence, developed by earlier workers. The fungi and primers are *Colletotrichum truncatum* (Ccap F; Ccap R.); *Colletotrichum gloeosporioides* (Cboncoll F; Cboncoll R.); *Colletotrichum coccodes* (Cco 1NF1; Cco2NR1).
- Seed Wash Examination technique is identified as a relatively quick method for the detection of surface adhered spores of *Alternaria burnsii*, the causal agent of devastating blight of cumin.
- Continued critical monitoring on the new emerging plant diseases of seed borne nature in the different region, indicated the incidence of Septoria blotch of wheat (*Septoria nodorum*) at Khudwanir, Anantnag, Srinagar, Shalimar, Sopore, and Baramula, Jammu & Kashmir.
- As per the Indian Seed Act, Rice bunt caused by *Tilletia barclayana* is the designated objectionable seed borne pathogen in rice seed production programme with certification standards 0.10 & 0.50 % in Foundation & Certified, respectively. For the first time TNAU Centre has conclusively reported the prevalence of this pathogen in Co 50 variety to the extent of 0.20% in farmers saved seed collected from Thanjavur district under South Indian agro-climatic conditions
- Effective management of seed rot, seedling blight, die-back and fruit rot of chilli caused by *Colletotrichum capsici* may be achieved through seed dressing with *Trichoderma harzianum* @ 10 g or *Trichoderma viride* @ 5 g + *Pseudomonas fluorescens* @ 5 g /kg seed. Use of biopesticides also results in higher seed germination and vigour.
- Effective prevention of the transmission of pathogens from plant to seed and management of pod blight complex disease of soybean may be achieved through two applications of Carbendazim + Mancozeb (0.30%) first at pod formation (R3) and second at preharvest stage (R5). It resulted in 62.3% disease control over check under conditions of Maharashtra and Madhya Pradesh.
- Effective management of seed rot, seedling blight of chilli caused by *Alternaria solani* may be achieved through seed dressing with *Trichoderma harzianum* @ 10 g or *Trichoderma viride* @ 5 g + *Pseudomonas fluorescens* @ 5 g / kg seed. Use of biopesticides also results in higher seed germination and vigour.

## Experiments - 2016-17

| Experiment | | Title |
|---|---|---|
| Experiment 1A | : | Monitoring and detection of rice bunt, false smut and bacterial leaf blight in processed, unprocessed and farmers seed sample |
| Experiment 02 | : | Monitoring of emerging new diseases of seed borne nature |
| Experiment 03 | : | Studies on seed health status of farmers own saved seeds |
| Experiment 3A | : | Studies on seed health status of farmers own saved seeds (Wheat) |
| Experiment 3B | : | Studies on seed health status of farmers own saved seeds (Soybean) |
| Experiment 3C | : | Studies on seed health status of farmers own saved seeds (Rice) |
| Experiment 3D | : | Studies on seed health status of farmers own saved seeds (Groundnut) |
| Experiment 3E | : | Studies on seed health status of farmers own saved seeds (Chickpea) |
| Experiment 04. | : | Standardization of detection methods for seedborne pathogens of significance |
| Experiment 05 | : | Correlation of various levels of seed infection by important seedborne fungi on seed germination and disease incidence in crops |
| Experiment 06 | : | Management of seedborne infection of *Colletotrichum capsici*, in chilli, *Alternaria solani* in tomato by way of biological agents obtained from locations |
| Experiment 07 | : | Management of seed associated *Fusarium oxysporum* f.sp. *ciceri* and *Macrophomina phaseolina* in chick pea through seed bio priming and soil application of *Trichoderma harzianum* strains obtained from different locations |
| Experiment 08 | : | Management of pod disease of soybean through fungicide application |
| Experiment 09 | : | Management of cumin blight through fungicide application |
| Experiment 10 | : | Establishment of seed certification standard for chilli anthracnose |
| Experiment 11 | : | Non chemical management of seedborne infection of bean anthracnose |
| Experiment 12 | : | Detection and molecular characterization of BCMV of mungbean |
| Experiment 13 | : | Monitoring of seedborne viruses in soybean and pulses and standardization of methods for detection through serological and molecular techniques |
| Experiment 14 | : | Standardization of biopriming technique for management of Fusarium wilt of safflower |
| Experiment 15 | : | Standardization of biopriming technique for management of *Alternaria helianthi* associated with sunflower seeds |
| Experiment 16 | : | Management of *Alternaria solani* through seed treatment and foliar application of new fungicides |
| Experiment 17 | : | Impact of different storage conditions and longevity on seed associated mycoflora of green gram / black gram |
| Experiment 18 | : | Detection, location and transmission of seed borne *Macrophomina phaseolina* in sesame |
| Experiment 19 | : | Management of purple blotch / stemphylium blight of onion through fungicide and plant based products |
| Experiment 20 | : | Effect of biologically synthesized metal oxide nano-particles on mycoflora associated with green gram seeds and impact on seed quality parameters |
| Experiment 21 | : | Detection, location and transmission of seed borne *Alternaria sesami* in sesame |

| | | |
|---|---|---|
| **Experiment 1A** | : | **Monitoring and detection of rice bunt, false smut and bacterial leaf blight in processed, unprocessed and farmers seed sample** |
| **Objective** | : | (i) To determine the status of pathogen in seed sample from farmer and processing plant<br>(ii) To prepare the distribution map in different locations |
| **Year of start** | : | 2002 (Conclude up to 2012-13) |
| **Status** | : | Continued 2016-17 |

## 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.
- Observations at growth stage 9 for rice bunt and false smut pathogen.
- Standard rating scale 0-9 to be followed for false smut infected rice florets
- Minimum number of fields to be visited is 50 per location and plants to be observed are 100 for false smut and bacterial blight.
- For BLB rating scale is 0-9. Record the disease in farmer's field and seed production plots.
- Meteorological data should be incorporated for correlation studies.

**Centre:** AAU, Anand; AAU, Jorhat; NDUA&T Faizabad; GBPUA&T, Pantnagar; OUA&T, Bhubaneswar; ANGRAU, Hyderabad; PAU, Ludhiana; CCSHAU, Hissar; HPKVV, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV, Rahuri; MAU, Parbhani; SKUA&T, Srinagar; PAJANCOA, Karaikal; ICAR-IARI, New Delhi and RAU, Pusa

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

| | | |
|---|---|---|
| **Experiment 2** | : | **Monitoring of emerging new diseases of seed borne nature** |
| **Objective** | : | To record the prevalence of new diseases and seed associated plant pathogens |
| **Year of start** | : | 2013-14 |
| **Status** | : | Continued 2016-17 |
| **Centre** | : | AAU, Anand; AAU, Jorhat; NDUA&T, Faizabad; GBPUA&T, Pantnagar; OUA&T, Bhubaneswar; ANGRAU, Hyderabad; PAU, Ludhiana; CCSHAU, Hissar; HPKVV, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV Rahuri; MAU, Parbhani; SKUA&T, Srinagar; PAJANCOA, Karaikal; ICAR-IARI, New Delhi; RAU, Pusa |

**Note:**

- *The incidence of unreported new pathogens and diseases of seed borne nature should be observed.*

- Information on symptoms, causal organism and factors affecting development of the particular diseases (all about epidemiology) is to be supplemented with photographs.

| | | |
|---|---|---|
| **Experiment 3** | **:** | **Studies on seed health status of farmers own saved seeds** |
| **Objective** | **:** | To determine the health status of seed samples from the farmers own saved seeds |
| **Year of start** | **:** | 2000 |
| **Status** | **:** | Continued 2016-17 |
| **Crops** | **:** | Wheat, Rice, Soybean, Groundnut, Chickpea |

**Attention Note**

- For each crop, respective centre will compile and prepare the disease distribution map of the state based upon the last 5 years data.
- 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.

| | | |
|---|---|---|
| **Experiment 3A** | **:** | **Studies on seed health status of farmers own saved seeds** |
| **Year of start** | **:** | 2000 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Wheat |
| **Centre** | **:** | PAU, Ludhiana; CCSHAU, Hissar; GBPUA&T, Pantnagar; HPKVV, Palampur; SKNAU, Durgapura; ICAR-IARI, New Delhi; RAU, Pusa; AAU, Anand |

## 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 rice varieties. Report the range.
- 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:*** Prepare a map depicting the selected locations; Provide the photographs showing the associated mycoflora; Impact on seed morphology**.**

| | | |
|---|---|---|
| **Experiment 3B** | **:** | **Studies on seed health status of farmers own saved seeds** |
| **Year of start** | **:** | 2000 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Soybean |
| **Centre** | **:** | SKRAU, Durgapura; JNKVV, Jabalpur; MPKV, Rahuri; MAU, Parbhani; ANGRAU, Hyderabad |

## Methodology

- Seed health be determined by employing Standard blotter method (ISTA, 1996) and visual inspection of seeds
- *Minimum seed sample size is 100 from all the sources, covering the popularly grown varieties. Report the range. Target pathogen may include* Macrophomina phaseolina, Fusarium oxysporum, Colletotrichum dematium *(*C. truncatum*),* Cercospora kikuchii, Fusarium *spp.,* Aspergillus *spp.,* Diaporthe *spp., and SMV induced symptoms.*
- Impact on germination, normal and abnormal seedling and seed rot be reported.
- Correlation with association of pathogen with seed germination, normal, abnormal seedling be specified, separately

***Note:*** *Prepare a map depicting the selected locations; Provide the photographs showing the associated mycoflora; Impact on seed morphology. Provide the information that farmers used their own saved seeds or of any company seeds.*

| | | |
|---|---|---|
| **Experiment 3C** | **:** | **Studies on seed health status of farmers own saved seeds** |
| **Year of start** | **:** | 2000 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Rice |
| **Centre** | **:** | OUA&T, Bhubaneswar; AAU, Jorhat; SKUA&T, Srinagar; TNAU, Coimbatore; HPKV, Palampur; NDUA&T, Faizabad; PAJANCOA, Karaikal; MPKV, Rahuri; ICAR-IARI, New Delhi; RAU, Pusa and PAU Ludhiana |

## 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.
- Mycoflora responsible for seed discoloration be reported.
- Impact on germination, normal and abnormal seedling and seed rot be reported.
- Correlation with association of pathogen with seed germination, normal, abnormal seedling be specified, separately.

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

| | | |
|---|---|---|
| **Experiment 3D** | **:** | **Studies on seed health status of farmers own saved seeds** |
| **Year of start** | **:** | 2000 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Groundnut |
| **Centre** | **:** | AAU, Anand; MPKV, Rahuri; SKNAU, Durgapura and JNKVV, Jabalpur |

## Methodology

- Seed health be determined by employing standard blotter method (ISTA, 1996) and visual inspection of seeds. Minimum seed sample size is 100 from all the sources, covering the popularly grown varieties. Report the range.
- Target pathogen may include *Aspergillus* spp.
- Impact on germination, normal and abnormal seedling and seed rot be reported.
- Correlation with association of pathogen with seed germination, normal, abnormal seedling be specified, separately.

**Note:** *Prepare a map depicting the selected locations; Provide the photographs showing the associated mycoflora; Impact on seed morphology*

| | | |
|---|---|---|
| **Experiment 3E** | **:** | **Studies on seed health status of farmers own saved seeds** |
| **Year of start** | **:** | 2000 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Chickpea |
| **Centre** | **:** | MPKV, Rahuri; SKNAU, Durgapura and ANGRAU, Hyderabad |

## Methodology

- Seed health be determined by employing standard blotter method (ISTA, 1996) and visual inspection of seeds
- Minimum seed sample size is 100 from all the sources, covering the popularly grown varieties. Report the range.
- Target pathogen may include *Botrytis* spp., *Macrophomina phaseolina*, *Fusarium* spp., *Aspergillus* spp., *Ascochyta rabiei.*
- Impact on germination, normal and abnormal seedling and seed rot be reported.
- Correlation with association of pathogen with seed germination, normal, abnormal seedling be specified, separately

**Note:** *Prepare a map depicting the selected locations; Provide the photographs showing the associated mycoflora; Impact on seed morphology.*

| | | |
|---|---|---|
| **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** | **:** | Continued 2016-17 |
| **Centre** | **:** | AAU, Anand; AAU, Jorhat; NDUA&T, Faizabad; GBPUA&T, Pantnagar; OUA&T, Bhubaneswar; ANGRAU, Hyderabad; PAU, Ludhiana; CCSHAU, Hissar; HPKVV, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV, Rahuri; MAU, Parbhani; SKUA&T, Srinagar; ICAR-IARI, New Delhi and RAU, Pusa |

**Note**

- *Provide the photographs showing the associated mycoflora.*
- *Impact on seed morphology.*
- *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.*
- *Focus on serological and nucleic acid based techniques*

| | | |
|---|---|---|
| **Experiment 5** | **:** | **Correlation of various levels of seed infection by important seed borne fungi on seed germination in crops** |
| **Objective** | **:** | To determine the influence of disease / pathogen association on seed germination |
| **Year of start** | **:** | 2013-14 |
| **Status** | **:** | Continued 2016-17 |
| **Crops** | **:** | All major crops |
| **Centre** | **:** | AAU, Anand; AAU, Jorhat; NDUA&T, Faizabad; GBPUA&T, Pantnagar; OUA&T, Bhubaneswar; ANGRAU, Hyderabad; PAU Ludhiana; CCSHAU, Hissar; HPKVV, Palampur; TNAU, Coimbatore; JNKVV, Jabalpur; MPKV, Rahuri; MAU, Parbhani; SKUA&T, Srinagar; PAJANCOA, Karaikal |

**Note**: *Follow the datasheet and data recording procedures as suggested by Dr. Karuna Vishunavat, GBPUAT, Pantnagar. The detailed methodology shall be provided by her on request.*

| | | |
|---|---|---|
| **Experiment 6** | **:** | **Management of seed borne infection of *Colletotrichum capsici* in chilli, *Alternaria solani* in tomato by way of biological agents obtained from different locations.** |
| **Objective** | **:** | To work out the safe treatment for the management of vegetable diseases of seed borne nature. |
| **Year of start** | **:** | 2012 (modified in 2013) |
| **Status** | **:** | Continued 2016-17 |
| **Methodology** | **:** | Seed treatment with biological agents |

**Treatments**

$T_1$: *Trichoderma viride* @ 10 g / kg of seed

$T_2$: *Trichoderma harzianum* @ 10 g / kg of seed

$T_3$: *Pseudomonas fluorescens* @ 10 g / kg of seed

$T_4$: *Trichoderma viride* @ 10 g + *Pseudomonas fluorescens* @ 10 g / kg of seed

$T_5$: *Trichoderma harzianum* @ 10g + *Pseudomonas fluorescens* @ 10g / kg of seed

$T_6$: Untreated seed (Control)

**Observation**: seed germination, counting of normal and abnormal seedling, seed rot, seed emergence, vigour index, speed of germination, association of mycoflora by standard blotter method and percent disease control over check

**Crop & pathogen :** Chilli (*Colletotrichum capsici*) and Tomato (*Alternaria solani*)

**Centre :** GBPUA&T, Pantnagar; HPKV, Palampur; SKUA&T, Srinagar

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

| | | |
|---|---|---|
| **Experiment 7** | **:** | **Management of seed associated *Fusarium oxysporum* and *Macrophomina phaseolina* in chick pea through seed bio priming and soil application of *Trichoderma harzianum* strains obtained from different locations.** |
| **Objective** | **:** | To determine the efficacy of biological agents and influence of priming on the seeds associated *Fusarium oxysporum* and *Macrophomina phaseolina* |
| **Year of start** | **:** | 2011-12 |
| **Status** | **:** | Continued 2016-17 |
| **Methodology** | **:** | Seed priming with *Trichoderma harzianum* strains |
| **Source of bioagent** | **:** | AAU, Anand; PAU, Ludhiana and GBPUA&T, Pantnagar |
| **Centre** | **:** | PAU, Ludhiana; HPKV, Palampur; ANGRAU, Hyderabad; MPKV, Rahuri; AAU, Anand |

**Mandatory**

- Source and status of initial seed sample be clarified with relation to inoculum load, soil type and meteorological data is to be provided for conclusive interpretation of results.
- Step wise step methodology for effective treatments should be given with results.
- Statement regarding existing efficacy of chemical treatment be provided.

**Note:**

- *Coordination for data sheet and detailed protocol shall be supplied by Dr. R.N. Pandey AAU, Anand.*
- *Bio-agents should be supplied before 7 September, 2016 by AAU, Anand, PAU, Ludhiana and GBPUA&T, Pantnagar to the cooperating centers*
- *Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

| | | |
|---|---|---|
| **Experiment 8** | **:** | **Management of pod disease of soybean through fungicide application** |
| **Objective** | **:** | To investigate the associated mycoflora affecting soybean pods<br>To determine the influence of fungicide application on pod blight in soybean |
| **Year of start** | **:** | 2014-15 |
| **Status** | **:** | Continued 2016-17 |
| **Crop/diseases** | **:** | Soybean pod blight complex |
| **Methodology** | **:** | Foliar application of fungicides @ two stages (first at pod formation and second at Pre-harvest plant growth stage); Fungicide: 7+1, Replication: 3, Plot size: 5 X 1 m; Design RBD; Basic seed treatment with Thiram + Carbendazim each @ 0.15% prior to sowing |

**Treatment**

$T_1$: Carbendazim @0.1%

$T_2$: Mancozeb@0.25%

$T_3$: Tebuconazole @0.1%

$T_4$: Hexaconazole @0.1%

$T_5$: Propiconazole @0.1%

$T_6$: Azoxystrobin@0.05%

$T_7$: Carbendazim + Mancozeb @0.25%

$T_8$: Control (Check) – No fungicide application

**Centre:** MPKV, Rahuri; JNKVV, Jabalpur and MAU, Parbhani

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

| | | |
|---|---|---|
| **Experiment 9** | **:** | **Management of cumin blight through fungicide application** |
| **Objective** | **:** | To investigate the associated mycoflora affecting cumin seed quality<br>To determine the influence of fungicide application |
| **Year of start** | **:** | 2014-15 |
| **Status** | **:** | Continued 2016-17 |
| **Crop/diseases** | **:** | Cumin – Alternaria blight (*Alternaria burnsii*) |
| **Methodology** | **:** | (I) Seed treatment with Thiram (0.3%); (II)Subsequent three applications of fungicides after initiation of disease incidence at 10day interval |

**Treatments**

$T_1$: Carbendazim @ 0.10%

$T_2$: Mancozeb@ 0.20%

$T_3$: Propiconazole @0.10%

$T_4$: Azoxystrobin@0.25%

$T_5$: Propineb @0.15%

$T_6$: Hexaconazole @0.05%

$T_7$: Carbendazim + Mancozeb @0.25%

$T_8$: Control (Check) – No fungicide application

**Observations :** Seed yield, disease control, pre- post association of Alternaria *burnsii* in seeds

**Centre :** AAU, Anand and SKNAU, Durgapura

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

| | | |
|---|---|---|
| **Experiment 10** | **:** | **Establishment of seed certification standard for chilli anthracnose** |
| **Objective** | **:** | To fix the seed certification limits |
| **Year of start** | **:** | 2015 -16 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Chilli |
| **Pathogen** | **:** | *Colletotrichum truncatum* |
| **Centre** | **:** | HPKV, Palampur; PAU, Ludhiana and MAU, Parbhani |

**Note:** *The detailed methodology and datasheet will be provided by DR. P.N. Sharma, HPKV, Palampur.*

| | | |
|---|---|---|
| **Experiment 11** | **:** | **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** | **:** | Continued 2016-17 |
| **Crop** | **:** | Bean (*Phaseolus* spp.) |
| **Pathogen** | **:** | *Colletotrichum* spp. |
| **Centre** | **:** | HPKV, Palampur and SKUAS&T, Srinagar |

**Note:** *The detailed methodology and datasheet will be provided by DR PN Sharma, HPKV, Palampur; Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

| | | |
|---|---|---|
| **Experiment 12** | **:** | **Detection and molecular characterization of BCMV of mungbean** |
| **Objective** | **:** | To determine the location of virus pathogen in parts of seed<br>To characterize the pathogen using molecular techniques |
| **Year of start** | **:** | 2015 -16 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Mung bean |
| **Pathogen** | **:** | Bean common mosaic virus |
| **Centre** | **:** | AAU, Anand |

**Note:** *The detailed methodology and data sheet will be provided by Dr. R.N. Pandey, AAU, Anand*

| | | |
|---|---|---|
| **Experiment 13** | **:** | **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.<br>To develop and standardize the nucleic acid based techniques for detection of seed associated viruses. |
| **Year of start** | **:** | 2009 |
| **Status** | **:** | Continued 2016-17 (Title modified in 2016-17) |
| **Centre** | **:** | AAU, Anand |

**Note:**

- *For identification of seed borne viruses in different crops, the other cooperating Centers are directed to supply the samples to AAU, Anand.*
- *Samples of leaves and /or seeds may be sent, sampling and dispatch procedure will be provided by Dr. Pandey, AAU, Anand on request.*

| | | |
|---|---|---|
| **Experiment 14** | **:** | **Standardization of biopriming technique for management of Fusarial wilt of Safflower** |
| **Objective** | **:** | To standardize the procedure for biopriming |
| **Year of start** | **:** | 2015 -16 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Safflower |
| **Pathogen** | **:** | *Fusarium oxysporum* |
| **Centre** | **:** | MPKV, Rahuri |
| **Methodology** | **:** | Biopriming of seeds with biopesticides |

**Treatments**

$T_{1}$ - *Trichoderma viride* @ 10 g/kg of seed

$T_{2}$ - *Trichoderma harzianum* @ 10 g/kg of seed

$T_{3}$ - *Pseudomonas fluorescens* @ 10 g/kg of seed

$T_{4}$ - *Bacillus subtilis* @10 g/kg of seed

$T_{5}$ - *Trichoderma viride* + *Pseudomonas fluorescens* @ 5 g each / kg of seed

$T_{6}$ - *Trichoderma harzianum* + *Pseudomonas fluorescens* @ 5 g each / kg of seed

$T_{7}$ - *Trichoderma viride* + *Bacillus subtilis* @ 5 g each / kg of seed

$T_{8}$ - *Trichoderma harzianum* + *Bacillus subtilis* @ 5g each / kg of seed

$T_{9}$ - Untreated control

**Note:** *The detailed methodology and datasheet will be provided by* Dr. Zanjare, MPKV, Rahuri. *Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

| | | |
|---|---|---|
| **Experiment 15** | **:** | **Standardization of biopriming technique for management of *Alternaria helianthi* associated with sunflower seeds** |
| **Objective** | **:** | To standardize the procedure for biopriming |
| **Year of start** | **:** | 2015 -16 |
| **Status** | **:** | Continued 2016-17 |
| **Crop** | **:** | Sunflower |
| **Pathogen** | **:** | *Alternaria helianthi* |
| **Methodology** | **:** | Biopriming of seeds with biopesticides |

**Treatments**

$T_{1}$ - *Trichoderma viride* @ 10 g / kg of seed

$T_{2}$ - *Trichoderma harzianum* @ 10 g / kg of seed

$T_{3}$- *Pseudomonas fluorescens* @ 10 g / kg of seed

$T_{4}$- *Bacillus subtilis* @ 10 g / kg of seed

$T_{5}$- *Trichoderma viride* + *Pseudomonas fluorescens* @ 5 g each / kg of seed

$T_{6}$- *Trichoderma harzianum* + *Pseudomonas fluorescens* @ 5 g each / kg of seed

$T_{7}$- *Trichoderma viride* + *Bacillus subtilis* @ 5 g each / kg of seed

$T_{8}$- *Trichoderma harzianum* + *Bacillus subtilis* @ 5 g each / kg of seed

$T_{9}$- Untreated control

**Centre :** MPKV, Rahuri

**Note:** *The detailed methodology and data sheet will be provided by Dr. Gawade, MPKV, Rahuri. Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

## New Pilot Experiments

| | | |
|---|---|---|
| **Experiment 16** | **:** | **Management of *Alternaria solani* through seed treatment and foliar application of new fungicides** |
| **Objective** | **:** | To determine the transmission of pathogen from seed to plant.<br>To determine the influence of fungicide application on the quality of harvested seeds and fruits. |
| **Year of start** | **:** | 2016 -17 |
| **Crop** | **:** | Tomato |
| **Pathogen** | **:** | *Alternaria solani* |
| **Methodology** | **:** | I. Basic seed dressing with Thiram and (II) subsequent 2 or 3 foliar application of fungicides after first appearance of disease |

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

$T_{1}$- Carbendazim (25 %) + Mancozeb (50 %)

$T_{2}$- Azoxystrobin (11 %) + Tebuconazole (18.3 %)

$T_{3}$- Hexaconazole (4 %) + Zineb (68 %)

$T_{4}$- Azoxystrobin (18.2 %) + Difenconazole (11.4 %)

$T_{5}$- Trifloxysytrobin (25 %) + Tebuconazole (50 %)

$T_{6}$- Metiram (55 %) + Pyraclostrobin (5 %)

$T_{7}$- Famoxadone (16.6 %) + Cymoxanil (22.1 %)

$T_{8}$- Pyraclostrobin

$T_{9}$- Azoxystrobin

$T_{10}$- Untreated

**Observation:** Disease development; yield and impact on seed quality

**Centre :** AAU, Anand

***Note:*** *The detailed methodology and datasheet will be provided by Dr. Parmar & Dr. Gohel. AAU, Anand. Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

| | | |
|---|---|---|
| **Experiment 17** | **:** | **Impact of different storage conditions and longevity on seed associated mycoflora of green gram / black gram** |
| **Objective** | **:** | To determine the extent of association of mycoflora with freshly harvested seeds.<br>To determine the influence of fungicide treatment on development of mycoflora and its impact on seed quality parameters under different storage conditions and periods |
| **Year of start** | **:** | 2016 |
| **Crop** | **:** | Green gram / Black gram |
| **Source of seed** | | (i) Farmer (ii) Seed production / Research Fields |
| **Pathogen** | **:** | *Macrophomina phaseolina, Fusarium oxysporum, Colletotrichum dematium* (*C. truncatum*), *Cercospora* spp., *Fusarium* spp., *Aspergillus* spp. |

**Storage condition:** (I) Gunny bags (II) Poly lined gunny bags and (III) Cloth bags

## Methodology

- 1. Basic seed dressing with Thiram @ 0.25% (prior to storage); 2. Subsequent storage in different containers; 3. Untreated seeds will serve as check.
- Freshly harvested seeds will initially be tested for extent of mycoflora and other seed quality parameters and designated as zero stage evaluation.
- Later at 30 day 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

**Centre :** TNAU, Coimbatore

**Note**: *Information on storage condition including temperature, moisture should be provided. The detailed methodology and data sheet will be provided by Dr. Indira, TNAU, Coimbatore.*

| | | |
|---|---|---|
| **Experiment 18** | **:** | **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 |
| **Crop** | **:** | Sesame |
| **Pathogen** | **:** | *Macrophomina phaseolina* |

## Methodology

- **Source of seeds** – Sesame seeds of different varieties will be collected from farmers, seed production fields, processing plants at different locations.
- **Detection** - Association of *Macrophomina phaseolina* will be determined by employing standard techniques (visual inspection; examination on Diaphanoscope; standard blotter method, standard agar plate method, test tube water agar technique).
- **Investigation on location of the pathogen in seeds** – by standard seed component plating technique
- ***Transmission*** – (I) - Seed to plant transmission will be confirmed through standard paper towel method and subsequently by sowing the seeds with known infection, in sterile soil / sand and concurrent isolation and confirmation of the target pathogen from developing young plant(s);

  (II) - Plant to seed transmission will be confirmed by (a) artificial inoculation of developing sesame pods and later extraction of seeds from maturing the pod, plating the seeds and confirmation of association (b) extraction of seeds from naturally infected pods and confirmation by plating , isolation of the fungus.

**Centre :** TNAU, Coimbatore

**Note**: *The detailed methodology and data sheet will be provided by Dr. Indira, TNAU, Coimbatore.*

| | | |
|---|---|---|
| **Experiment 19** | **:** | **Management of purple blotch / Stemphylium blight of onion through fungicide and plant based products** |
| **Objective** | **:** | To determine the influence of fungicide application on the quality of harvested seed and development of diseases. |
| **Year of start** | **:** | 2016 |
| **Crop** | **:** | Onion |
| **Pathogen** | **:** | *Alternaria porri* |
| **Methodology** | **:** | (I) Basic seed dressing with Captan / Thiram and (II) Subsequent 2 or 3 foliar application after first appearance of disease at 10 days interval (III) amended with sticker agent. |

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

| | Application combination | Periodicity |
|---|---|---|
| $T_1$ | Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 spray of Mancozeb @ 0.3% + 0.11% Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_2$ | Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 spray of Copper oxy chloride @ 0.25 % + 0.11 % Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_3$ | Seed Treatment with Captan / Thiram@3 g / kg seed + 2 spray of Propiconazole @ 0.1% + 0.11 % Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_4$ | Seed Treatment with Captan / Thiram @ 3 g / kg seed + 2 spray of Hexaconazole @ 0.1% + 0.11 % Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_5$ | Seed Treatment with Captan / Thiram @ 3 g/ kg seed + 2 spray of Tebuconazole @ 0.1% + 0.11% Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_6$ | Seed Treatment with Captan / Thiram @ 3 g/ kg seed + 4 spray of crude leaf extract of *Azadirachta indica* @ 0.5% + 0.11% Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_7$ | Seed Treatment with Captan / Thiram @ 3 g / kg seed + *Lantana camara* @ 0.3 % + 0.11 % Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_8$ | Seed Treatment with Captan / Thiram @ 3 g/ kg seed + *Pongamia pinnata* @ 0.3 % + 0.11 % Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_9$ | Seed Treatment with Captan / Thiram @ 3 g / kg seed + 4 spray of Mancozeb @ 0.3 % + 0.11 % Triton / Linseed oil as sticker | At 10 day interval after disease appearance |
| $T_{10}$ | Check (No spray) | - |

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

**Centre :** PAU, Ludhiana

**Note:** *The detailed methodology and datasheet will be provided by* Dr. Anju Sharma, PAU, Ludhiana. *Information on statistical data, Cost: Benefit ratio (economics); yield data and correlation with meteorological data should be supplemented.*

**Experiment 20** : **Effect of biologically synthesized metal oxide nano-particles on mycoflora associated with green gram seeds and impact on seed quality parameters**

**Objective** : To study the effect of biologically synthesized nano-particles on seed associated mycoflora ; Impact on seed quality characters

**Year of start** : 2016

**Crop** : Green gram

**Pathogen** : *Macrophomina phaseolina, Fusarium oxysporum, Colletotrichum dematium* (*C. truncatum*), *Cercospora* spp., *Fusarium* spp., *Aspergillus* spp.

**Methodology** : Seeds will be treated with biologically synthesized nano-particles

**Treatment**

| | Nano-particles | Dosages |
|---|---|---|
| $T_1$ | ZnO | 2ppm |
| $T_2$ | ZnO | 3ppm |
| $T_3$ | ZnO | 4ppm |
| $T_4$ | MgO | 2ppm |
| $T_5$ | MgO | 3ppm |
| $T_6$ | MgO | 4ppm |
| $T_7$ | Silver | 2ppm |
| $T_8$ | Silver | 3ppm |
| $T_9$ | Silver | 4ppm |
| $T_{10}$ | Untreated | - |

**Observation :** Extent of seed infection; impact on seed quality parameters

**Centre :** ANGRAU, Hyderabad

**Note**: *The detailed methodology and datasheet will be provided by Drs. Pushpavati & Dr. Bharthi, ANGRAU, Hyderabad.*

**Experiment 21** : **Detection, location and transmission of seed borne *Alternaria sesami* in sesame**

**Objective** : To determine the transmission of seed borne target pathogen

**Year of start** : 2016

**Crop** : Sesame

**Pathogen** : *Alternaria sesami*

**Centre** : ANGRAU, Hyderabad

## Methodology

***Source of seeds:*** Sesame seeds will be collected from farmers, seed production fields, processing plants different locations, varieties.

***Detection***: Association of *Alternaria sesami* will be determined by employing standard techniques (visual inspection; examination on Diaphanoscope; standard blotter method, standard agar plate method, test tube water agar technique)

***Investigation on location of the pathogen in seeds*** – by Standard seed component plating technique

***Transmission***

(I) Seed to plant transmission will be confirmed through standard paper towel method and subsequently by sowing the seeds with known infection, in sterile soil /sand and concurrent isolation and confirmation of the target pathogen from developing young plant(s);

(II) Plant to seed transmission will be confirmed by (a) artificial inoculation of developing sesame pods and later extraction of seeds from maturing the pod, plating the seeds and confirmation of association (b) extraction of seeds from naturally infected pods and confirmation by plating, isolation of the fungus.

**Note**: *The detailed methodology and datasheet will be provided by Drs. Pushpavati & Bharthi, ANGRAU, Hyderabad.*

### List of Participants

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# D. Seed Entomology

| | | |
|---|---|---|
| **Chairman** | : | **Dr. Jim Thomas**, ADR, KAU, Thrissur |
| **Convener** | : | **Dr. Amit Bera,** Scientist (SS), ICAR-CRIJAF, Barrackpore |

## Recommendation

1. Emamectin benzoate 5SG @ 2 ppm a.i. (40.0 mg/kg seed) or Spinosad 45 SC @ 2 ppm a.i. (4.4 mg/kg seed) or deltamethrin 2.8 EC @ 1.0 ppm a.i. (0.04ml /kg seed) treated seeds (at 10% moisture content) stored in moisture impervious bags provide safer storage up to 6-9 months in coastal region. This technology may be adopted.
2. Modified atmosphere storage at 50% $CO_2$ concentration can provide safe storage of groundnut seed against *C. serratus* up to 9 months of storage and wheat seed against *T. granarium* up to 12 months of storage without affecting seed quality. This technology may be adopted.

## Experiment 1: 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:** 2012

**Year of modification:** 2013

| Crop | Centre |
|---|---|
| Wheat | RAU, Durgapura; ICAR-IISR, Mau |
| Maize | TNAU, Coimbatore; UAS, Bangalore |
| Pearl millet | JAU, Jamnagar; MPKV, Rahuri |
| Paddy | OUA&T, Bhubaneswar; AAU, Jorhat, PJTSAU, Hyderabad |
| Pigeon pea | NDUA&T, Faizabad; PDKV, Akola |
| Cowpea | UAS, Bangalore |
| Mung bean | RAU, Durgapura; OUA&T, Bhubaneswar; MPKV, Rahuri |
| Chickpea | PJTSAU, Hyderabad; JAU, Jamnagar |
| Black gram | TNAU, Coimbatore |
| Field pea | CSAUA&T, Kanpur |

## Treatment

**A. Chemical**

1. Emamectin benzoate (Proclaim 5 SG) @ 2 ppm (40.0 mg/kg seed)
2. Spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed)
3. Indoxacarb (Avaunt 14.5 SC) @ 2 ppm (13.8 mg/kg seed)
4. Rynaxypyr (Coragen 20 SC) @2ppm (0.01ml/kg seed)
5. Chlorfenapyr (Intrepid 10 EC)@2ppm (0.02ml/kg seed)
6. Profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed)
7. Novaluron (Rimon 10 EC) @ 5ppm (0.05ml/kg seed
8. Deltamethrin 2. 8 EC @ 1.0 ppm (0.04 ml/kg seed)
9. Untreated control

**B. Packaging Material:** Gunny bag-lets of 2 kgs 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 5 ml water to treat 1 kg of seed for proper coating. After drying in shade, seeds will be packed and kept in room under ambient temperature. The temperature and relative humidity of the room will be recorded on standard weekly basis.

## Observations

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

## Observation to be recorded

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

**Experiment 2: 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. 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 3: Quality seed production through insect pollination

## Objectives

- Collection, identification and temporal abundance of important insect pollinators.
- Evaluation of seed quality of insect and self-pollinated products from different crops.

**Date of Start:** 2010

| Crop | Centre |
|---|---|
| Berseem | ICAR-IISR, Mau; NDUA&T, Faizabad; PJTSAU, Hyderabad; RAU, Durgapura and JNKVV, Jabalpur |

**Treatments:** Entomophilous crop will be grown in 1000 sq. m or more area following recommended cultural practice.

$T_1$ - Three random plots of 3 m x 2 m will be covered with insect proof net cages measuring (length = 5m, width = 2m) at bud stage to exclude insect's visit to flower in order to get self-pollinated (SP) seeds.

$T_2$ - Three random plots of same size 3 m x 2 m without insect proof net cages to serve as open pollinated (OP) seed.

$T_3$ - One plot of 15 m X 10 m with partially caged with insect proof nets with 8 frame honey bee colony to serve as bee pollinated (BP) seed.

**The following observations are to be recorded**

**Observations**

a) Pollinators' visits in $1m^2$ area in fore noon and afternoon.

b) Percent seed set and yield under each conditions.

c) Assessment of seed quality

   i. Seed germination

   ii. Seed vigour

d) Record of weather condition particularly air temperature, humidity and sunshine prevailing during flowering period of the crop.

**However, GOT test should also be performed and reported with other observation.**

**Experiment 4: Effect of carbon dioxide ($CO_2$) treatment on the control of storage insect pests and the seed quality attributes under ambient conditions.**

**Year of start:** 2010

**Objectives**

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

| Crops | Centre |
|---|---|
| Chickpea | RAU, Durgapura (*Callosobruchus*) |
| Paddy | PJTSAU, Hyderabad (*Sitotroga*); NDUA&T, Faizabad (*Sitotroga*); PAJANCOA, Karaikal (*Sitotroga*) |
| Green gram | OUA&T, Bhubaneswar (*Callosobruchus*) |
| Pigeon pea | PJTSAU, Hyderabad, (*Callosobruchus*) |
| Sorghum | TNAU, Coimbatore (*Sitophilus* sp.) |

## Treatment

**A. Treatment**

$T_1$ - Normal air treatment (untreated control)

$T_2$ - Carbon dioxide ($CO_2$) @ 30% of the volume

$T_3$ - Carbon dioxide ($CO_2$) @ 40% of the volume

$T_4$ - Carbon dioxide ($CO_2$) @ 50% of the volume

**B. Exposure period (P) in months**

$P_1$ - 03

$P_2$ - 06

$P_3$ - 09

$P_4$ - 12

**Replication:** 3 **Design:** FCRD

## Materials

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

## Methods

Seed of a popular crop variety with high germination and free from insect infestation (fumigate prior to use to ensure complete kill of field infestation, if any) should be used in the experiment. Fabricate or purchase airtight plastic containers of 1 kg capacity with rubber septa on its lid to insert syringe to remove air and add ($CO_2$) in proportion to give-desired level of concentration in the containers by flushing method with an inlet and an outlet which will be sealed after release of $CO_2$.

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

## Observations to be recorded at the end of each storage period

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

## Experiment 5: Demonstration of efficacy of $CO_2$ treatment for management of insect pests of stored seeds in large capacity storage bin.

### Objective

- To design large container to treat $CO_2$ for management of pests of stored seeds
- To demonstrate efficacy of $CO_2$ treatment for management of insect pests of stored seeds in large capacity storage bin

**Year of start:** 2011

| Crop | Centre |
|---|---|
| Pulse (Green gram or black gram or red gram) | TNAU, Coimbatore |
| Paddy | UAS, Bangalore; PJTSAU, Hyderabad |
| Chickpea | MPKV, Rahuri |
| Wheat | ICAR-IISS, Mau |

The methodology and design of storage bin will be standardized for treating stored paddy / pulse seeds. Required quantity of seeds will be taken and artificially infested with 100 pairs of lesser grain borer (in paddy) and pulse beetle (in pulses) prior to experimentation and then treated with 0 and 50 % $CO_2$ (in two separate containers) and the percent seed damage due to insect, insect population (live and dead adults in 100g sample), seed germination and moisture will be recorded at 3, 6 and 9 months after treatment. The level of $CO_2$ in the containers will be assessed periodically. The temperature and RH of storage room will be recorded on weekly basis.

Every centre shall design the container for storing 100 kg of seed in collaboration with design engineer. After the designing of the container, the concerned centres will explore for the efficacy of $CO_2$.

## Experiment 6: Efficacy of insecticides and botanicals against storage insects of seeds and their influence on seed viability during storage under ambient condition

| Crop | Centre |
|---|---|
| Wheat | RAU, Durgapura; ICAR-IISR, Mau |
| Maize | TNAU, Coimbatore |
| Paddy | OUAT, Bhubaneswar; AAU, Jorhat, PJTSAU, Hyderabad, PAJANCOA, Karaikal |
| Pigeon pea | NDUAT, Faizabad, PDKV, Akola |
| Cowpea | UAS, Bangalore |
| Chick pea | PJTSAU, Hyderabad; JAU, Jamnagar; |
| Black gram | TNAU, Coimbatore, PAJANCOA, Karaikal |
| Field pea | CSAUAT, Kanpur |

## Objectives

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

## Treatment

**A. Insecticides/botanicals**

1. Emamectin benzoate @ 2ppm (40.0 mg/kg of seed)
2. Deltamethrin @ 1ppm (0.04 ml/kg of seed)
3. Neem Azal 10000ppm @ 1.5ml/kg seed (=15 mg Azadirachtin./ kg seed)
4. *Karanj (Pongamia pinnata)* oil @5ml/kg seed
5. Citronella oil @ 5 ml/kg of seed
6. *Acorus calamus* TNAU Formulation @ 10 ml/kg of seed
7. Untreated control

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

**Replications:** 3 **Design:** CRD

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

## Observations

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

## Observation to be recorded

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

## Experiment 7: Management of groundnut pod borer (*Caryedon serratus*) in groundnut pods

### Objectives

1. To know the sources of infestation and alternate host plants existing in groundnut growing areas of different states
2. Management by pod treatments with new insecticides molecules

| Crop | Centres |
|---|---|
| Groundnut | JAU, Jamnagar; PDKV, Akola; MPKV, Rahuri and PJTSAU, Hyderabad |

### Treatments

1. Emamectin benzoate (Proclaim 5 SG) @ 2 ppm (40 mg/kg of pod)
2. Spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg of pod)
3. Thiodicarb (Larvin 75 WP) @ 2ppm (2.7 mg/kg of pod)
4. Rynaxypyr (Coragen 20 SC) @2 ppm (0.01 ml/kg of pod)
5. Profenofos (Curacron 50 EC) @2 ppm (0.004 ml/kg of pod)
6. Novaluron (Rimon 10 EC) @ 5 ppm (0.05 ml/kg of pod)
7. Deltamethrin 2.8 EC @ 1ppm (0.04 ml/kg of pod)
8. Untreated control

**Packaging material** : Gunny baglets of 2 kg capacity

**Replications:** 3 **Design:** CRD

### Methodology

- Survey the groundnut areas at the time of harvest by collecting the samples before storage in the gowdowns and observe for the emergence of adults.
- Collect and observe the plants that bear pods like tamarind etc to find out the host plants that attract pod borer
- One kg of freshly harvested certified pod with very percentage of germination and low moisture content (< 10%) will be taken for each treatment. Required quantity of pesticides will be diluted in 15ml water to treat 1 kg of pod for proper coating. After drying in shade, seeds will be packed and kept in room under ambient temperature. The temperature and relative humidity of the room will be recorded on standard weekly basis.

### Observations

**Residual toxicity:** Take out 100 g of treated pod. Release 10 adult insects *Caryedon serratus* insects depending upon the crop and record mortality after 3, 7 and 15 days interval and thereafter, every 3 months for a total period of 12 months or loss of germination below IMSCS, whichever is early.

### Observations to be recorded

1. Seed germination, seed moisture
2. Insect infestation (% pod damage)
3. Presence/ Absence of insects (live and dead)

**New experiment 8: Evaluation of pre-harvest spraying of insecticides for management of pulse beetle (*Callosobruchus* sp.)**

### Objective

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

| Crop | Centre |
|---|---|
| Pigeon pea | UAS, Bangalore; PJTSAU, Hyderabad and PDKV, Akola |
| Green gram | OUAT, Bhubaneswar and JAU, Jamnagar; |
| Chickpea | MPKV, Rahuri; RAU, Durgapura and NDUA&T, Faizabad |
| Black gram | TNAU, Coimbatore; PAJANCOA, Karaikal and AAU, Jorhat |

### Treatments

**A. Insecticides/Botanicals**

1. Emamectin benzoate @ 0.3 ml/L
2. Malathion dust @ 10 kg/acre
3. Profenofos 50 EC @ 1 ml/L
4. Neemazal 10000 ppm @ 1 ml/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 5 m x 3 m. Harvest the crop leaving border rows. After threshing seed should be kept in cloth bag ensuring protection from cross infestation during storage. Observation on adult emergence should be taken at 7 days interval up to two months.

**Observation:** No. of exit hole

## Experiment 9: Effect of new packaging material (insecticide incorporated polypropylene bags - Zerofly) on storability of seed under ambient condition.

### Objectives

- To study the effect of new packaging material (insecticide incorporated polypropylene bags) on storability of seed.
- To evaluate the effectiveness of new packaging material (insecticide incorporated polypropylene bags) against major storage insect-pests damaging seed.

**Year of Start:** 2015

| Crop | Centre |
|---|---|
| Paddy | OUA&T, Bhubaneswar; UAS, Bangalore and ICAR-IISR, Mau |
| Mungbean | OUA&T, Bhubaneswar and UAS, Bangalore |
| Sunflower | OUA&T, Bhubaneswar and UAS, Bangalore |
| Wheat | RAU, Durgapura and ICAR-IISR, Mau |
| Chickpea | RAU, Durgapura and ICAR-IISR, Mau |

### Treatments

**A. Seed treatment**

1. Treated with Emamectin benzoate @ 2 ppm (40.0 mg/kg of seed)
2. Untreated seed

**B. Packaging material**

1. Insecticide incorporated polypropylene storage bag
2. Untreated bag (same fabric i.e. PP Bag)
3. Gunny bag (control)

**Replication: 3** **Design:** FCRD

**Method**: Required quantity of freshly harvested certified seed (Wheat, Rice - 10 Kgs; Chickpea, Sunflower, Green gram – 5 Kgs) with very high percentage of germination and low moisture content (<10 %) will be taken for each treatment. Required quantity of pesticide will be diluted in 5 ml water to treat 1 kg of seed for proper coating. After drying in shade, seeds will be packed and kept in room under ambient temperature. Temperature and relative humidity of the room will be recorded weekly.

**Observations**: Every two months for a total period of 12 months or loss of germination below IMSCS whichever is early.

a. Seed germination
b. Seedling vigour
c. Seed moisture content

d. Natural insect infestation Insect infestation (% kernel damage and types of insect)

e. Presence / absence of insects (live and dead)

**Proceedings of the meeting held at Kochi on 20th April, 2016 to finalize technical programme of Seed Entomology for the year 2016-17**

Dr. Amit Bera, PI, Seed Entomology convened the session with a warm welcome to the Chairman, Dr. Jim Thomas, ADR, KAU, Thrissur. Dr. A. N. Singh, Senior Scientist, ICAR-IISS, Mau and Dr. Arulprakash R., Asst. Prof., Seed Centre, TNAU, Coimbatore acted as rapporteurs. Ten seed entomologists from different centres participated in this session.

- Experiment No. 1 on "Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition" modified in 2013 will be continued in existing format. MPKV, Rahuri; TNAU, Coimbatore and PJTSAU, Hyderabad will do the residue analysis after longest duration of effective storage (when either or both the standard of insect damage and seed germination fail).
- Experiment No. 2 on "Evaluation of packaging material and methodology to store seed in coastal region" concluded with recommendation.
- Experiment No. 3 on survey of seed health status will be continued in its existing format. Survey should be done following proper sampling procedure. The data should also be sent to the PI, Seed Pathology.
- Experiment No. 4 on "Quality seed production through insect pollination" will be continued in its existing format with addition of three new centres *viz.*, RAU, Durgapura; PJTSAU, Hyderabad and JNKVV, Jabalpur in berseem crop. Experiment on pigeon pea concluded with the conclusion that bee pollination alone is not sufficient to maximize seed yield of pigeon pea. Other pollinators like leaf cutter bee, carpenter bee also play a major role in pollination of pigeon pea**.**
- Experiment No. 5 on "Effect of $CO_2$ treatment on the mortality / survival of storage insect pests will be continued in its existing format with addition / deletion of few centres. Experiments on wheat and groundnut will be concluded with recommendation. New experiment on chickpea is allotted to RAU, Durgapura.
- Experiment No. 6 on "Demonstration of efficacy of $CO_2$ treatment for management of insect pests of stored seeds in large capacity storage bin" will be continued for demonstration purpose. One more centre, ICAR-IISS, Mau is added for demonstrating efficacy of $CO_2$ for management of insect pests of wheat.
- Experiment No. 7 on "Efficacy of insecticides and botanicals against pests of stored seeds and their influence on seed viability during storage under ambient condition" will be continued in existing format. PAJANCOA, Karaikal centre will send karanj oil and TNAU, Coimbatore will send *Acorus calamus* formulation and citronella oil to all centres.

- Experiment No. 8 on "Management of groundnut pod borer (*Caryodon serratus*) in groundnut pods" will be continued in existing format.
- Experiment No. 9 "Evaluation of pre-harvest spraying of insecticides for management of pulse beetle (*Callosobruchus* sp)" will be continued in existing format.
- Experiment No. 10 on "Effect of new packaging material (insecticide incorporated polypropylene bags - Zerofly) on storability of seed under ambient condition" will be continued in existing format.

Dr. Rajendra Prasad, Director, ICAR-IISS, Mau emphasized on timely submission of data to PI before 31st January. He also instructed all the centres to conduct research with strict adherence to technical programme. He appreciated the efforts of STR, Seed entomology group.

The meeting ended with thanks to the delegates.

## List of Participants

| S.No. | Name | Designation | Address | Telephone No. & Email. address |
|---|---|---|---|---|
| 1. | Dr. Jim Thomas | ADR | KAU, Thrissur | 09495783190<br>adrart@kau.in |
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| 9. | Dr.R. Arulprakash | Asstt. Prof. (Agri. Ento.) | TNAU, Coimbatore | 09597481060<br>avrarulprakash@gmail.com |
| 10. | Dr. J.D. Patel | ASRO, STR | PDKV, Akola | 08308003905<br>seed_tech@yahoo.co.in |
| 11. | Dr. Jitendra Kumar | Junior Entomologist | CSAUA&T, Kanpur | 09621633301<br>jitendraento_csa@rediffmail.com |
| 12. | Smt. A. Padmasri | Scientist, Entomology | PJTSAU, Hyderabad | 09000791123<br>padmasri_1972@rediffmail.com |

# E. Seed Processing

| | | |
|---|---|---|
| **Chairman** | : | **Dr. J.P. Sinha,** Principal Scientist, SPU, DSST, ICAR-IARI, New Delhi |
| **Convener** | : | **Dr. K.V. Sripathy**, Scientist, ICAR-IISS, Mau. |

## Recommendations

1. Standard method as per ISTA for optimization of sieve size to be followed i.e., employing sieve shaker and anemometer (for assessing terminal velocity of seed) method and all centres involved in this experiment will make arrangements for procurement of sieve shaker through revolving fund operating at respective centres.
2. Under experiment no. 1 (Optimization sieve sizes) the seed recovery (%) shall be calculated using standard formulae considering seed physical and engineering properties across crop/ varieties.
3. All centres essentially refer passport data for each variety to known the seed size, which will aid in selection of sieves.
4. House recommended for conductance of special training programme at ICAR-IARI RS, Karnal (Coordinated by Dr. J.P. Sinha & Dr. Ashwani Kumar, ICAR-IARI, New Delhi) for all scientists involved in seed processing experiment across cooperating centres during the month of June 2016.
5. Under experiment no. 2 (mechanical damage at harvesting and threshing) it is suggested for use of drum with spike toothed mechanism for threshing of seed crop to reduce mechanical damage.

**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.
2. To standardize the size and type of grading sieve.

| Crop | | Centres |
|---|---|---|
| Chickpea | : | PDKV, Akola; MPKV, Rahuri and UAS, Raichur |
| Pigeon pea | : | UAS, Bangalore and UAS, Raichur. |
| Soybean | : | UAS, Dharwad; MPKV, Rahuri; PDKV, Akola and UAS, Raichur |
| Wheat | : | HPKVV, Palampur; CSAUA&T, Kanpur; CCSHAU, Hisar and ICAR-IARI RS, Karnal |
| Paddy | : | ICAR-IARI, RS, Karnal; UAS, Bengaluru PAJANCOA, Karaiakal and TNAU, Coimbatore |
| Maize | : | UAS, Bangalore |
| Mustard | : | CSAUA&T, Kanpur and HPKVV, Palampur |

| | | |
|---|---|---|
| Green gram | : | UAS, Dharwad |
| Field bean | : | UAS, Bengaluru |
| Finger millet | : | UAS, Bengaluru |

**Treatments**

1. Crop : As above
2. Machine : Standard sieve shaker (specifications as per ISTA)
3. 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. The brief description of machine and grading screen sizes for each crop will be given by Dr. J.P. Sinha, PS, ICAR-IARI, New Delhi.

**Observations**

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

**Experiment 2: Management of mechanical damage at harvesting and threshing**

**Objective :** To study the management of mechanical damage due to different harvesting and threshing methods.

| Crop | | Centres |
|---|---|---|
| Paddy | : | TNAU, Coimbatore and PAJANCOA, Karaikal |
| Chickpea | : | MPKV, Rahuri; UAS, Dharwad |
| Soybean | : | PDKV, Akola; UAS, Dharwad; MPKV, Rahuri |
| Wheat | : | HPKVV, Palampur |

## Harvesting methods

## Treatment

**I. Harvesting**

1. Traditional method (by sickle)
2. Mechanical method (by combine harvester)

**II. Threshing**

1. Traditional (by stick beating)
2. Multi-crop thresher at varied speed
3. Combine harvester at varied speed

**Note:** In chickpea and soybean, manual harvesting followed by mechanical threshing using multi-crop thresher/combine harvester at varied drum speed will be adopted. Experiment should be carried out in one acre area for above mentioned crops in harvesting as well as threshing treatments.

## Methodology

The crop will be harvested and threshed by different methods *i.e.* harvesting and threshing manually, harvesting manually and threshing by multi-crop thresher and harvesting and threshing by using combine harvester. In chickpea and soybean, harvesting will be done manually followed by threshing using multi-crop thresher.

The seeds obtained from each method will be collected and tested for seed quality parameters like mechanical damage, germination percentage, seedling length, vigour index, 100 seed weight, insect damage and fungal infection. The field losses will be estimated by collecting the scattered seed, uncut plants, half cut plants *etc*. from per unit area. In case of machine harvesting, length of the field area should be equal to the width of combiner and 1m wide including the area under the grain trap will mark for estimating the field losses. The entire seed quality test will be conducted initially as well as at bimonthly intervals up to next planting session or up to reduction in IMSCS for germination as per the standard procedure.

## Observation

1. Mechanical injury (%) - $FeCl_2$ (20 %) test - 15 min.
2. Broken seeds (%)
3. Germination (%)
4. Physical purity (%)
5. Pure live seed (%)
6. Vigour index - I & II
7. Moisture content (%) of straw and seed at harvesting
8. Moisture content (%) of straw and seed at threshing

9. 1000 seed weight (g)
10. Seed storability of different harvesting and threshing methods at bimonthly intervals under ambient storage condition.
    i) Seed germination (%)
    ii) Seedling vigor
    iii) Seed infection (%)
    iv) Insect infestation (%)

## List of Participants

| S. No. | Name | Designation | Centre | Mobile No. |
|---|---|---|---|---|
| 1. | Dr. Sripathy K.V. | Scientist | ICAR-IISS, Mau | kudekallu2@gmail.com/ 08005202449 |
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| 12. | Dr. V. Vakeswaran | Asst. Professor | TNAU, Coimbatore | vakeswaran@gmail.com 09952176477 |
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# Session VI & VII

## General discussion, Issues on Breeder Seed Production, AUCs/Finances and monitoring Reports and Plenary Session

**Date: 21.04.2016** **Time: 11:30 AM-02:30 PM**

| | | |
|---|---|---|
| **Chairman** | : | **Dr. Sajan Kurien,** Director of Research, KAU, Thrissur |
| **Co-Chairman** | : | **Dr. J.S. Chauhan,** ADG (Seed), ICAR, New Delhi |
| | | **Dr. S. Rajendra Prasad,** Director, ICAR-IISS, Mau |
| **Rapporteurs** | : | **Dr. L.V. Subba Rao**, Principal Scientist, ICAR-IIRR, Hyderabad |
| | | **Dr. Meghachandra Singh**, Principal Scientist, ICAR RC NEH, Manipur |
| | | **Dr. Sandeep Lal**, Principal Scientist, ICAR-IARI, New Delhi |

Due to paucity of time, both the sessions i.e., VI (General discussion, Issues on Breeder Seed Production, AUCs/Finances and Monitoring Reports) and VII (Plenary) were clubbed. Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau requested the nodal officers to brief regarding specific and general issues pertaining to technical, budget utilization, financial issues, revolving fund, etc. to put up before the concerned authorities. He also pointed out issues like isolation shall be properly taken care while planning breeder seed production programme. Nodal Officer (BSP) from RAU, Pusa and MPKV, Rahuri reported that university authority does not release the revolving fund for the purpose of farm development/seed production activities. Nodal officer, SKRAU, Bikaner reported that the revolving fund is being utilized for payment of pension; neither any initiative is taken up to fill vacant positions. Dr. Ashraf Bhat, Nodal Officer, SKUAST, Srinagar stated that the position of seed entomologist is vacant due to transfer and university comptroller is not releasing the ORC funds timely. Nodal Officer, CSAUAT, Kanpur mentioned about delay in releasing of revolving fund revenue for utilization. Nodal Officer, OUAT, Bhubaneswar pointed that scientists involved in seed production activity are not given due weightage in Career Advancement Scheme of university. Dr. J.S. Chauhan, ADG (Seed) responded that council would request the universities for proper financial discipline and that in ICAR system there is due weightage for scientists involved in seed production activity in Career Advancement and it should be followed uniformly and assured proper action in future.

Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau stated that regarding proper utilization of revolving fund and filling up of vacancies, as it has become almost ineffective to approach the Directors of Research, council may write to all the Vice Chancellors. Dr. J.S. Chauhan, ADG (Seed), ICAR, New Delhi requested for proper utilization of ORC and not to return back to council. Dr. Sajan Kurien, Director of Research, KAU, Thrissur requested for upliftment of Seed Technology Research unit at KAU through adequate financial support. Dr. J.S. Chauhan assured that it would be possible only in the XIII Five Year Plan. Dr. S. Rajendra Prasad pointed that many centres have

not submitted report on assessment of seed quality sold at various outlets to farmers. Dr. J.S. Chauhan asked to work out the cost of breeder seed production soon, considering all factors including land, manpower and depreciation of processing plants as the rates in the BSP meet at Umiam, Meghalaya needs to be justified.

Dr. S. Rajendra Prasad appreciated JAU, Jamnagar, RARI, Durgapura and UAS, Bengaluru for their outstanding contributions. He also expressed dissatisfaction about the status of MPUAT, Udaipur and RAU, Pusa and asked the centres which have not submitted BSP IV to submit at the earliest. Dr. J.S. Chauhan, ADG (Seed) cautioned about variation in BSP data reported by various centres.

The recommendations of all the technical sessions and technical programme for year 2016-17 were presented, discussed and finalized. Proceedings of inaugural session was presented by Dr. K. Rathinavelu, Principal Scientist, ICAR-CICR RS, Coimbatore; Technical programme for 2016-17 for Seed Production and Certification was presented by Dr. Rakesh Seth, Principal Scientist, ICAR-IARI, RS, Karnal; Seed Storage and Physiology by Dr. P.C. Nautiyal, Principal Scientist & PI (Seed Physiology), ICAR-IARI, New Delhi; Seed Entomology by Dr. Amit Bera, Scientist & PI (Seed Entomology), ICAR-CRIJAF, Barrackpore; Seed Pathology by Dr. M.S. Bhale, Professor & PI (Seed Pathology), JNKVV, Jabalpur and Seed Processing by Dr. Sripathy K.V., Scientist, ICAR-IISS, Mau. The superannuating scientists were felicitated including Dr. J.S. Chauhan, ADG (Seed), ICAR, New Delhi and Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau for their outstanding contribution for seed production and research.

Dr. S. Rajendra Prasad asked to incorporate all the suggestions in the technical programmes. Dr. L. V. Subba Rao, Principal Scientist, ICAR-IIRR, Hyderabad stressed upon to give due importance to maintenance breeding programme. KAU, Pattambi and PAJANCOA&RI, Karaikal requested for revolving fund under BSP. It was also decided to adopt on farm demonstration on seed priming with at least 10 farmers at each location. For offseason seed production in soybean, it was suggested to take October planting at different locations. In seed processing experiments, it is requested to record electrical conductivity of seed leachates to assess mechanical damage to seed.

The plenary session of 31$^{st}$ Annual Group Meeting of AICRP- National Seed Project (Crops) 2016 ended with vote of thanks by Dr. S. Rajendra Prasad, Director, ICAR-IISS, Mau and Dr. Narayanankutty, Associate Director of Research, RARS, Pattambi, KAU, Thrissur.

# Constitution of Monitoring Teams for 2016-17

## *Kharif* season: Sept. / Oct. 2016; Rabi season: Feb. / Mar. 2017

| Zone / NSP centres | Name/ Address/ Convener & Member | | Email | Mobile No. |
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| **Northen Zone: Group II** HAU, Hisar; GBPUAT, Pantnagar; DWR, Karnal; VPKAS, Almora; DSST,IARI, Delhi/ Karnal; SVBPUA&T, Meerut; DMR, Delhi | Dr. A.K. Shinde, KKV, Dapoli. | Convener | shindeak53@rediffmail.com | 09423874285 |
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| **Central Zone I**<br>DSR, Indore, PDKV, Akola;<br>MAU, Parbhani; MPKV, Rahuri,<br>VSI, Pune; KKV, Dapoli | Dr. D.K. Agarwal, IISS, Mau | Convener | agarwaldk4@gmail.com | 09565068025 |
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| **Central Zone II**<br>JNKVV, Jabalpur; CICR, Nagpur; IGKVV Raipur; OUAT,<br>Bhubaneswar; CRRI, Cuttack | Dr. V.J. Bhatia, JAU, Junagadh | Convener | vjbhatia@jau.in; megaseed@jau.in | 09979298558 |
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## Calendar of Events

| 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 |

| S. No. | Event | Last date for completion of action | |
|---|---|---|---|
| **Calendar of Events for Breeder Seed Production** | | ***Kharif*** | ***Rabi*** |
| 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 | 30th December | |
| 5. | Submission of Monitoring Team Report to ICAR-IISS, Mau | 31st March | |
| 6. | Annual Group Meeting of AICRP-NSP (Crops) | 1st week of April | |

**NOTE**

हर कदम, हर डगर
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