वार्षिक प्रतिवेदन
ANNUAL REPORT
2014-15

भा.कृ.अनु.प. – बीज अनुसंधान निदेशालय

ICAR - Directorate of Seed Research

भारतीय कृषि अनुसंधान परिषद्

Indian Council of Agricultural Research

कुशमौर, मऊ – 275103 (उ.प्र.)

Kushmaur, Mau - 275103 (U.P.)

www.seedres.in

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ICAR-DSR

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Contents

Preface

Subeejam Sukshetre Jayate Sampadhyate (Good Seed on Good Soil Yields Abundantly), the often quoted verse from Manu Smriti is self revealing. Seed is the bridge for perpetuity and it is the first and the most vital link in the food chain. The response of all other inputs depends on quality of seeds to a large extent; quality seed alone contributes about 15–20 % to the total production depending upon the crop and could be up to 45 % if coupled with efficient management of other inputs. Food security is fundamental for any kind of progress and for India with a billion plus population, it is of utmost priority. Seed is prime input having the capacity to ensure food security by means of seed security. Increased food grain production in the country despite of abnormal weather conditions for last couple of years could largely be credited to the use of quality seed of improved varieties/ hybrids, improved farming practices along with ingenuity and industry of Indian farmers. All India Coordinated Research Project- National Seed Project [AICRP-NSP] (Crops) since its inception in 1979 as National Seed Project has contributed immensely in ensuring the food and nutritional security of the country. Progress in seed research, production and development has been spectacular and brought about visible growth in the activities/enterprise that provides inputs-services-supplies to the seed industry. In value terms, India has the 6th largest seed economy of a tune of nearly 2 billion US $. There seems to be no apparent reason for it not growing further in to world's 3 top most seed economies.

Launching of AICRP – NSP (Crops) was a phenomenal milestone in Indian seed sector which has led to sea change, as witnessed by increase from a meager breeder seed production of 3914 quintals during 1981 – 82 to a level of 89266.23 quintals during 2013-14, which has surpassed the indents received both from DAC as well as state governments. The breeder seed availability has improved the quantity / quality of seeds in subsequent generations in the seed multiplication chain which has resulted in increasing seed replacement of different crops. Ample scope exists to augment agricultural production in almost all crops in near future simply by capitalizing the benefits of quality seeds. In a further bid to reinforce the achievements of AICRP – NSP (Crops) and to strengthen infrastructure facilities for seed production under NARS, ICAR had launched a network project viz. Seed Production in Agricultural Crops & Fisheries during 2005-06 that has been extended to horticultural crops during XII Plan. This project has ushered significant positive impact on enhancing quality seed production to aid seed security *vis a vis* food security.

Directorate of Seed Research, Mau, apart from quality seed production and capacity building among various stake holders, has generated invaluable scientific information and user-friendly agro-techniques aimed at diverse clientele of seed domain viz., Seed Production, Protection Measures, Quality Enhancement etc. At present ICAR-DSR is having 20 in-house research projects in operation. With an increase in scientific cadre strength, there is substantial increment in research output. Experiments conducted at the Directorate during the year generated invaluable scientific information and user-friendly agro-techniques aimed at diverse clientele of seed domain. Salient research achievements of year

2014-15 are identification of suitable varieties of field crops for eastern UP region, nutrient management for recovery of high quality produce, micro-nutrient dose for application in rice and wheat, priming and coating techniques for enhancing seed germination, initial vigour and growth, deployment of molecular tools and techniques to ascertain genetic purity of varieties and QTL mapping for seed vigour and bruchid resistance are a few to quote. In addition, survey to identify important seed-borne diseases and storage pests in major crops and studies on insecticidal resistance to develop prophylactic & control measures to avert seed-borne pest problems.

It is a matter of great pleasure for me to present Annual Report 2014-15 of ICAR-Directorate of Seed Research, Mau. I place on record my heart felt gratitude to Dr. S. Ayyappan, Hon'ble Secretary, DARE & Director General, ICAR for his genial support and dynamic leadership to this directorate to excel in the arena of seed science research. I also express my sincere thanks to Dr. J.S. Sandhu, Deputy Director General (Crop Science) and Prof. Swapan K. Datta, Hon'ble Ex-Deputy Director General (Crop Science) for their incessant guidance and support for all the endeavours. My sincere thanks are also due to Dr. J.S Chauhan, ADG (Seed) and staff of the Seed Unit, Crop Science Division, ICAR for their support in smooth conductance of research and development of the institute. I convey my thanks to all the staff members of DSR, who have worked with sincerety for coordination of network projects as well as for execution of *in house* research projects. My special thanks to Dr. D.K. Agarwal and other editorial team for nicely prepared this Annual report. I have a firm belief and trust that in years to come ICAR-DSR, Mau would excell in seed science research and would provide national leadership in attaining seed security for the country.

Maunath Bhanjan
Date : 25.05.2015

(S. Rajendra Prasad)
Project Director

1 Introduction

Agriculture constitutes the lifeline of villages where more than 70% of Indian population lives. To have successful agriculture, quality seed constitute the most important component. Realizing the importance of seed and to keep pace with fast evolving policy initiative on seeds by Govt. of India, the Indian Council of Agricultural Research launched the All India Coordinated Research Project on seed the "National Seed Project" in 1979. Based on the overall progress and development of the National Seed Project and growing importance of seed in modern agriculture, the Indian Council of Agricultural Research has upgraded the Project Coordinator Unit of National Seed Project to the status of the Project Directorate in X Plan and named it as Directorate of Seed Research. Directorate of Seed Research started operating since 31 December 2004 from Kushmaur village in the district Maunath Bhanjan, UP. Directorate that has made modest beginning has now 02 principal scientists, 06 senior scientists, 17 scientists, 06 administrative, 09 technical, one supporting staff and a few contractual staff. There is still a need to fill up the vacant positions to meet the targets outlined for the institute in the XII Plan.

The Directorate of Seed Research is the leading coordination unit of seed science research and quality seed production in the country marching ahead with renewed vigour to face the challenges and harness the domestic and global opportunities for the welfare of seed growers, farmers and other stake holders in seed supply chain. It is working with a missionary zeal to secure country's food and nutritional security through ensuring the seed security. Directorate of Seed Research is a unique institute of ICAR, engaged exclusively in coordination and conduction of seed science research countrywide. Besides its mandate for undertaking seed production and seed technology research, the institute is deemed to undertake training and capacity building in this important sector of agriculture. At present the country is experiencing gradual increase in seed replacement rate (SRR), which needs to be increased substantially in the years to come for improved productivity and production of agricultural crops. As per the recommendation of QRT; creation of centre of excellence across best performing seed technology research centres, exposure visits and advanced training of the scientists in reputed labs (both national & international), strong maintenance breeding and sufficient recurring contingency for testing of genetic purity using molecular tools was emphasized during XII plan. Seed technology research in respect of seed entomology, pathology, physiology and molecular biology would develop appropriate technological backstopping, which would help the seed industries, farmers and other entrepreneurs for quality seed production and their perpetuation at large-scale for the great cause of productive agriculture in the country. The programmes undertaken at DSR are focused at increasing the Seed Replacement Rate (SRR) and Varietal Replacement Rate (VRR) in crops through increased seed production, standardization of improved seed production technology in different crops, enhancing the quality of seeds, standardization of seed testing procedures and deciphering the mechanism of seed germination, dormancy, vigour and longevity at molecular level especially at genomic and proteomic levels.

Vision

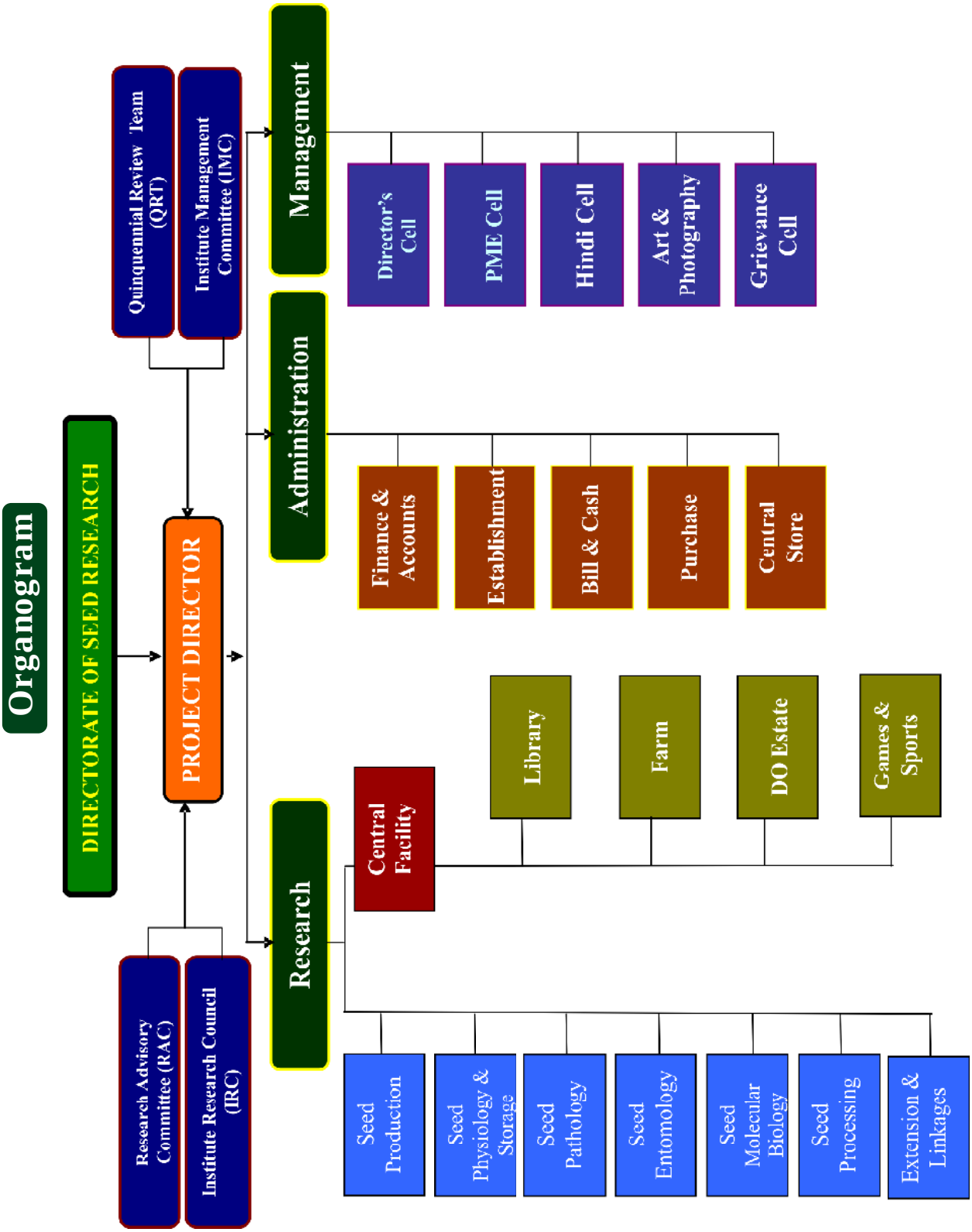
To ensure the quality seed security to the farmers through technological intervention and sustainable agriculture.

Mission

Enhancing genetic and physical characteristics of seed for increased productivity, quality and sustainability.

Mandate

- To conduct basic, applied, strategic and anticipatory research in diverse fields of seed science and technology.
- To function as apex centre for coordination of breeder seed production activity and seed technology research under AICRP-NSP.
- To function as apex centre for coordination of quality seed production activity of field crops under ICAR Seed Project.
- To have liaison with PPV&FR Authority and supporting research for protection of new varieties of crop plants under PPV&FR act.
- To undertake Human Resource Development (HRD) through imparting training to the field staff, scientists, farmers and different stakeholders in the field of seed production, testing and certification in different crops.


Orgamogram
DIRECTORATE OF SEED RESEARCH
PROJECT DIRECTOR
Research Advisory Committee (RAC)
Institute Research Council (IRC)
Quinquennial Review Team (QRT)
Institute Management Committee (IMC)
Management
Director's Cell
PME Cell
Hindi Cell
Art & Photography
Grievance Cell
Administration
Finance & Accounts
Establishment
Bill & Cash
Purchase
Central Store
Research
Central Facility
Library
Farm
DO Estate
Games & Sports
Seed Production
Seed Physiology & Storage
Seed Pathology
Seed Entomology
Seed Molecular Biology
Seed Processing
Extension & Linkages

2 Executive Summary

Directorate of Seed Research has made significant achievements in quality seed production as well as research during 2014-15 by conducting basic, applied, strategic and anticipatory research in seed science and technology and in effective coordination and monitoring of nationwide network projects, as envisaged in its mandate. During the current year, breeder seed production under AICRP-NSP (Crops) amounted to 89266.23 quintals in addition to 6.48 lakh quintals of quality seed production of field crops under the project 'Seed production in agricultural crops'.

This Directorate, with the 25 number of scientists has been working on 20 in house research projects. With the limited infrastructure and small farm, the directorate at its farm has produced 39.0 quintals (graded) of breeder seed of paddy varieties such as IR 36, IR 64, MTU 7029 and BPT 5204; 128.30 quintals (graded) of foundation & TFL seed of paddy; approximately 58.0 quintals (ungraded) of breeder seed of wheat varieties such as HD 2733 and HI 1563; 121.50 and 5.0 quintals (ungraded) of quality seed of wheat and barley, respectively; 15.0 quintals of quality seed of chickpea, 6.50 quintals of mustard (Pusa Bold & CS-52) and linseed (Azad Alsi-1) and 3.0 quintals of quality seed of potato (Kufari Anand & Kufari Kanchan) These seeds were processed in directorate's own processing unit and sold to the farmers and other Government organization in the locality to popularize quality seeds in bringing farm prosperity.

Field and laboratory experiments conducted at the Directorate during the year generated invaluable scientific information and development of user-friendly agro-techniques. Identification of suitable varieties of field crops for the region, nutrient management for recovery of high quality produce, micro-nutrient dose for rice and wheat, fine tuning of seed production technologies for hybrid rice under eastern UP conditions, priming and coating of seed for enhancing seed germination, initial vigour and growth, deployment of molecular tools and techniques to ascertain genetic purity of varieties and QTL mapping for seed vigour and bruchid resistance and optimum seedling age. In addition, survey to identify important seed borne diseases and storage pests in major crops and study on insecticidal resistance led to development of prophylactic and control measures to avert disease and insect problems. The salient research achievements during 2014-15 in ICAR-DSR are as under.

- Molecular characterization of five paddy hybrids (DRRH3, PSD1, PSD3, PRH10 and NDRH2), five cotton hybrids (CSHH 198, CSHH 238, CSHH 243, CICR2 and Phule 388) and three sunflower hybrids (KBSH 41, KBSH 44 and KBSH 53) along with their parents were done to assess the genetic purity by using microsatellite SSR marker at genomic level. Most of the bands are found to be monomorphic across the genotypes tested, indicating substantial homogeneity in respect to the genome and loci tested.
- In the in-house project entitled "QTL Mapping for Seed Vigor in Rice (*Oryza sativa* L.)", crossing among genetic divergent parent's for high and low vigour trait to generate recombinant inbred lines (RILs) population was carried out and resultant F_1 seeds generated have been advanced to

F_2 segregating population in off season nursery (*Rabi*-2015) at seed production centre ICAR-DSR, GKVK campus Bangalore. The morphological data on various traits were recorded among F_1 and the same were compared with its parents. Variance due to genotype was significant for all the quantitative traits studied indicating the presence of large variations in the germplasm.

- For improvement in seed yield through source-sink manupulations in wheat, spraying of GA_3 at the time of anthesis significantly increased the number of seed/spike, biological yield, 1000 seed weight and grain yield over control (10-12 %). The influence of GA_3 @ 100 ppm was more than compared to GA_3 @ 50 ppm.
- In pigeon pea seed priming with tap water, inorganic salt KNO_3 (0.2%) and plant growth regulator GA_3 (100 ppm) for 12 h. significantly enhanced the germination, shoot and root length, seedling dry weight and vigour indices over unprimed control. The highest germination was recorded in the seeds primed with GA_3 followed by KNO_3 and tap water. Seedling growth including shoot and root length was more influenced with the priming of GA_3 over KNO_3 and tap water priming. The vigour indices like vigour index I & II were also enhanced more with GA_3 priming than by KNO_3 and tap water.
- In priming studies on pigeon pea, germination enzymes including α-amylase and protease were assayed and it was found that GA_3 priming influences more activity of these germination enzymes as compared to KNO_3 and tap water. Nitrate assimilatory enzymes were found to be more influenced by KNO_3 priming, as compared to GA_3 and tap water. The similar trend was observed in chlorophyll a and b contents. Proline accumulation in the leaves of pegion pea varieties was minimally reduced with KNO_3 priming as compared to priming with tap water and GA_3. Priming with inorganic salts and plant growth regulator showed the improvement in plant height and yield attributes including no. of branches, no. of pods, test weight, biological yield and finally grain yield (5 %).
- In an experiment on devising agro-techniques for reducing the seed rate of wheat, it was found that spacing 22.5 x 10 cm and 22.5 x 7.50 cm have favorable effect on spike length (cm), seed weight/ spike (g), test weight (g) and number of seed / spike over spacing 22.5 x 7.50 cm and 22.5 x 5.0 cm. Among growth regulator GA_3 recorded maximum spike length (cm), seed weight/ spike (g), test weight (g) and number of seed/spike as compared to IAA.
- Zero Tillage (ZT) practice significantly enhanced yield (biological, seed and straw yield) as well as harvest index as compared to Conventional Tillage (CT) and Raised Bed (FIRB). The maximum cost of cultivation was recorded under CT followed by FIRB and lowest in ZT. Gross return, net return and B: C ratio was highest under ZT followed by CT and FIRB. The saving in total cost of cultivation with ZT was ₹ 8,800 and 6,000/ha as compared to CT and FIRB, respectively.
- Nine gram negative bacterial isolates showed antagonistic activity against *Macrophomina phaseolina* and *Rhizoctonia solani* causing root rot of chickpea, *Fusarium oxysporum* f.sp. *ciceri* causing wilt of chickpea, *Ustilaginoidea virens* causing false smut of rice, *Magnoperthae grisae* causing blast of rice.

- In a survey among NSC godowns in South India for insecticide resistance among insects, all the insects collected from different NSC godowns showing high level of resistance to insecticide Deltamethrin. Among all locations, at NSC Secenderabad population of *Rhizopertha dominica* and *Tribolium castaneum* recorded more resistance *i.e.* L_{C50} of 0.057 and 0.165 respectively, and lowest resistance was recorded in *Rhizopertha dominica* (L_{C50} 0.041*)* population from NSC, Bangalore and *Tribolium castaneum*(L_{C50} 0.089*)* population from NSC, Coimbatore.
- In a study to work out cost of seed production, the total cost of cultivation in Pigeonpea seed production was found to be around 23 per cent higher than grain production while, gross return was about 32 per cent higher in seed production (₹ 73300 /ha) than grain production (₹ 55700/ ha). Consequently, net return from seed production of pigeonpea was 44 per cent (₹ 33864/ha) higher than grain production (₹ 23502/ha). Hence, production of certified seed has resulted in win-win situation for the farmers with higher yield and better quality of output. Because of seed production, seed producer obtained higher price than the grain in the marketing of produce.

During the year 2014-15, in addition to in-house research projects, activities of Directorate of Seed Research was concerned mainly towards coordination and monitoring of following network projects countrywide.

1. AICRP – National Seed Project (Crops)
2. Seed production in agricultural crops

Project wise salient findings/ achievements

AICRP-National Seed Project (Crops)

I. Breeder seed production

Breeder seed production during 2013-14 touched a production level of 89266.23q against the indent of 84788.60q. However, slight shortfall in few crops was observed due to climate vagaries in the referred year.

II. Seed Technology Research

A. Seed Production and Certification

- In hybrid paddy, mixed method of planting for male parent produced significantly higher hybrid seed yield as compared to alternate method of planting.
- Wheat seed crop grown on ridge with fertilizer application of 150: 75: 50 NPK/ ha and 10 kg/ha Zinc sulphate as basal dose was found to be best integrated approach for enhancing seed yield &seed quality parameters.
- In sunflower hybrid DRSH 1, spray of zinc gave maximum seed yield with 22.76 *per cent* improvement over the control.

- Alternative areas were identified for hybrid seed production of paddy, sunflower, maize, pearlmillet, pigeon pea and jute.
- In DRRH-3 hybrid seed production, SRI method resulted in 16.05% improved seed yield over the conventional method.
- Hybrid seed production under shed house condition in tomato hybrid (Pusa Hybrid-4) showed better seed yield/plant, seed yield per hectare and seed quality attributes compared to open field condition.
- Alternative planting windows were identified and evaluated for hybrid seed production of sunflower, sorghum, maize and pearlmillet.
- Under aerobic condition paddy hybrid KRH-4 recorded higher seed yield followed by cultivars MAS-26, KMP-175 and Rasi, which revealed its suitability for direct seeding.

B. Seed Physiology, Storage and Testing

- In maize, SVI I and SVI II including several root parameters were higher among hybrids. Further, 1000 seed weight was found to be positively correlated with seed vigour and seed yield.
- SSR marker, RM 228 was found to be unique for DRRH3 rice hybrid and can identify any potential contaminant from PSD1, PSD3, PRH10, NDRH2 and other thirty two rice varieties.
- RM81057, RM10103, RM9a2 were found to be the unique SSR markers for rice hybrid KRH-4 and RM9310, RM9106 for rice hybrid KRH-2 which can also be multiplexed.
- Pulsed Electromagnetic Field (PEMF) treatment @ 50 Hz & 100 Hz improved germinability and vigour in tomato and green gram respectively.
- Among the seeds of rice, onion, soybean and sunflower stored in airtight polythene bags (700 gauge) along with desiccant beads (Zeolite beads/silica gel), the seed quality attributes were recorded at their maximum even after 6 months of storage and least insect infestation was observed.
- Groundnut seeds (off shell) stored in polythene bags (700 gauges) along with the 20% CO_2 (v/v) concentration maintained higher viability upto 6 months of storage period.
- A total of 85 demonstrations of hydro-priming technology were organized at farmer's field across the centres and farmers were convinced upon this low cost technological intervention for maximizing the yield.

C. Seed Pathology

- Standard Blotter method is best suited technique for detection of *Alternaria carthami* associated with safflower. Maximum counts of infected seeds was recorded on 5 days incubated seeds at 22-24°C placed on top of wet blotters under alternate cycles of 12 hr. dark and 12hr light periods provided by 40W tube lights.
- False smut (*Ustilaginoidea virens*) is a potential threat in paddy seed production, foliar application of propiconazole @ 0.1% at boot stage resulted in maximum disease control.

- Standard blotter method for detection of *Macrophomina phaseolina, Fusarium oxysporum and Colletotrichum dematium* (*C. truncatum*) associated with moongbean, urdbean and soybean was found to be most suited detection technique.
- Seed wash technique was identified as a relatively quick method for detection of surface adhered spores of *Alternaria burnsii*, causal agent of blight in cumin.
- Effective prevention of transmission of *Alternaria carthami* from seed to plant was achieved through seed treatment with Thiram + Carbendazim (0.15% each) or Thiram + Carboxin (0.15% each).
- For ecofriendly management of early blight of tomato, seed dressing with bioagent *Trichoderma harzianum* @ 10g /Kg seed has been found promising under conditions of Uttarkhand and Himachal Pradesh having higher seed germination with least association of *Alternaria solani*.

D. Seed Entomology

- Various new insecticides evaluated against major storage insect-pests damaging cereals and pulse seeds, were found to be at par with Deltamethrin (Decis 2.8 EC) @1.0 ppm and provided control of infestation in cereals and pulses under different agro-climatic conditions up to 6 to 9 months.
- Paddy seed treated with insecticides and stored in moisture impervious bags like super grain bags maintained seed germination above IMSCS with appreciable control of insect infestation up to 6 months period in coastal region.
- Bee pollination was found to play a major role in improving quantity of seed produced in berseem.
- CO_2 concentration of 50% (v/v) provided effective protection against *Khapra* beetle in wheat, rice weevil in paddy, groundnut beetle in groundnut and pulse bruchid in green gram, pigeon pea and chick pea without affecting seed quality up to 6-9 months of storage.
- Insecticide impregnated bags were highly effective in management of storage insects of wheat, paddy, maize, chickpea and green gram and maintained seed germination above IMSCS up to 8-10 months of storage (except maize).
- Various botanicals were tested along with emamectin benzoate and deltamethrin and was found that *Acorus calamus* TNAU formulation @ 10 ml/kg seed was on par with insecticidal seed treatment up to three months of storage.
- Emamectin benzoate, spinosad and deltamethrin were found highly effective against groundnut pod borer as they provided complete protection upto 3-6 months and maintained seed germination above IMSCS.

E. Seed Processing

- Standardization of sieve sizes for processing of recently released varieties of chickpea, wheat, sunflower hybrids, pigeonpea, sunhemp, fieldbean and green gram was done and the recommended sieve sizes are as follows:

Crop	Variety /cultivars	Recommended screen size
Chickpea	Desi	5.00 mm (S)
	Kabuli	5.5 mm (S)
Wheat		2.30 mm (S)
		2.75 mm (S)
Sunflower	Hybrid KBSH 44	2.80 x 20 mm (S)
Red gram	BRG 2	5.00 (R)
Sun hemp	Co 1	7.00 mm (R)
Field bean	HA 4	5.50 mm (R)
Green gram	BGS 9, Basanti, Satya, MH 421	2.4 mm (R)

- The use of combine harvester at 5 cm height of cutter bar from ground level and at 12% moisture content along with 500 rpm drum speed is found most economical and effective for maintaining seed quality during harvesting and threshing of soybean.
- Insect damaged seed can be effectively separated by needle separator which resulted in reduction of insect damaged seed to the tune of 57.1%.
- In case of soybean, sun drying for 20 h was found highly economical compared to heated air drying in reducing moisture from 33.93 % to safe level without affecting seed quality.

Awards and Publications under AICRP-NSP (Crops)

In reference to recognitions, scientists / cooperating centres received five awards / merit certificates for excellence in agricultural research and development activities, and published 70 research papers related to seed science and technology in national / international peer reviewed journals.

Extension Activities

Imparting field level training and practical exposure to field staff and farmers engaged in seed production programme are being taken up by different centres. Several extension activities like exhibitions,

Sl. No.	Centre	No. of Training	Exhibition/ *Kisan Mela*	Research Paper	Awards
1	PAU, Ludhiana	2	2	5	1
2	PDKV, Akola	12	2	3	-
3	AAU, Anand	4	3	11	2
4	JAU, Jamnagar	-	2	3	-
5	IGKV, Raipur	2	1	2	-
6	TNAU, Coimbatore	6	-	-	-
7	ANGRAU, Hyderabad	5	1	12	-
8	UAS, Bengaluru	13	3	7	11
9	UAS, Raichur	3	1	3	-
10	BSKKV, Dapoli	3	-	2	-
11	JNKVV, Jabalpur	10	2	10	-
12	DSR, Mau	4	2	12	2
	Total	**64**	**19**	**70**	**16**

kisan melas, *kisan goshtis*, field day, demonstration have been conducted by several cooperating centres. In order to create the required scientific manpower and to enhance the expertise and skill of the existing scientific staff, the STR centres were entrusted with the task of conducting training programmes under human resource development (HRD). This would certainly boost the quality and quantity of the seed and would help to increase the seed replacement rate (SRR) in different crops.

Monitoring: Monitoring teams for different zones (Northern, Eastern, Western, Central and South Zone) constituted during the last workshop have visited different centres and the observations made by different monitoring teams have been presented in Annexure I. Project Director has also monitored the progress of BSP and STR research activities.

Seed Production in Agricultural Crops

During the year 2013-14, total production of quality seed including all classes was 648325 quintals against the target of 475179 quintals. Production comprises 94953 quintals of breeder seed, 144369 quintals of foundation seed, 163465 quintals of certified seeds, 172351 quintals of truthfully labelled seed and 73185 quintals of planting material of field crops. In addition, 155.59 lakhs planting material and 5.60 lakh tissue culture plantlets of field crops were produced against the targets of 94.80 and 2.07 lakhs.

2 कार्यकारी सारांश

वर्ष 2014–15 की अवधि में निदेशालय ने बीज प्रौद्योगिकी संबंधी अनेक आधारभूत, व्यवहारिक, सामरिक एवं अपेक्षित शोध कार्यों में संलग्न रहते हुए दो अति महत्वपूर्ण राष्ट्रव्यापी परियोजनाओं का सफल संचालन एवं समन्वयन कार्य संपादित किया। इस अवधि में राष्ट्रीय बीज परियोजना के अन्तर्गत प्रजनक बीजों का उत्पादन अपने रिकार्ड स्तर 89266.23 कुन्तल तक पहुँच गया साथ ही कृषि फसलों की बीज उत्पादन परियोजना के तहत 6.48 लाख कुन्तल विभिन्न फसलों के गुणवत्ता युक्त बीज उत्पादन की सम्भावना है।

निदेशालय द्वारा वर्ष 2014–15 में कुल 25 वैज्ञानिकों के साथ 20 शोध परियोजनाओं का संचालन किया गया तथा विभिन्न फसलों के लगभग 121.50 कुन्तल गुणवत्ता युक्त बीज का उत्पादन एवं प्रसंस्करण करके स्थानीय कृषकों को उपलब्ध कराया गया। शोध परियोजनाओं के परिणाम स्वरूप अनेक कृषकोपयोगी बीज उत्पादन, भण्डारण, शुद्धता निर्धारण संबंधी तकनीक विकसित की गयी। क्षेत्र के लिए अधिक उपज देने वाली अनुकूल फसल प्रजातियों की संस्तुति, धान एवं गेहूँ बीज उत्पादन के लिए फसल ज्यामिति एवं पोषक तत्व प्रबंध, पूर्वी उत्तर प्रदेश में संकर धान के बीज उत्पादन हेतु तकनीकी का विकास, पौधों के जमाव, आरम्भिक विकास एवं ओज में वृद्धि के लिए बीज प्रारम्भन एवं बीज लेपन तकनीक का उपयोग, बीज शुद्धता निर्धारण के लिए अणुजैविक तकनीकों का परिष्करण, बीज ओज एवं ब्रुचिड अवरोधिता हेतु क्यूटीएल मैपिंग आदि महत्वपूर्ण उपलब्धियाँ इस अवधि में अर्जित की गयीं। वर्ष के दौरान प्राप्त शोध उपलब्धियां निम्नानुसार हैं।

- विभिन्न धान, कपास एवं सूरजमुखी की संकर प्रजातियों का उनके पैतृकों के साथ माइक्रो सेटेलाइट एसएसआर मार्कर द्वारा आनुवंशिक शुद्धता का जीनोमिक स्तर पर मापन किया गया। जिसमें ज्यादातर बैन्डस मोनोमार्फिक पाये गये। जो कि जीनोम की समरूपता को इंगित करते हैं।
- धान के बीज ओज हेतु क्यूटीएल मैपिंग तैयार किया गया जिससे पैदा हुए प्रथम चरण के बीज को जीकेवीके कैम्पस बैंग्लूर स्थित निदेशालय केन्द्र पर आफ सीजन पौधशाला के माध्यम से द्वितीय चरण के बीज में परिवर्तित किया गया। प्रथम चरण के बीजों में ही आकारिकी गुणों में विभिन्नता का उनके पैतृकों से तुलनात्मक अध्ययन किया गया जिसमें प्रजातीय स्तर पर मात्रात्मक गुणों में विभिन्नता पायी गयी है।
- गेहूँ में सोर्स सिंक मैनुपुलेशन द्वारा बीज उपज में सुधार हेतु जिब्रैलिक अम्ल–3 के 100 पीपीएम का पर्णीय छिड़काव बीज संख्या, जैविक उपज 1000 बीज वजन एवं बीज उपज बढ़ाने में सार्थक स्तर पर प्रभावी पाया गया।
- अरहर के बीजों में सामान्य जल, अकार्बनिक लवण पोटैशियम नाइट्रेट (0.2 प्रतिशत) एवं पादप वृद्धि नियंत्रक जिब्रैलिक अम्ल–3 (100 पीपीएम) से 12 घंटे तक बीज प्रारम्भन करने से बीजों के जमाव, पौध की लम्बाई, शुष्क भार एवं ओज में सार्थक स्तर पर वृद्धि पायी गयी है। प्रयोग किये गये प्रारम्भन कारकों में से जिब्रैलिक अम्ल–3 सर्वाधिक प्रभावी पाया गया।

- बीज प्रारम्भन हेतु प्रयोग किये गये जिब्रैलिक अम्ल–3, अकार्बनिक लवण पोटैशियम नाइट्रेट व सामान्य जल में, जिब्रैलिक अम्ल–3 जमाव सम्बन्धी इन्जाइमों की सक्रियता में सर्वाधिक प्रभावी रहा जबकि नाइट्रेट संश्लेषण एवं एन्टी ऑक्सीडेन्ट सम्बन्धी इन्जाइमों की सक्रियता पर पोटैशियम नाइट्रेट सर्वाधिक प्रभावी रहा। उपरोक्त प्रारम्भन कारकों का धनात्मक प्रभाव पौधे की लम्बाई एवं विभिन्न उपज कारकों पर भी पाया गया।
- गेहूँ में बुवाई हेतु बीज दर कम करने हेतु सस्य तकनीकों का संसाधन किया गया जिसमें बुवाई हेतु निर्धारित अन्तरावकाश 22.5 x 10 सेमी. एवं 22.5 x 7.5 सेमी का प्रभाव : बाली की लम्बाई, बीज के वजन एवं प्रति बाली बीजों की संख्या पर, अन्तरावकाश 22.5 x 7.5 सेमी. एवं 22.5 x 5 सेमी. की तुलना में अच्छा पाया गया।
- जीरो टिलेज पद्धति प्रचलित टिलेज एवं उथली क्यारी पद्धति की तुलना में सार्थक स्तर तक बीजों की उपज बढ़ाने में अच्छी पायी गयी है। आर्थिक दृष्टिकोण से भी जीरो टिलेज अन्य विधियों की तुलना में उपयोगी पायी गयी है।
- चने के जड़ गलन हेतु उत्तरदायी मैक्रोफामिना फैजियोलीना, राइजोक्टोनिया सलनाई, चने के उकठा रोग हेतु उत्तरदायी फ्यूजेरियम ऑक्सिस्पोरम, एफ एसपी साइसेराई, धान के फाल्स स्मट हेतु उत्तरदायी स्टीलैगिनाइडिया वायरेन्स एवं धान के ब्लास्ट हेतु उत्तरदायी मग्नोपार्थिग्राइसी के प्रति इन्टागोनेस्टिक प्रभाव प्रदर्शित करने वाले 9 ग्राम निगेटिव जीवाणुओं की पहचान की गयी है।
- दक्षिण भारत के विभिन्न एनएससी बीज गोदामों में किये गये कीटनाशक प्रतिरोधिता सम्बन्धी सर्वेक्षणों से ज्ञात हुआ है कि कीटनाशक डेल्टामेथरिन के प्रति कीड़ों में अधिक प्रतिरोधिता उत्पन्न हो गयी है। सर्वेक्षण में लिये गये विभिन्न बीज गोदामों में से सिकन्दराबाद पर राइजोपर्था डोमेनिका एवं ट्राइबोलियम कास्टेनियम में सर्वाधिक प्रतिरोधिता पायी गयी है जबकि न्यूनतम प्रतिरोधिता राइजोपर्था डोमेनिका में बेंग्लूरू केन्द्र पर एवं ट्राइबोलियम कास्टेनियम में कोयम्बतूर केन्द्र पर पायी गयी है।
- अरहर की फसल में उत्पादन लागत हेतु किये गये अध्ययन में ज्ञात हुआ है कि बीज उत्पादन में अन्न उत्पादन की तुलना में 23 प्रतिशत अधिक लागत लगती है। जबकि पूर्ण प्रतिफल बीज उत्पादन में अन्न उत्पादन की तुला में 32 प्रतिशत अधिक होता है। इस प्रकार बीज उत्पादन का शुद्ध प्रतिफल लगभग 44 प्रतिशत अन्न उत्पादन की तुलना में ज्यादा आता है और किसान बीज उत्पादन करके अधिक लाभ कमा सकते हैं।

वर्ष 2014–15 में निदेशालय स्तर पर चल रहे विभिन्न शोध परियोजनाओं के अतिरिक्त निदेशालय द्वारा निम्न राष्ट्रीय स्तर की परियोजनाओं का समन्वय एवं निगरानी का कार्य पूरे देश में सफलता पूर्वक किया गया है।

1. अखिल भारतीय समन्वित शोध परियोजना– राष्ट्रीय बीज परियोजना (फसल)
2. सस्य फसलों की बीज उत्पादन परियोजना

परियोजनानुसार महत्वपूर्ण उपलब्धियाँ निम्नलिखित हैं:–

अखिल भारतीय समन्वित शोध परियोजना– राष्ट्रीय बीज परियोजना (फसल)

I. प्रजनक बीज उत्पादन

वर्ष 2013–14 में प्रजनक बीजों का उत्पादन 84788.60 क्विंटल मांग के सापेक्ष 89266.23 क्विंटल के स्तर तक पहुँच गया है। फिर भी जलवायु अनियमितता के कारण कुछ फसलों में थोड़ा बहुत कम उत्पादन का अवलोकन किया गया है।

II. बीज अनुसंधान प्रौद्योगिकी

अ. बीज उत्पादन एवं प्रमाणीकरण

- धान के संकर पौधों में नर पैतृक पौधों को मिश्रित पद्धति से लगाने पर वैकल्पिक पद्धति की अपेक्षा बीज उपज में सार्थक स्तर पर अधिक उत्पादन प्राप्त होता है।
- मेढ़ों पर गेहूँ के बीज फसल को 150:75:50 एनपीके/हेक्टेयर तथा जिंक सल्फेट 10 किग्रा/हे. के साथ लगाने से सर्वाधिक बीज उपज एवं उसकी गुणवत्ता में वृद्धि पायी जाती है।
- सूरजमुखी के संकर प्रभेद डीआरएसएच 1 में जिंक का पर्णीय छिड़काव करने से 22.76 प्रतिशत की बीज उपज में वृद्धि प्राप्त होती है।
- धान, सूरजमुखी, मक्का, अरहर तथा जूट में संकर बीजों के उत्पादन के लिए वैकल्पिक क्षेत्रों को चिन्हित किया गया है।
- डीआरआरएच–3 में संकर बीज का उत्पादन श्री विधि से करने पर 16.05 प्रतिशत की वृद्धि पायी गयी है।
- टमाटर में सकर बीज उत्पादन हेतु खुले की अपेक्षा छायादार घर की दशा बीज उपज एवं बीज गुणवत्ता के संदर्भ में उपयुक्त पायी गयी है।
- सूरजमुखी, ज्वार, मक्का एवं बाजरा में संकर बीज उत्पादन हेतु वैकल्पिक रोपण खिड़की की पहचान की गयी है।
- संकर धान केआरएच–4, एमएएस 26, केएमपी 175 एवं राशी वायुवीय दशा में अधिक बीज उपज देती हैं जोकि सीधी बुवाई हेतु संस्तुत की गयी हैं।

ब. बीज कार्यिकी भण्डारण एवं परीक्षण

- मक्के के विभिन्न संकर किस्मों में बीज ओज प्रथम एवं द्वितीय जिसमें विभिन्न जड़ लक्षण शामिल हैं अधिक पाये जाते हैं साथ ही 1000 दाने के वजन का धनात्मक सम्बन्ध बीज ओज एवं बीज उपज में पाया गया है।
- संकर धान डीआरआरएच–3 के एसएसआर मार्कर आरएम 228 धान की 32 प्रजातियों में मिलावट को पहचानने हेतु उपयुक्त पाया गया है।

- संकर धान सी.ओ.आर.एच. 4 हेतु आर.एम. 515, के.आर.एच. 4 हेतु आर.एम. 81057, आर.एम. 10103 एवं के आर.एच. 2 हेतु आर.एम. 9310, आर.एम. 10103 एवं के आर.एच. 2 हेतु आर.एम. 9310, आर.एम. 9106 एस.एस.आर. मार्कर उपर्युक्त पाये गए है।
- पल्स इलेक्ट्रोमैगनेटिक फील्ड का 50 एवं 100 हर्ज का उपचार टमाटर एवं मूँग के जमाव एवं ओज में वृद्धि कारक पाया गया है।
- वायु रहित पालीथीन बैग में धान, प्याज, सोयबीन एवं सूर्यमुखी के बीजों को डेसीकैन्ट बीड्स के साथ भण्डारण करने पर छः माह बाद भी अच्छा जमाव, अच्छा बीजगुणवत्ता एवं रोगों तथा कीटों का प्रकोप कम पाया गया।
- मूँगफली के बीजों को 20 प्रतिशत कार्बन–डायक्साइड सांद्रता के साथ पॉलीथीन बैग में भण्डारित करने से छः माह तक बीजों की जीवन्तता बनी रहती है।
- जल प्रारंभन पर विभिन्न फसलों में कुल 85 प्रक्षेत्र प्रर्दशन विभिन्न सहयोगी केन्द्रों पर किये गए हैं।

स. बीज रोग विज्ञान

- मानक स्याहीचट विधि कुसुम के साथ जुड़े अल्टरनेरिया कार्थेमी कवक का पता लगाने के लिए सबसे उपयुक्त तकनीक है। 5 दिवसीय मानक ब्लाटर पत्र तकनीक चक्र में 22.44^0 से तापमान पर गीला ब्लॉटर्स के शीर्ष पर 12 घंटे प्रकाश के आभाव तथा 12 घंटे 40 वाट के ट्यूबलाईट प्रकाश में रख कर गणना करने पर अधिकतम संक्रमित बीज लेख्यांकित किये गए।
- धान बीज उत्पादन कमी में आभासी कंडुवा रोग (आस्टिलैगोनोय्डी वायिरेंस) एक संभावित खतरा है। बाली आने के पहले (पत्रांक प्रस्फुटन) के समय 0.1% प्रोपिकोनाजोल के छिड़काव से अधिकतम नियंत्रण किया जा सकता है।
- सोयाबीन के मक्रोफोमिना फैजोलिना, फ्यूजेरियम आक्सीस्पोरम तथा कोलेटोट्रिकमडीमयटियम (सी. ट्रंकटम) के पहचान के लिए मानक ब्लाटर पत्र तकनीक अत्यधिक उपयुक्त है।
- जीरा पौधे में अंगमारी के लिए उत्तरदायी अल्टरनेरियाबर्नसाई के जीरा के बीज की सतह में चिपके बीजाणुओं की त्वरित पहचान के लिए बीज प्राक्षालन तकनीक पहचान की गयी।
- बीज से पौधे के मध्य में संचरित अल्टरनेरियाकार्थेमी की रोकथाम के लिए थीरम+कार्बेन्डाजाइम (0.15% प्रत्येक) अथवा थाईरम+कर्बोक्सीन (0.15% प्रत्येक) द्वारा बीज उपचार प्रभावी पाया गया।
- पर्यावरण के अनुकूल टमाटर की अगैती अंगमारी के प्रबंधन के लिए जैब नियंत्रक ट्राईकोडर्मा हारजिएनम (10 ग्रा/किग्रा) द्वारा बीज प्रसाधन से उत्तराखंड व हिमाचल प्रदेश में उच्च बीज अंकुरण प्रतिशत (81.5%) तथा निम्न अल्टरनेरियासोलेनाई (2%) का सक्रमण दर्ज किया गया।

द. बीज कीट विज्ञान

- समस्त नवीन कीटनाशकों एवं मानक रसायन (डेल्टा मैथ्रीन) जिनका मूल्यांकन खाद्य एवं दलहनी फसलों के बीजों के भंडारण कीट के प्रबंधन के लिए किया गया, उनमें एमामेक्टिन बेन्जोएट (प्रोक्लेम

5 SG) 2 ppm (40 मि.ग्रा./कि. बीज) के दर से, स्पाइनोर्सेड (ट्रेसर 45 SC) 2 ppm (4.4 मि.ग्रा./कि. बीज) के दर से प्रयोग उपरांत परिणाम डेल्टामेथ्रीन (डेसिस 2.8EC) 1.00 ppm के दर से प्रयोग करने जैसा ही प्राप्त हुआ। इन तीनो कीटनाशकों ने खाद्य एवं दलहनी फसलों के बीजों को विभिन्न कृषि जलवायु परिस्थितियों में 6 से 9 माह तक कीटों से सुरक्षा प्रदान की।

- कीटनाशक उपचारित धान बीज जो नमी अभेद्य पदार्थ जैसे सुपर ग्रेन बेग में भंडारित किये गये थे। उनमें मानक (IMSCS) अनुसार बीज जमाव एवं प्रर्याप्त कीट सुरक्षा बरकरार रहा।
- मधुमक्खी परागण बरसीम बीज उत्पादन की वृद्धि में प्रमुख भूमिका निभाता है।
- कार्बन्डाइऑक्साइड (CO_2) की 50 प्रतिशत (c/v) सान्द्रता में भंडारित गेहूँ खपरा बीटल से, धान घुन से, मूँगफली बीटल से तथा मूँग, अरहर व चना ब्रुकीड से 6.9 माह तक सुरक्षित रहता है। इस सांद्रता पर इन फसलों के बीजों के बीज जमाव पर भी इसका कोई दुष्प्रभाव नहीं पाया गया।
- तीन प्रकार के कीटनाशक व्याप्त बैगों [(a) उपचारित बैग, परतबंद रहित अस्तर रहित (b) उपचारित बैग, अनुपचारित परतबन्द, अनुपचारित अस्तर (c) उपचारित बैग, उपचारित परतबन्द, उपचारित अस्तर] और टाट के बोरों के तुलना में किया गया।
- विभिन्न प्रकार के वानस्पति जैसे एकोरस कालामस TNAU सूत्रीकरण वाइटेक्स मेगुण्डो पत्ती पाउडर, लेण्टाना कैमरा पत्ती पाउडर एवं सिट्रोनेला तेल क्रमशः 10 मि.ली./कि. बीज, 10 ग्राम/कि. बीज 10 ग्राम/कि. बीज व 5 मि.ली./कि. बीज के दर से प्रयोग कर एमामेक्टिन बेन्जोएट व डेल्टामेथ्रीन के तुलना में परखे गये। भण्डारण के 3 माह तक TNAU सूत्रीकरण का प्रभाव कीटनाशक बीज उपचार के बराबर पाया गया।
- एमामेक्टिन बेन्जोएट, स्पाइनोसैड और डेल्टामेथरिन को मूंगफली पौड बोरर के विरूद्ध बहुत प्रभावी पाया गया है। इससे 3 से 6 माह तक पूर्ण सुरक्षा प्रदान होता है।

य. बीज प्रसंस्करण

- चना, गेहूँ, संकर सुरजमूखी, अरहर, पटसन, फिल्डबीन और मूंग के निर्गत प्रभेदों के लिए चलनी माप का मानकीकरण किया गया जो निम्नवत है।

फसल	प्रभेद	अनुसंसित चलनीमाप
चना	देशी	5.00 मिमी.(एस)
	काबुली	5.5 मिमी.(एस)
गेहूँ		2.30 मिमी.(एस)
		2.75 मिमी.(एस)
सूरजमुखी	संकर केबीएसएच 44	2.80 x 20 मिमी.(एस)
अरहर	बीआरजी 2	5.00 मिमी.(आर)
पटसन	सीओ 1	7.00 मिमी.(आर)
फिल्डबीन	एचए 4	5.50 मिमी.(आर)
मूंग	बीजीएस 9, बसंती, सत्या, एमएच 421	2.4 मिमी.(आर)

- सोयाबीन की मशीन द्वारा फसल कटाई जिसमें कटर बार की ऊंचाई जमीनी स्तर से 5 सेमी और 500 आर.पी.एम. ड्रम गति के साथ–साथ 12% नमी पर कटाई करना बीज की गुणवत्ता बनाए रखने के लिए सबसे किफायती और कारगर होता हैं।
- कीट क्षतिग्रस्त बीज का विभाजन सुई विभाजक विधि द्वारा प्रभावी ढंग से किया जा सकता है। इससे करीब 57.1 प्रतिशत क्षतिग्रस्त बीज को अलग किया जा सकता है।
- सोयाबीन के संदर्भ में 20 घंटे के लिए धुप में सुखाना बीज की गुणवत्ता को प्रभावित किए बिना नमी को 33.93% से सुरक्षित स्तर तक कम करने में गर्म हवा से सुखने की तुलना में अत्यधिक किफायती पाया गया।

पुरस्कार और प्रकाशन

विभिन्न सहभागी केन्द्रों व उनमें कार्यरत वैज्ञानिकों द्वारा 5 पुरस्कार/मेरिट सर्टिफिकेट कृषि अनुसंधान एवं विकास गतिविधियों में उत्कृष्ट कार्य हेतु प्राप्त किये गये हैं। साथ ही बीज विज्ञान एवं तकनीकी से सम्बन्धित विशिष्ट समीक्षात्मक राष्ट्रीय एवं अन्तर्राष्ट्रीय पत्रिकाओं में 70 शोध पत्र भी प्रकाशित किये है।

प्रसार गतिविधियां

विभिन्न सहभागी केन्द्रों द्वारा बीज उत्पादन कार्यक्रम में लगे हुए सार्वजनिक क्षेत्र के कर्मियों एवं किसानों को प्रक्षेत्र स्तर के प्रशिक्षण दिये जाते रहे हैं। विभिन्न प्रसार गतिविधियों जैसे–प्रदर्शनी, किसान मेला, किसान गोष्ठी, प्रक्षेत्र दिवस, प्रदर्शन भी विभिन्न केन्द्रों द्वारा समय–समय पर आयोजित किये गये हैं। मानव संसाधन विकास कार्यक्रम के अन्तर्गत बीज विज्ञान विज्ञान एवं प्रोद्योगिकी एवं बीज उत्पादन के क्षेत्र में मानव शक्ति के सृजन एवं कार्यरत वैज्ञानिकों के कौशल में वृद्धि करने हेतु तकनीकी एवं वैज्ञानिक प्रशिक्षण कार्यक्रम आयोजित किये गये। उपरोक्त कार्यक्रमों से बीज की उपलब्धता एवं गुणवत्ता में सुधार होने के परिणामस्वरूप बीज बदलाव दर में वृद्धि होना अपेक्षित है।

क्र.सं.	केन्द्र	प्रशिक्षण की संख्या	प्रदर्शनी/किसान मेला	शोध पत्र	पुरस्कार
1	पीएयू, लुधियाना	2	2	5	1
2	पीडीकेवी, अकोला	12	2	3	-
3	एएयू, आनन्द	4	3	11	2
4	जेएयू, जामनगर	-	2	3	-
5	आईजीकेवी, रायपुर	2	1	2	-
6	टीएनयू, कोयम्बतूर	6	-	-	-
7	एएनजीआरएयू, हैदराबाद	5	1	12	-
8	यूएएस, बैंगलौर	13	3	7	11
9	यूएएस, राईचुर	3	1	3	-
10	बीएसकेकेवी, धपोली	3	-	2	-
11	जेएनकेवीवी, जबलपुर	10	2	10	-
12	डीएसआर, मऊ	4	2	12	2
	योग	**64**	**19**	**70**	**16**

निगरानी : देश के विभिन्न क्षेत्रों (उत्तर, पूरब, पश्चिम, मध्य एवं दक्षिण जोन) हेतु गठित निगरानी समितियों द्वारा आवंटित क्षेत्रों में निगरानी कार्य सम्पन्न किये गये तथा समितियों द्वारा लिये गये प्रेक्षणों का संक्षिप्त विवरण परिशिष्ट–1 में दिया गया है। साथ ही परियोजना निदेशक द्वारा भी स्वतः सभी प्रजनक बीज उत्पादन केन्द्रों एवं बीज तकनीकी अनुसंधान केन्द्रों के निगरानी का कार्य किया है।

भा.कृ.अनु.प. बीज परियोजना

वर्ष 2013–14 में कुल 648325.00 कुन्तल गुणवत्तायुक्त बीज का उत्पादन निर्धारित लक्ष्य 475179.00 कुन्तल के विरूद्ध किया गया जिसमें 94953.00 कुन्तल प्रजनक बीज, 144369.00 कुन्तल आधारीय बीज, 163465.00 कुन्तल सत्यापित बीज, 172351.00 कुन्तल विश्वसनीय बीज एवं 73185.00 कुन्तल प्लांटिंग मैटेरियल विभिन्न फसलों के पैदा हुए। इसके अतिरिक्त 155.59 लाख प्लांटिंग मैटेरियल एवं 5.60 लाख टिसु कल्चर प्लांटलेट निर्धारित लक्ष्य 94.80 एवं 2.07 लाख के विरूद्ध भी पैदा किये गये।

1 Research Programmes and Achievements

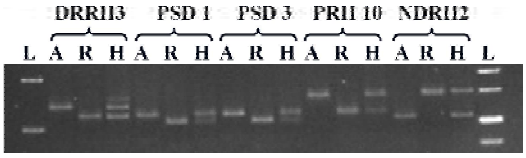
1.1 Directorate of Seed Research, Mau

1.1.1 Seed Molecular Biology

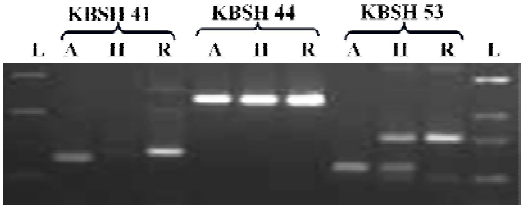
1.1.1.1. Assessment of genetic purity in major crops including hybrids through molecular tools and techniques

Molecular Characterization of Paddy, Cotton and Sunflower Hybrids Using Microsatellite SSR Markers

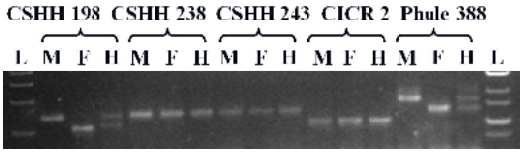
Assessment of genetic purity is one of the most important quality control components in seed production. Traditionally, it has been the practice to carry out a grow-out test (GOT), based on morphological traits, for assessment of purity of seeds. GOT is time consuming (takes one full growing season for completion), space demanding and often does not allow the unequivocal identification of genotypes. Molecular markers (Simple sequence repeat markers) for differentiating five major paddy hybrids and its parental line cultivated in Uttar Pradesh, five cotton hybrids released for cotton leaf curl virus resistant characteristics (close kinship phenotypic characters- difficult to perform through GOT) and three major sunflower hybrids cultivated in India have been used in the present investigation.



Molecular characterisation of paddy hybrids & its parental lines using SSR marker



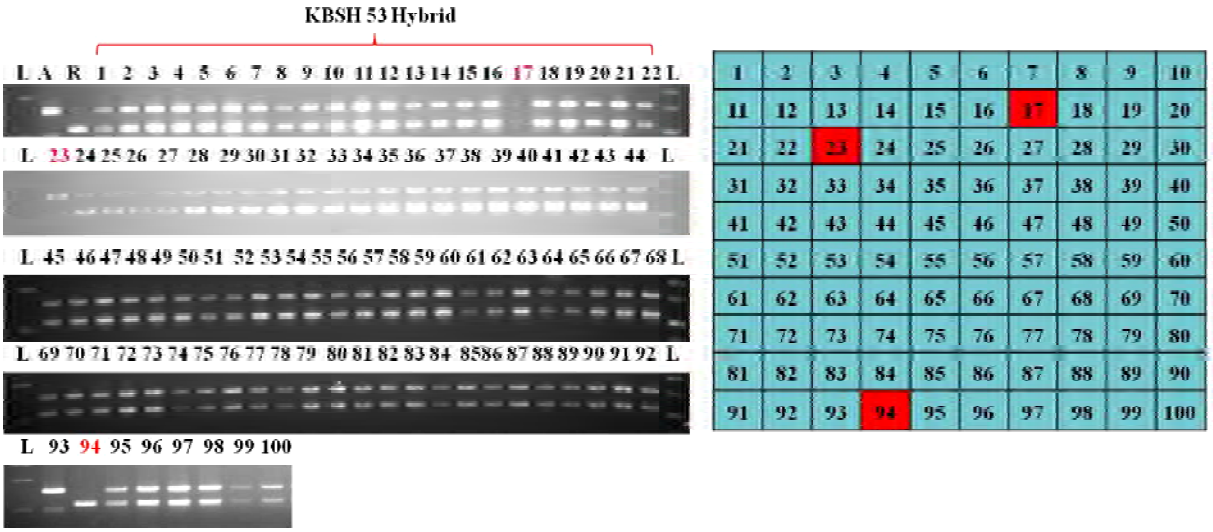
Molecular characterisation of cotton hybrids & its parental lines using SSR marker



Molecular characterisation of sunflower hybrids & its parental lines using SSR marker

- Molecular characterization of five paddy hybrids (DRRH3, PSD1, PSD3, PRH10 and NDRH2), five cotton hybrids (CSHH 198, CSHH 238, CSHH 243, CICR2 and Phule 388) and three sunflower hybrids (KBSH 41, KBSH 44 and KBSH 53) along with their parents were done using breeder seed to assess the genetic purity by using microsatellite SSR marker at genomic level. Most of the bands are found to be monomorphic across the genotypes tested, indicating substantial homogeneity in respect to the genome and loci tested.
- Three SSR markers (RM228, CM42 and ORS 811) showed amplification of an allele, which was very specific and unique to a particular parental line and not amplified in any other parental line or hybrid tested. The dendrogram generated using the data, also confirmed close kinship among the hybrid and their parents while both were found to be grouped separately with each

other. It also showed that the hybrids are near or having similar distance from both the parents which indicates true blend of both the parents.



Genetic Purity Testing of Sunflower hybrids and its parental lines using SSR marker

- Thus, these SSR markers are found to be the effective and alternative tool against the conventional Grow Out Test (GOT) and has immense potential to reduce the cost and time required for estimation of genetic purity in paddy, cotton and sunflower hybrids. Using cultivar specific and trait specific SSR molecular markers, one can estimate the hybrid purity and genetic purity in the commercial seed lots of KBSH 53 sunflower hybrid. It is also mentionable that there is ample scope to identify more sunflower hybrids through use of sunflower specific SSR markers.

1.1.1.2. QTL mapping for seed vigour in rice (Oryza sativa)

In the in-house project entitled "QTL Mapping for Seed Vigor in Rice (*Oryza sativa* L.)", crossing among genetic divergent parent's for high and low vigour trait to generate recombinant inbred lines (RILs) population were carried out during *Kharif*-2014 at ICAR-DSR, Mau. A total of 294 (Table no. 1 and Fig. 1) F_1 seeds of rice were generated from the cross GP 74×IR36, GP 74×IR64, IR36×GP 74 and IR 64×GP 74.

Table 1. F_1 seeds generated from four crosses for seed vigour in rice

Total Number of Crosses Involved	Number of plants used for emasculation	Number of Panicles emasculated and pollinated	Number of F_1 Seed produced
GP 74× IR36	25	35	82
IR36×GP 74	20	30	107
GP 74×IR64	25	35	49
IR64×GP 74	20	30	56
Total	**90**	**130**	**294**

Further, the F_1 seeds generated have been advanced to F_2 segregating population in off season nursery (*Rabi*-2015) at seed production centre ICAR-DSR, GKVK campus Bangalore. The morphological data on prominent basal leaf: sheath colour (brownish colour) (Fig. 2 and 2a), number of tiller per plant, leaf colour, leaf margin colour (dark brown colour), robustness etc. in F_1 plants were recorded and same has been compared with its parents. The prominent basal leaf: sheath colour (brownish colour) and leaf margin colour (dark brown colour) will serve as the morphological markers to identify the Recombinant Inbreed Lines (RILs) population in future. Further, for confirmation of hybridity through molecular marker; leaf samples of all F_1 and its parents have been collected for further analysis.

Fig. 1. Crossing of high and low vigour parents at ICAR-DSR, Mau

Germination tests (5th interval) of 155 rice germplasm lines were conducted during 2014-15. Present investigation revealed that, variance due to genotype was significant for vigour traits. Further, the observations on ten quantitative traits (days to 50 % flowering, plant height, length of upper most internodes, panicle length, number of spikelet per panicle, flag leaf length, flag leaf width, number of panicles per plant, number of tillers per plant and test weight) were recorded. Variance due to genotype was significant for all the quantitative traits studied indicating the presence of larger variations in the germplasm. Test weight ranged from 9.9 to 32.8g with the mean of 23.2g. Correlation of test weight with plant height, panicle length and flag leaf length was positive and significant and was negative with number of panicles and number of tillers.

Fig. 2. F_1 seed has been advanced to F_2 segregating population during off season (*Rabi*-2015) at seed production centre ICAR-DSR, GKVK campus Bangalore.

Fig. 2a. Prominent basal leaf: sheath color (brownish color) and leaf margin colour (dark brown colour) prominent basal leaf: sheath and leaf margin are colourless

Earlier identified markers which are reported to be linked with seed vigour trait QTLs, including minor and few major QTLs of seed vigour traits were selected for validation of marker-trait association. The phenotyping of 155 germplasm lines of rice has completed and found that, variance due to genotype was significant for vigour traits. Further leaf samples of 155 germplasm lines has been collected and stored in deep freeze (-80°C).

TZ test was carried out to test viability of identified two low vigour lines *viz.*, GM-100 (Acc. No. 3118) GM-73 (Acc. No. 2693) and along with three high vigour cultivars *viz.*, IR 36, IR 64 and HUR 105. The results revealed that, all germplasm lines showed viable except GM-100 (Acc. No. 3118).

1.1.1.3. Molecular mapping of quantitative trait loci (QTL) for bruchid resistance in chickpea (*Cicer arietinum* L.)

215 chickpea accessions and 23 varieties from International Crops Research Institute for the Semi Arid Tropics (ICRISAT), Patencheru, Hyderabad, India were received through SMTA under Multilateral System of the ITPGRFA. Three bruchid species were procured from IARI, New Delhi. All the 238 chickpea accessions were visually observed for different seed morphological characteristics such as seed type, seed colour, seed shape, seed testa texture and seed ribbing. Screening of chickpea accessions against three species of bruchid namely *Callosobruchus chinensis, C. maculatus, C. analis* has been completed. The identified resistant (acc.no.4418, 2242 and BG372) and the susceptible varieties (acc.no. 7668, 2580 and 9848) are being used for developing RILs.

Phenotyping of germplasm and released varieties for qualitative and quantitative traits (including seed size, No. of seed per pod, No. of pods per plant, 100 grain weight etc.) has been carried out. The identified resistant (acc.no.4418, 2242 and BG372) and the susceptible varieties (acc.no. 7668, 2580 and 9848) have been staggeredly sown in pots for making crosses. Crosses have been effected between resistant and susceptible lines.

1.1.2 Seed Physiology Storage and Testing

1.1.2.1. Studies on gibberellins in regulation of source-sink relations in wheat under different moisture regime

Improvement in seed yield through source-sink manupulations in wheat

The experiment was initiated with three treatments of foliar spraying of gibberellic acid including control along with two varieties of wheat and two moisture levels in split plot design replicated three times at DSR farm during past *rabi* season.

There are two major processes involved in the realization of seed yield, the production of photosynthates in the leaves and utilization of these photosynthates by the developing seeds. Any alterations in source activity through external interventions results in corresponding change in seed number and weight in a given unit area. The principle could be moulded favourably by external application of growth hormones.

The technical programme of the project was as under :

(A) Foliar spraying of gibberellic acid (GA_3) at anthesis stage :

1. Control (No. spraying)
2. Spraying of GA_3 @ 50 ppm
3. Spraying of GA_3 @ 100 ppm

(B) Wheat varieties :

V1- Raj 3765

V2- HI-1563

(C) Moisture level :

M1- Normal (5 irrigation)

M2- Deficient (2 irrigation)

Plot Size - 6 x 4 (metre)

Replication – 03

The observations on germination, vigour, growth parameters yield attributes have been recorded. On the basis of observations it was found that there was no effect of treatments on germination, seedling growth and vigour indices since the treatments were applied at anthesis stage of the crop only. Among the varieties, HI 1563 displayed the higher value for germination, speed of germination, seedling length, vigour index I and vigour index II over Raj 3765.

On the basis of observations recorded at the harvest it was evident that spraying of GA_3 at the time of anthesis significantly increased the number of seed/spike, biological yield, 1000 seed weight and grain yield over control. The influence of GA_3 @ 100 ppm was more as compared to GA_3 @ 50 ppm. The values obtained in seed number, 1000 seed weight and grain yield were higher under normal

moisture condition. Variety HI 1563 displayed the higher mean values over Raj 3765 in almost all the characters studied.

Studies on gibberellins in regulation of source-sink relations in wheat under different moisture regime

Observations prior treatment application

Variety	Germination	Seedling length	Seedling dry weight (in mg.)	Vigour index 1	Vigour index 2
V1-HI 1563	98.7	38.97	169.0	3846.33	16680.3
V2-Raj 3765	98.0	37.76	165.0	3700.48	16170.0
sMean	**98.35**	**38.36**	**167.0**	**3773.41**	**16425.15**
SE±	1.275	2.161			
CD at 5%	5.483	9.245			
CV %	1.643	7.07			

Plant height (cm)

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	90.17	88.88	**89.525**	86.32	84.02	**85.17**
T2 Spraying of GA_3@50 ppm	90.43	91.02	**90.725**	88.27	87.25	**87.76**
T3 Spraying of GA_3@100 ppm	92.75	91.26	**92.005**	92.92	90.48	**91.7**
Mean	**91.12**	**90.39**		**89.17**	**87.25**	
	SE±			CD		
Treatment (T)	1.77			4.98		
Variety (V)	0.41			1.49		
V× T	1.81			4.99		
Irrigation (I)	1.65			3.56		
T x I	2.89			6.19		
V x I	2.28			4.99		
T x V x I	3.99			8.68		

No. of tillers

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	5.4	4.8	**5.1**	4.2	4.1	**4.2**
T2 Spraying of GA_3@50 ppm	6.0	5.5	**5.7**	5.5	4.7	**5.1**
T3 Spraying of GA_3@100 ppm	6.3	6.2	**6.3**	6.1	5.3	**5.7**
Mean	**5.9**	**5.5**		**5.3**	**4.7**	
	SE±			CD		
Treatment (T)	0.67			1.81		
Variety (V)	0.41			2.05		
V× T	0.50			1.36		
Irrigation (I)	0.41			0.88		
T x I	0.69			1.50		
V x I	0.57			1.23		
T x V x I	0.98			2.11		

Spike length (cm)

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	9.58	9.53	**9.56**	8.84	8.50	**8.67**
T2 Spraying of GA_3@50 ppm	9.91	9.75	**9.83**	9.56	9.34	**9.45**
T3 Spraying of GA_3@100 ppm	11.12	10.66	**10.89**	10.09	9.73	**9.91**
Mean	**10.21**	**9.98**		**9.49**	**9.19**	
		SE±			**CD**	
Treatment (T)		0.53			1.42	
Variety (V)		0.20			0.75	
V× T		0.36			0.89	
Irrigation (I)		0.22			0.48	
T x I		0.39			0.77	
V x I		0.31			0.64	
T x V x I		**0.51**			**1.10**	

No. of Seeds/spike

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	38.59	38.32	**38.455**	38.00	36.97	**37.485**
T2 Spraying of GA_3@50 ppm	40.83	39.17	**40**	38.41	38.21	**38.31**
T3 Spraying of GA_3@100 ppm	41.72	41.20	**41.46**	40.99	38.83	**39.91**
Mean	**40.38**	**39.57**		**39.14**	**38.01**	
		SE±			**CD**	
Treatment (T)		0.81			2.07	
Variety (V)		2.08			8.82	
V× T		2.21			6.19	
Irrigation (I)		1.47			3.18	
T x I		2.49			5.40	
V x I		2.07			4.42	
T x V x I		3.50			7.60	

1000 Seed weight (g)

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	37.94	36.91	**37.43**	35.48	33.22	**34.35**
T2 Spraying of GA_3@50 ppm	39.24	38.71	**38.98**	39.03	38.6	**38.82**
T3 Spraying of GA_3@100 ppm	45.15	40.02	**42.58**	42.92	39.95	**41.44**
Mean	**40.78**	**38.55**		**39.15**	**37.26**	
		SE±			**CD**	
Treatment (T)		0.99			2.69	
Variety (V)		0.81			3.34	
V× T		0.94			2.52	
Irrigation (I)		0.98			2.11	
T x I		1.70			3.61	
V x I		1.37			2.98	
T x V x I		2.38			5.12	

Biological yield (kg/plot)

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	17.19	14.93	**16.06**	15.91	14.55	**15.23**
T2 Spraying of GA_3@50 ppm	18.15	18.02	**18.08**	17.84	16.08	**16.96**
T3 Spraying of GA_3@100 ppm	19.55	19.23	**19.39**	18.97	18.93	**18.95**
Mean	**18.29**	**17.39**		**17.58**	**16.52**	
	SE±			CD		
Treatment (T)	1.53			4.20		
Variety (V)	0.75			3.10		
V× T	1.30			3.53		
Irrigation (I)	0.80			1.72		
T x I	1.39			2.97		
V x I	1.11			2.42		
T x V x I	1.91			4.17		

Grain yield (kg/plot)

Treatment/variety	Moisture level					
	I1			I2		
	V1	V2	Mean	V1	V2	Mean
T1 Control	5.8	5.4	**5.6**	5.5	5.3	**5.4**
T2 Spraying of GA_3@50 ppm	6.2	6.1	**6.15**	5.9	5.8	**5.85**
T3 Spraying of GA_3@100 ppm	7.5	6.7	**7.1**	6.9	6.3	**6.6**
Mean	**6.5**	**6.0**		**6.1**	**5.8**	
	SE±			CD		
Treatment (T)	0.80			2.21		
Variety (V)	0.34			1.29		
V× T	0.37			0.89		
Irrigation (I)	0.47			0.96		
T x I	0.78			1.61		
V x I	0.63			1.31		
T x V x I	1.08			2.25		

V_1: HI- 1563, V_2: Raj-3765, T_1: Control, T_2: Spraying of GA_3 @ 50ppm, T_3: Spraying of GA_3 @ 100 ppm, I_1: Normal (05 Irrigation), I_2: Deficient (02 Irrigation)

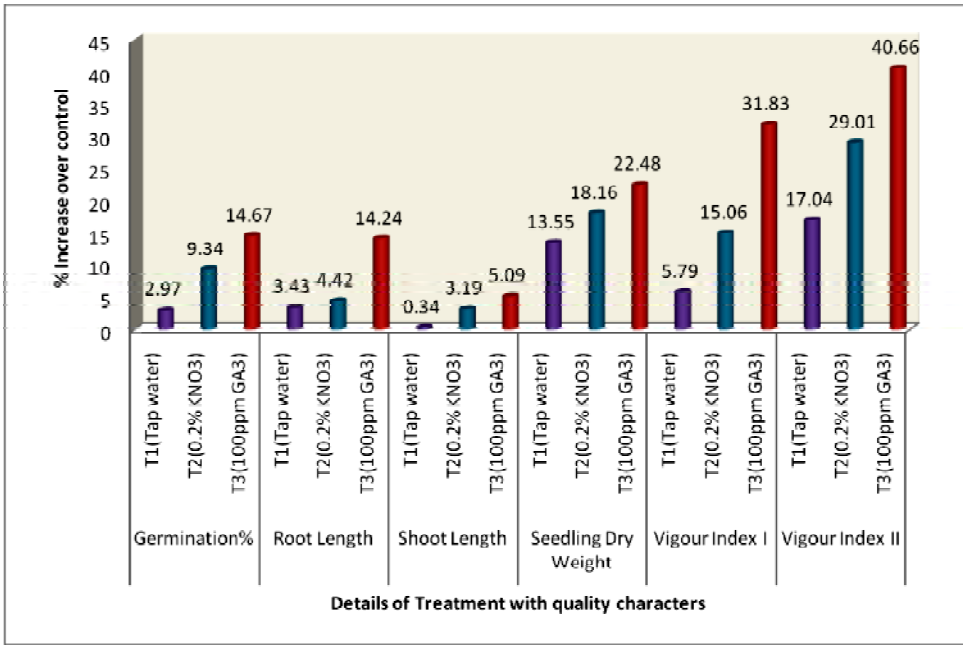
1.1.2.2 Seed enhancement in pigeon pea

The project "Studies on seed priming induced physico-chemical and isozyme changes and its effect on crop performance in pigeon pea (*Cajanus cajan* L)" was conducted as per the approved technical programme in four consecutive years (2010-2014) with two pigeon pea varieties namely Malviya 13 and Bahar. The observations were recorded under lab and field conditions on germination, shoot and root length, seedling dry weight and vigour indices indicated

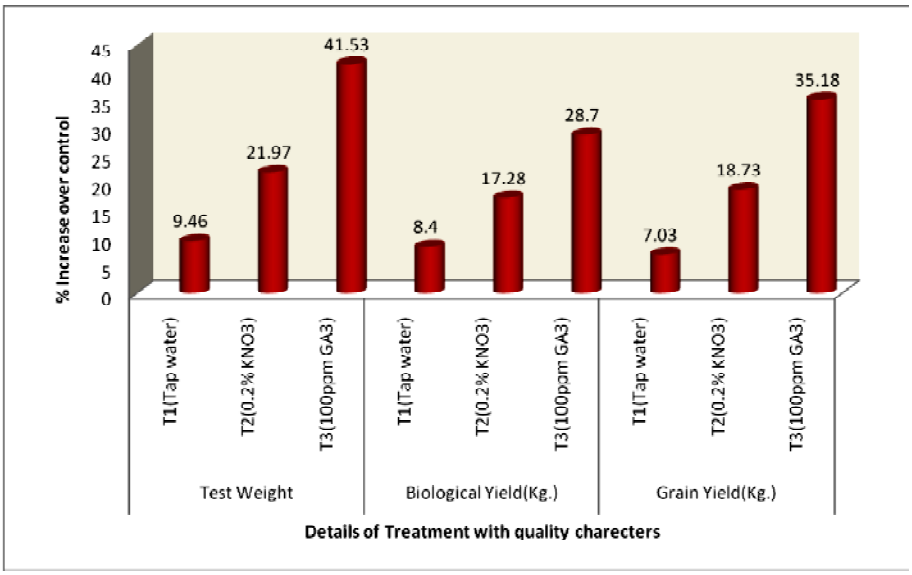
Seeds are the platforms to deliver high end technologies to the farmers. Various Seed quality enhancement strategies including priming, pelleting and coating has the potential to suitably bolster the seed germination and vigour and thereby culminating in better plant stand and seed yield. By utilization of plant hormones and other inorganic salts, seed germination and seedling emergence can favourably be altered.

that seed priming with tap water, inorganic salt KNO_3 (0.2%) and plant growth regulator, GA_3 (100 ppm) for 12 h. significantly enhanced the aforesaid characters over unprimed control. The highest germination was recorded in the seeds primed with GA_3 followed by KNO_3 and tap water.

Seedling growth including shoot and root length was more influenced with the priming of GA_3 over KNO_3 and tap water priming. The vigour indices like vigour index I & II was also enhanced more with GA_3 priming followed by KNO_3 and tap water.

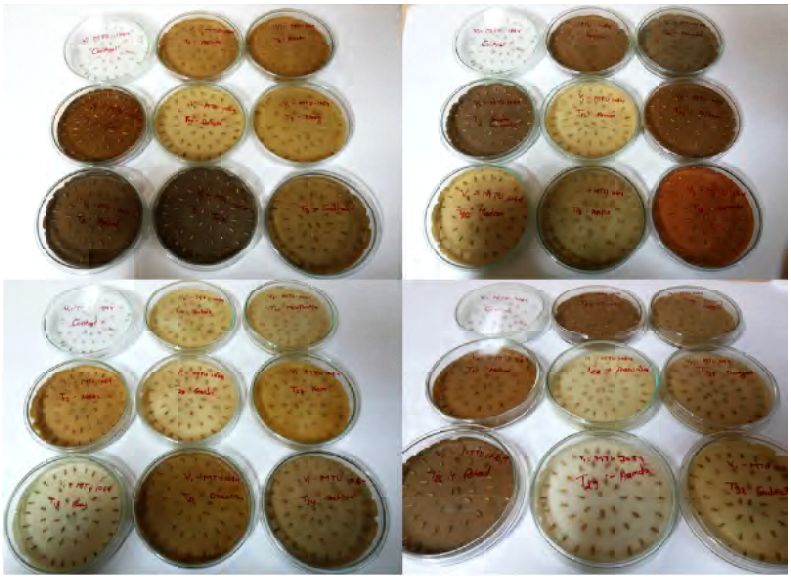


Germination enzymes including α-amylase and protease were assayed following standard procedures during germination and indicated that GA_3 priming influences more activity of these germination enzymes as compared to KNO_3 and tap water over unprimed control. Nitrate assimilatory enzymes including nitrate and nitrite reductase were assayed in the fresh leaves of germinating seedlings using standard methods. Data recorded revealed that nitrate assimilatory enzymes were more influenced by KNO_3 priming, as compared to GA_3 and tap water over control. The similar trend was observed in chlorophyll a and b contents. Proline accumulation in the leaves of pigeon pea varieties was significantly reduced by the treatments applied over unprimed control, however the reduction was minimum with KNO_3 priming since it is an inorganic salt that enhances the solute accumulation in the plant system and thereby showing relatively higher proline content as compared to priming with tap water and GA_3. The anti oxidant enzymes including catalase, peroxidase and super oxide dismutase were assayed using the respective standard methods in growing seedlings. The observations recorded indicates that among the priming agents used, KNO_3 enhanced relatively more activity of catalase, peroxidase and super oxide dismutase over unprimed control. Priming with inorganic salts and plant growth regulator showed the improvement in plant height and yield attributes including no. of branches,no. of pods, test weight, biological yield and finally grain yield in both the varieties evaluated. Among varieties, Bahar displayed higher values for all the parameters studied.



Seed enhancement through use of botanicals

Green leaves of thirty two (32) plants of varying species were collected, dried and grinded to make leaf powder of each plant separately and were used to prepare leaf extracts with water in 1:10 (w/v) ratio involving 08 hours continuous shaking. Effect of all 32 leaf extracts were tested on paddy variety MTU-1064 and the result obtained revealed that maximum germination enhancement was in paddy seeds treated with *Panica granatum* L., *Dalbergia sisso, Carissa carandas, Bambuseae, Ficus sycomorus* and *Syzygium cumini* over untreated control. List of botanicals leaf extracts used and their responses with respect to germinationof paddy variety MTU-1064 is as under:



Seed enhancement in rice through use of leaf extracts

S.No.	Common Name	English Name	Botanical Name	Germination %
1.	Control	Untreated Seed (MTU-1064)		78
2.	Bael	Wood Apple	*Aegle marmelos*	70
3.	Peepal	Bio-Tree	*Ficus religiosa L.*	58
4.	Ashoka	Ashoka Tree	*Saraca asoca*	76
5.	Datura	Sacred Datura	*Datura wrightii*	38
6.	Tulsi	Holy Basil	*Oscimum tenuiflorum*	82
7.	Neem	Indian Lilac	*Azudiracta Indica*	80
8.	Bhang	Bhang	*Cannabis sativa*	48
9.	Gudhal	Hibiscus	*Hibiscus rosa sinensis L.*	00
10.	Amrood	Guava	*Psidium guajava*	72
11.	Madar	Calotropis	*Calotropis procera*	58
12.	Sahjan	Drum stick	*Moringa oleifera*	76
13.	Anaar	Pomegranate	*Panica granatum L.*	82
14.	Arjun	Arjun Fruit	*Terminalia arjuna*	64
15.	Chichda	Prickly Chaff	*Achyranthes aspera*	56
16.	Shisam	Indian Rose wood	*Dalbergia sisso*	80
17.	Karonda	Karoda	*Carissa carandas*	82
18.	Neebu	Lemon	*Citrus limon L.*	70
19.	Baas	Bamboo	*Bambuseae*	80
20.	Gulaab	Rose	*Rosa rubiginosa*	62
21.	Lahsun	Garlic	*Allium astivum L.*	70
22.	Dhaicha	Sesbania	*Sesbania bispinosa*	00
23.	Mor Pankhi	Oriental thuja	*Thuja orientalis*	76
24.	Aam	Mango	*Mangifera Indica L.*	72
25.	Sahtoot	Mulberry	*Morus nigra*	20
26.	Makoi	Black night shade	*Solanum nigrum*	04
27.	Pakad	Fig tree	*Ficus sycomorus*	80
28.	Jamun	Jambul	*Syzygium cumini*	82
29.	Aawala	Emblic	*Phyllanthus emblica L.*	74
30.	Aamda	Ambarell/Ambade	*Spondias dulcis*	58
31.	Carry patta	Curry leaf tree	*Murraya koenigii*	76
32.	Bargad	Banyan	*Ficus benghalesis*	70
33.	Gulmohar	Gulmohar	*Delonix regia*	54

1.1.2.3 Studies on the impact of priming agents on the improvement of physiological parameters and their relationship with seed yield in chickpea (*Cicer arietinum* L.)

Objectives

- To increase crop stand through seed priming.
- To assess the effect of GA_3- priming and *Rhizobium*- coating on quality and seed yield in chickpea.
- To assess the effect of growth regulators on the improvement of physiological parameters linked with increase in seed yield.

Priming Agents Used

- GA_3 @ 100 *ppm* for 8-12 hours
- Culture of *Rhizobium ciceri* obtained from NBAIM, Mau

Seven diverse varieties of chickpea were primed with GA_3 and with known strain of *Rhizobium ciceri*. The GA_3 concentration (100 ppm) was used for priming. *Kabuli* chickpea varieties CSJK 21 and PUSA 1088 were soaked in 100 ppm solution of GA_3 for 8 hours, while three *desi* varieties BGD 72, PUSA 362 and RSG 807 were dipped in GA_3 solution for 10 hours and the rest two dwarf *desi* varieties KGD 11 and JG 11 were dipped in GA_3 solution for 12 hours. Before coating of Rhizobium culture, all the seeds of 7 varieties were thoroughly washed in distilled water and were then coated with *Rhizobium ciceri* with the help of carboxy methyl cellulose media and charcoal. The experiment was sown in the conserved residual moisture of rice plot in R.B.D. with 3 replications in plot size of 10.80 sq. mt each.

Highest increase in yield in GA_3 primed seed in case of dwarf chick pea variety KGD 11 was recorded over the control (29.45%) followed by JG 11 (28.18%). The gain in GA_3 primed seed in case of other three varieties viz; RSG 807, PUSA 362 and BGD 72 was 9.2 %, 2.29% and 0.16 %, respectively.

S.N.	Variety	Days to heading in control (in days)	Seed yield in control based on 3 rep. (in gm)	Seed yield in GA_3-primed based on 3 rep. (in gm)	Per cent gain in GA_3 –primed over control
1.	KGD 11	80	6180	8000	29.45 %
2.	JG 11	74	6280	8050	28.18 %
3.	PUSA 362	74	7870	8050	2.29 %
4.	BGD 72	80	6080	6090	0.16 %
5.	RSG 807	80	6520	7120	9.2 %
6.	CSJK 21(K)	76	5410	5890	8.87 %
7.	PUSA 1088(K)	75	5990	6220	3.84 %

1.1.2.4 Enhancing Seed Quality Parameters in rice and soybean with Smoke Water

Under in-house project "Enhancing Seed Quality Parameters in Rice and soybean with Smoke Water" the smoke water was prepared from burning of wheat straw as well as from burning of paddy straw as per the method of Baxter *et. al.*, (1994) with minor modifications. Seeds of the GP-74, a low vigour rice germplasm line, were used for the current study. Different dilutions of both the smoke waters were tested in three replications each to standardize the optimum dilution for the physiological response germination/seedling growth. Based on these

In some plant species existential needs have led to evolution of seeds that respond to fire related germination cues such as smoke which has the potential to break dormancy and stimulate germination. Use of smoke water as a seed priming agent is being tried world over in a number of crops to enhance germination and seedling vigour.

studies, a 750 fold dilution of paddy straw derived and 1000 fold dilution of wheat straw derived smoke water showed maximum response compared to the distilled water being used as control. Further physiological and biochemical studies will be conducted using these dilutions.

1.1.3 Seed production and certification

1.1.3.1. Devising agro-techniques for reducing the seed rate of wheat

Studies on optimization of planting density of wheat

Seed is one of the costliest inputs in farming. Saving the quantity of seed used per unit area without affecting the total productivity is a very important researchable issue in resource poor situations. Experimenting different crop geometry in tandem with growth hormones and different doses of fertilizers, allows optimising the seed rate per unit area while maximizing the quantity and quality of farm output.

Wheat is one of the most important cereal crops of India. India is now the second largest wheat producer in the world next to China. The massive increases in production of wheat became possible by wide spread adoption of improved technology, appropriate agro-techniques, suitable variety, optimum sowing time and judicious water and fertilizer management. In India wheat production is required to be enhanced to 109 million tones by 2025 AD from the present level of 92.46 million tones. Among various approaches to achieve this, larger coverage of wheat area under quality seed sowing appears to be effective as quality seed alone can enhance crop productivity by 15-20%.

Area coverage under quality seed can be enhanced either through increased production of quality seed or by reducing the seed rate for sowing of wheat. As enhanced seed production would require additional and other resources, reduced seed rate appeared to be more feasible for achieving greater spread of quality seeds. Recommended seed rate for wheat sowing varies from 100 to 120 kg/ha. However, sowing with seed drills effectively saves 25-30% of the seed by uniform placement of seeds at proper depth in the soil. Further, if effective tillers/hill could be raised to 3-4 from existing 1-2 through the use of growth regulators at par yields can be achieved even at half of the recommended seed rate. This would effectively enhance the seed replacement rate to enable us to raise wheat production in country.

Seed rate for wheat is recommended to be 100-120 kg/ha in order to ensure optimum crop stand and remunerative yield. In view of poor seed replacement rate (32%) for wheat, seed rate is required to be effectively reduced through suitable agro-techniques capable of ensuring synchronous effective tillering in greater number under crop conditions.

Treatments

The experiment was conducted during *Rabi* season at research farm of ICAR-Directorate of Seed Research, Mau, UP. The sandy loam soil of the experimental field had 0.33% organic carbon, 215.0 kg/ha available nitrogen, 13.5 kg/ha available phosphorus and 184.0 kg/ha available potassium

with pH 7.7 during 2013-14, respectively. There were 27 treatment combinations comprised of three spacing (22.5x10 cm, 22.5x7.5 cm and 22.5x5 cm) and three genotypes treatments (HD 2733, PBW 550 and PBW 502) in the main plots and three growth regulators (control, GA_3 and IAA 100 ppm) in the sub plots were tested in three times replicated split plot design. The net plot size was 8.0 m x 3.0 m respectively. The recommended dose of NPK fertilizer for wheat crop was 120:60:50:25 kg/ha, using urea (46% N), diammonium phosphate (46% P_2O_5 and 18% N), muriate of potash (62% K_2O) and zinc sulphate (21%) as a source of fertilizers. Full dose of P, K and $ZnSO_4$ along with half of N were applied as a basal at the time of sowing and remaining N was applied in 2 splits at crown root initiation (CRI) and ear initiation (EI) stages of the crop during the year of experimentation. The first irrigation was given 20-25 days after sowing and the second 40-45 days after sowing, thereafter the fields were irrigated every 15-20 days until the end of the season for a total of six irrigations. Seeds were sown on December 14, 2013-14. Wheat was harvested in second fortnight of April 2014.

Findings

The data pertaining to plant height of wheat (Table 2) showed that spacing 22.5 x 5.0 cm increased the plant height (80.86 cm) and number of tillers/m row length (69.67) significantly increased as compared to spacing 22.5 x 7.5cm (78.03 cm 76.19 cm) and 22.5 x 10 cm (59.59 and 53.83) at harvesting stage. Among the different genotypes PBW 502 recorded significantly higher values of plant height (81.97 cm) and number of tillers/m row length (66.60) as compared to PBW 550 and HD 2733. Seed treated with GA3 and IAA significantly increased the plant height over control. Maximum plant height (80.03 cm), number of tillers/ plant (5.96) and number of tillers/m row length (63.20) were recorded with GA_3.

Table 2: Growth and yield attributes of wheat affected by different spacing, genotypes and growth regulators

Treatments	Plant Height (cm) at harvest	No. of tillers/ plant at harvest	No. of tillers/ m row length at harvest	Spike length (cm)	Seed weight/ spike (g)	Test weight (g)	No. of seed/ spike	Spikelet /spike	Processed Seed yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest Index
Seed Rate (kg/ha)												
50 kg/ha	76.19	5.76	53.83	10.55	1.99	35.45	53.90	18.88	35.03	61.63	96.66	36.10
75 kg/ha	78.03	5.20	59.59	10.21	1.87	34.89	51.85	19.33	41.43	68.30	109.73	37.85
100 kg/ha	80.86	5.08	69.67	10.03	1.71	34.75	51.03	18.81	38.55	72.59	111.14	34.58
Sem+	0.99	0.17	1.47	0.10	0.05	0.75	0.75	0.15	1.26	1.18	1.74	0.94
LSP P=0.05	2.94	0.49	4.41	0.29	0.16	NS	2.24	0.46	3.77	3.54	5.23	NS
Genotypes												
HD 2733	74.83	5.00	54.66	9.51	1.68	35.31	46.39	19.01	35.75	62.15	97.90	36.33
PBW 550	78.28	5.19	61.83	10.59	1.82	34.27	51.63	18.69	38.33	70.52	108.85	35.20
PBW 502	81.97	5.85	66.60	10.69	2.07	35.51	58.76	19.32	40.93	69.85	110.79	37.01
Sem+	0.98	0.17	1.47	0.10	0.05	0.75	0.75	0.15	1.26	1.18	1.74	0.94
LSP P=0.05	2.94	0.49	4.41	0.29	0.16	NS	2.24	0.46	3.77	3.54	5.23	NS
Growth Regulators												
Control	76.79	4.19	56.57	9.98	1.81	34.48	51.02	18.89	35.95	65.93	101.87	35.53
GA_3	78.26	5.88	63.25	10.39	1.90	35.43	53.12	19.04	39.43	67.37	106.80	36.85
IAA	80.03	5.96	63.27	10.43	1.87	35.18	52.65	19.10	39.63	69.22	108.86	36.16
Sem±	0.58	0.35	1.37	0.09	0.02	0.17	0.39	0.04	0.73	0.58	1.27	0.23
LSP P=0.05	1.65	1.01	3.91	0.25	0.05	0.50	1.12	0.11	2.10	1.68	3.64	0.67

Results on yield attributes viz. spike length, seed weight/ spike, test weight and number of seed / spike of wheat were affected by spacing, genotypes and growth regulators have been presented in Table 3. It is evident from the data that spacing 22.5 x 10 cm and 22.5 x 7.50 cm have favorable effect on spike length, seed weight/ spike, test weight and number of seed / spike over spacing 22.5 x 7.50 cm and 22.5 x 5.0 cm. Among the genotypes yield attributes were increased with PBW 502 except spikelet/ spike which was significantly higher with PBW 550. Among growth regulator GA_3 recorded maximum spike length, seed weight/spike, test weight and number of seed/spike as compared to IAA.

Processed seed yield (41.43q) and harvest index (37.85) were significantly higher with spacing 22.5 x 7.50 cm as compared to 22.5 x 10 cm and 22.5 x 5.0 cm. Among the different genotypes PBW 502 recorded significantly higher processed seed yield as well as harvest index. Among all the treatments, IAA and GA_3 recorded significantly increase the processed seed yield (39.63 and 39.43 q) over control (35.95 q). Straw yield (72.59 q) and biological yield (111.14 q) were significantly higher with spacing 22.5 x 5.0 cm as compared to spacing 22.5 x 7.50 (68.30 and 109.73 q) and 22.5 x 10 cm (61.63 and 96.66 q). Among the different genotypes PBW 550 recorded significantly higher straw yield as compared to PBW 502 and HD 2733. The seed treated with GA_3 significantly increase the straw and biological yield over all other treatments.

Data pertaining to seed quality parameters in seed of wheat have been presented in Table 3. Significant improvement in the seed quality parameters viz. germination (95.78 %), root length (21.36 cm), seedling length (35.06 cm), seedling dry weight (0.199 g), vigour index I (3365.50) and vigour index II (19.07) were significantly higher with spacing 22.5 x 10 cm as compared to spacing 22.5 x 7.50 cm and spacing 22.5 x 5.0 cm. Among the genotypes HD 2733 recorded significantly higher values of seed quality parameters viz. germination (97.04%), root length (21.64cm), shoot length

Table 3: Effect of spacing, genotypes and growth regulators of wheat on seed quality parameters

Treatments	Germination %	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Seedling dry weight (g)	Vigour Index I	Vigour Index II
Seed Rate (kg/ha)							
50 kg/ha	95.78	21.36	13.71	35.06	0.199	3365.5	19.07
75 kg/ha	94.48	20.60	14.00	34.60	0.197	3277.6	18.67
100 kg/ha	94.74	20.37	13.52	33.89	0.195	3217.1	18.56
Sem±	0.53	0.27	0.16	0.31	0.003	41.31	0.30
LSP P=0.05	NS	0.79	NS	0.94	NS	123.86	NS
Genotypes							
HD 2733	97.04	21.64	13.89	35.54	0.208	3453.8	20.19
PBW 550	92.15	20.02	13.56	33.57	0.184	3098.9	16.96
PBW 502	95.81	20.66	13.77	34.43	0.200	3307.5	19.15
Sem±	0.53	0.27	0.16	0.31	0.003	41.31	0.30
LSP P=0.05	1.57	0.79	NS	0.94	0.009	123.86	0.88
Growth Regulators							
Control	91.30	18.04	13.08	31.13	0.182	2841.9	16.62
GA_3	96.59	22.09	13.95	36.04	0.204	3483.9	19.73
IAA	97.11	22.19	14.19	36.38	0.205	3534.4	19.95
Sem±	1.14	0.84	0.21	1.04	0.005	136.50	0.66
LSP P=0.05	3.26	2.40	0.59	2.98	0.013	391.52	1.89

(13.89cm), seedling length (35.54cm), seedling dry weight (0.208 g), vigour index I (3453.79) and vigour index II (20.19) as compared to PBW 550 and PBW 502. The seed treated with GA_3 significantly increased the seed quality parameters viz. germination (97.11%), root length (22.19 cm), shoot length (14.19 cm), seedling length (36.38 cm), seedling dry weight (0.205 g), vigour index I (3534.40) and vigour index II (19.95) over all other treatments.

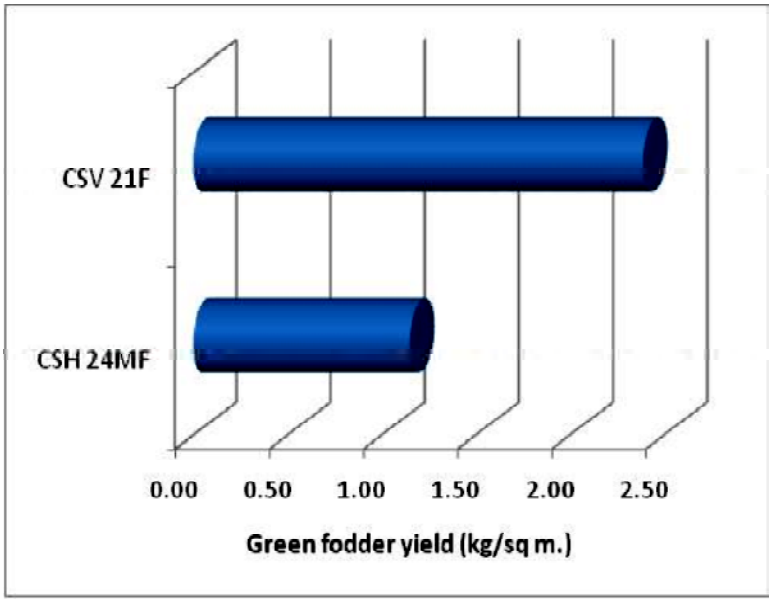
Fig. 3: Effect of growth regulators on growth and yield attributing character of wheat

Performance evaluation of high yielding sorghum cultivars in eastern India under staggered planting in the spring season

Objectives:

1. To assess the performance and stability of sorghum cultivars across environments (latitudes) under staggered plantings in spring season of eastern India.
2. To identify best genotype and planting date suitable to be planted in the spring season.

An exploratory trial on growing sorghum in Uttar Pradesh has been organized during summer (February & March sowings) season of 2015 to evaluate the growth and performance of various sorghum hybrids/varieties. The aim was to meet the demand for grain as well as good quality fodder through crops like millets including sorghum, in the regions with predominant scarcity of rains / irrigation water. This mid term report till June 2015 compiles the crop growth dynamics of sorghum cultivars across different dates of sowing. Fodder harvested from CSV 21 F and CSH 24 MF at flowering and sixty days after sowing respectively at MAU center indicates the higher green fodder yield from single cut fodder variety CSV 21 F (Fig 4).



1st Sowing (16-Feb-2015)	Fodder Cultivars SC - CSV 21F MC- CSH 24MF	• Single cut fodder variety was harvested at flowering stage. • Multi-cut fodder variety was harvested twice at 60 days after sowing and at 45 day after first cut.
	Grain Sorghum Cultivars KH– CSH 14, 16, 13 KV- CSV 17, CSV 27 R V– Phule Anuradha & Phule Revati	• All grain sorghum cultivars are at seed setting stage. • CSV 17, CSH 14 and CSH 16 are showing excellent performance and approaching physiological maturity.
	Sweet Sorghum Cultivar CSH 24 SS	• The sweet sorghum cultivar is at grain filling stage
2nd Sowing (03-Mar-2015)	Fodder Cultivars SC - CSV 21F MC- CSH 24MF	• Single cut fodder variety was harvested at flowering stage. • Multi-cut fodder variety was harvested once at 60 days after sowing. • After first cut nitrogen top dressing and irrigation was completed.
	Grain Sorghum Cultivars KH– CSH 14, 16, 13 KV- CSV 17, CSV 27 RV – Phule Anuradha & Phule Revati	• *Kharif* hybrids CSH 13, 14, 16 and Variety CSV 17 are at seed setting stage. • All other grain sorghum cultivars are at flowering stage & grain filling stage.
	Sweet Sorghum Cultivar CSH 24 SS	• The sweet sorghum cultivar is at flowering stage.

Fig. 5. Sorghum crop performance with the different dates of sowing.

3rd Sowing (18-Mar-2015)	Fodder Cultivars SC - CSV 21F MC- CSH 24MF	• Single cut fodder variety was harvested at flowering stage • Multi-cut fodder variety was harvested once at 60 days after sowing
	Grain Sorghum Cultivars KH– CSH 14, 16, 13 KV- CSV 17, CSV 27 RV – Phule Anuradha & Phule Revati	• Sorghum genotype CSV 17 being early is in milking stage • Kharif hybrids CSH 14 and CSH 16 are in flowering stage. Other genotypes are in boot and panicle initiation stage.
	Sweet Sorghum Cultivar CSH 24 SS	• The sweet sorghum cultivar is at boot leaf stage.

1.1.3.2. Impact of genotypes and conservation tillage on seed quality and productivity of wheat in the eastern-UP

Zero tillage or direct drilling is a method of cultivating crops without disturbing the soil through tillage. It saves the cost, labour and precious time particularly when planting window between two crops in a cropping sequence is very narrow. In Eastern U.P. conditions, use of late sown long duration paddy varieties at times leave very little opportunity for timely sowing of wheat.

The research project was started during *Rabi* 2012-13 with 18 treatment combinations of three tillage operations (Zero tillage, Conventional tillage and Raised Bed) and six genotypes (PBW 502, KRL-213, HD-2733, HD-2967, DBW-39 and PBW-550) in a split plot design with three replications.

The experiment was sown on 03.12.14 and KRL 210 genotype was replaced with PBW 502 due to poor performance during last 2 years of experimentation. The wheat was sown under ZT after spray of Glyphosate @ 0.5 kg a.i. ha^{-1} before sowing (2 days) at proper moisture, while CT/RB was sown as farmers' practises. CT wheat was sown with a tractor drawn seed drill using a seed rate of 100 kg/ha and a spacing of 22.5 cm and under RB 75 kg seed rate, 2 rows of wheat (30 cm apart), while under ZT plots, the crop was sown without any preparatory tillage using zero-till seed-cum-fertiliser planter and a seed rate of 100 kg/ha with a spacing of 22.5 cm. The recommended dose of N: P: K, 120:50:40 kg ha^{-1} was applied through urea (46% N), diammonium phosphate (46% P_2O_5 & 18% N) and MOP (60% K_2O). Full dose of P and K along with half of N were applied as a basal and remaining N was applied in 2 splits at crown root initiation (CRI) and ear initiation (EI) stages of the crop.

Zero tillage treatment recorded significantly higher growth and yield attributes (dry matter accumulation, tillers m^{-2}) as compared to CT and FIRB. However, plant height was more under CT. The yield attributes like spike length and grains/spike were more under FIRB system due to each and every row showed border effect resulting in higher yield attributes. Among the wheat genotypes HD 2967 recorded significantly higher growth and yield attributes followed by KRL 213 and DBW 39 and least in HD 2733.

The results on yield and economics were under progress for current season and during last year (2013-14) revealed that ZT practice effect significantly on yield (biological, seed and straw yield) as

Zero Tillage | Conventional Tillage | Raised Beds

well as harvest index as compared to CT and FIRB. The wheat genotypes i.e. HD 2967 recorded significantly higher biological, seed and straw. The maximum cost of cultivation was recorded under CT followed by FIRB and lowest in ZT. Gross return, net return and B: C ratio was highest under ZT followed by CT and FIRB. The saving in total cost of cultivation due to ZT was ₹ 8,800 and 6,000/ha as compared to CT and FIRB, respectively. However, under ZT saving cost of cultivation along with additional net return gain was ₹ 10,200/ha as compared to CT.

Seed, biological yield and economic of wheat as affected by different tillage and genotypes

Treatments	Seed yield (q/ha)	Biological yield (q/ha)	Cost of cultivation (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	BCR
Tillage methods						
ZT	47.8	98.2	22563	97594	75031	3.33
CT	43.8	93.5	29886	90856	60970	2.04
RB	34.3	76.8	26919	72530	45611	1.69
SEm±	1.19	0.99	-----	1590	1590	0.06
LSD P=0.05	4.7	3.9	-----	6242	6242	0.23
Genotypes						
KRL 213	42.4	87.5	26456	86764	60309	2.35
HD 2733	40.4	84.0	26456	82888	56432	2.19
PBW 550	39.9	88.5	26456	84137	57681	2.24
HD 2967	46.5	98.1	26456	95979	69523	2.71
KRL 210	42.4	91.5	26456	88387	61931	2.41
DBW 39	40.1	87.3	26456	83806	57350	2.23
SEm±	1.20	1.34	----	1883	1883	0.07
LSD P=0.05	3.5	3.9	----	5440	5440	0.20

The wheat genotype HD 2967 recorded highest gross return, net return and B:C ratio as compared to other genotypes. This was due to genotypes HD 2967 performs better under this agro-ecological condition and produced high seed yield.

1.1.3.3 Effect of various bioactive chemicals on traits favoring out crossing and their molecular characterization in hybrid rice (*Oryza sativa* L.)

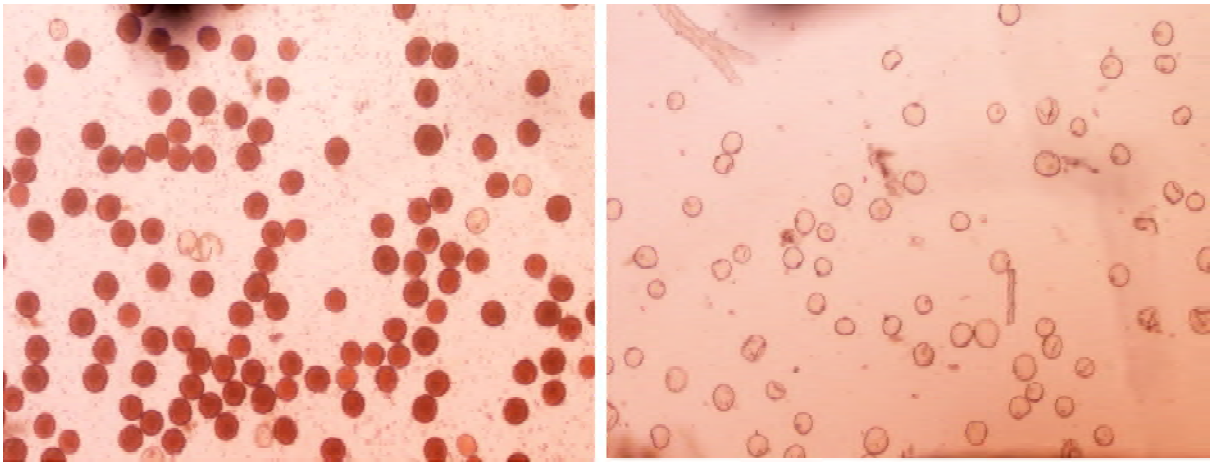
Hybrid rice is fast catching up in the country under the patronage of Government. Availability of quality hybrid seed is the major impediment in the fast expansion of the technology. Increasing the seed set and seed recovery % in hybrid rice seed production are the major needs to achieve this. Various responsible floral traits like flowering synchronization, and panicle exsertion can be suitably altered by application of growth regulators.

Among two hybrid parental lines PRH10 and DRRH2 (A and R line), two bioactive chemical in six different combination treatments *viz.*, T1 (Control), T2 (GA_3, 50 ppm), T3 (Chemical X, 1mM), T4 (Chemical X, 2mM), T5 (T2+T3) and T6 (T2+T4) were applied during 5-10% panicle emergence stage to study the morpho-physiological effect in response to different bioactive chemicals during *Kharif*-2014 at ICAR-Directorate of Seed Research, Mau. Various floral traits favouring out-crossing

viz. days to fifty percent flowering, panicle exsertion percentage, percent stigma exsertion, spikelet opening angle, number of spikelet per panicle, panicle length, flag leaf angle, number of panicles per plant, number of tillers per plant, percentage seed setting and yield per plant, days to maturity, plant height and test weight were recorded.

Pollen viability percentage in A (female) and R (male) lines of parents PRH10 and DRRH2.

Hybrid	Parental Lines	Viability (%)	Non-Viability (%)	Range
PRH10	A Line		100	
	R Line	87	13	84-91
DRR2	A Line		100	
	R Line	89	11	82-90



R-Line (Viable pollen grains) A-Line (100% Non-viable pollen grains)
Acetocarmine staining for pollen viability test

The result revealed that hybrid seed setting has increased by a range of 4-8% in both hybrids in all treatments over control. This increase in yield can be attributed by increase in the panicle exsertion (4-6%), stigma exsertion (4-10%), spikelet opening angle (2-4°) and flag leaf angle (2-5°). Among the treatments, T6 showed higher seed setting (6-8%) and stigma exsertion (8-10%) over control.

Nursery bed Rope pulling for maximising out-crossing

1.1.3.4 Comparative study of floral biology in CMS, chemically induced male sterile and protogynous (self incompatilble) lines of Indian mustard (*Brassica junceae*)

Mustard genotype (Pusa Bold), protogynous line and male sterile line (A line of NRCHB-506 hybrid) were sown during *Rabi* 2014-15 at ICAR-DSR Mau to revalidate the expression of male sterility during the season (earlier in 1st and 2nd year it was found that the expression of male sterility was not uniform in all plants). Comparative floral morphological traits *viz.*, Floral bud initiation, Anther length (mm), No. of pollen grains / bagged flower, Pollen fertility 1st day after flowering, 10th day after flowering, 15th day after flowering, 20th day after flowering and 25th day after flowering, Style length (mm), Time stigma receptivity and No. ovules/ flower among plants treated with surfactant and untreated plants have been recorded.

It was found that the flowering in plants treated with 3, 5 and 8% surfactant was delayed by 3, 5, and 6 days, respectively and the same has been compared with untreated plants where floral bud initiation occurred 35 days after sowing. The size of flowers in treated plants was slightly reduced and anthers of treated plants with 8 % surfactants were also reduced in size (1.4 mm) as compared to control (2.4 mm). Therefore, the reduction in anther size was directly proportional to the concentration of surfactant. Similarly, reduction in number of pollen grains per flower was also recorded and maximum reduction was in plants sprayed with 8% surfactant (13,900 pollen grains/ flower). Hence, all the treatments with surfactants were found to be quite effective in inducing pollen sterility.

Further, the pollen fertility was tested at regular intervals and it indicated that plants sprayed with 8% surfactant exhibited complete pollen sterility even after 25 days of treatment. However, 3% surfactant -treated plants after 15, 20 and 25 days exhibited only a slightly reduction in their pollen sterility (95.7, 83.5 and 82.5%, respectively). On the other hand, plants sprayed with 5% surfactant exhibited 94.1 and 92.5% pollen sterility after 20 and 25 days, respectively. The surfactant treated bagged flowers failed to produce any seeds which indicated the complete sterility but expression of male sterility was not uniform in all plants.

Further, in case of style length in the buds of treated plants with 8% surfactant, the maximum elongation (3.3 mm) of style was recorded, hence, style length in the buds is directly proportionate to the concentration of surfactant used. Due to increase in the size of the style, the stigma protruded out of all the buds of the inflorescence observed. The stigma of such floral buds was receptive between 8.00 am to 10.00 am among control plants, whereas, treated plants stigma showed receptivity between 7.25 to 10.10 am. The No. of ovules/flower and pollen-ovule ratio showed higher value among control plants as compared to treated plants. Similarly, seed set % was higher in 3 % and 5 % surfactants treated plants *i.e.* 93.96 % and 92.95 %, respectively as compared to control (90.53 %) plants.

Spray of 2% surfactant caused slight reduction in total yield/plant (23.57 g/plant) as compared to control (28.3 g/plant). The reduction in total yield/plant treated with 8% surfactant was very high (4.93 g/plant) owing to reduction in the seed size, seed weight and delay in recovery of plant growth after scorching effect.

In the Protogynous lines (Pg), the stigma exertion was more prominent than induced male sterile flowers. Further, results showed that, the protogynous interval extended up to 9-10 days and stigma

remained receptive up to 3-4 days from its protrusion. However, partial male sterility (30-45%) and closed type flowers (indehiscent in nature) were noticed in Pg lines.

Comparative floral morphology of treated and untreated plants

Character	Control plant	Surfactant treated plants		
		3%	5%	8%
Floral bud initiation	35	38	40	41
Anther length (mm)	2.4	2.0	1.9	1.4
No. pollen grains / bagged flower	31464	28590	16636	13900
Reduction in Pollen fertility				
1st day after flowering	-	0.00	0.00	0.00
10th	-	0.00	0.00	0.00
15th	-	4.3	0.00	0.00
20th	-	16.5	5.9	0.00
25th	-	17.5	7.5	0.00
Stylar length (mm)	2.00	2.13	2.62	3.30
Stigma receptivity Period	8.00am-10.00am	7.25am-10.10am		
No. ovules/ flower	20.00	17.00	14.00	11.00
Pollen – ovule ratio	1747:1	1682:1	1189:1	1166:1
Seed set (%)	90.53	93.96	92.95	88.52
Total yield/ plant (g)	28.3	23.5	17.00	4.93

1.1.3.5 Improving hybridization efficiency in castor through exogenous application of plant growth regulators

In the in-house project entitled "Improving hybridization efficiency in castor through exogenous application of plant growth regulators", sowing of parental lines (Female-JP 65 and Male- JI 96 of GCH-6 and Female- SKP84 and Male- SKI 205 of GCH-7) of two castor hybrid were done on 12.11.2014 at DSR, farm. However, due to low temperature during early phase of development and saline soil conditions, germination and plant establishment of these lines was poor which resulted in low hybrid seed production in both the hybrids. Hybrid seeds of GCH-7 and GCH-6 produced at DSR farm will be further utilized for genetic purity testing using isozyme markers.

1.1.3.6. Hydropolymers : As regulatory switch for germination and smart delivery system in hybrid seed production of maize

Regarding in-house project titled "Hydropolymers: As regulatory switch for germination and smart delivery system in hybrid seed production of maize", preliminary investigations on polymer coating efficiency in reference to maize seed germination regulation was initiated.

1.1.4 Seed protection

1.1.4.1. Bio-priming for seed born disease management and seed quality enhancement of rice and chickpea

Bacteria that colonize plant roots and promote plant growth are referred to as plant growth-

promoting rhizobacteria (PGPR). PGPR are highly diverse and has been formulated as in house project with the objectives of isolation and trait characterization of new/existing microbial strains as bio-priming agents and evaluate the seed borne disease management and seed quality enhancement potential of rice and chickpea by the bio-priming agents, finally standardization of suitable formulation, quality control modules and delivery system of the bio-priming agents. In-house project start with rhizosphere soil sample collection from DSR field, Mau, Uttar Pradesh. Isolated microbes were tested for plant growth promoting rhizobacteria activities like IAA, Siderophore, phosphate solublization etc., and biochemical test as IMViC test, cellulose activity, triple sugar iron test, starch hydrolysis, lipase test, urease, citrate utilization.

Simultaneously isolated microbes were also accessed for antagonistic activity against fungal pathogens causing diseases in chickpea and rice. Nine gram negative bacterial isolates showed antagonistic activity against *Macrophomina phaseolina* and *Rhizoctonia solani* causing root rot of chickpea, *Fusarium oxysporum* f.sp. *ciceri* causing wilt of chickpea, *Ustilaginoidea virens* causing false smut of rice, *Magnoperthae grisae* causing blast of rice. After statistical interpretation of data nine potential bacteria were screened and identified as *Bacillus aerophilus, Bacillus methylotropicus,Prolinoborus fasciculus, Brevibacterium halotolerans* through 16s rDNA sequencing and sequence were submitted to NCBI GenBank accession KM459542-KM459550 (Table 4).

Table 4: Details of identified bacterial strains with GenBank accession number

Sl. No.	Strain	Identified Bacteria	GenBank Accession
1.	RRB-3	*Bacillus aerophilus*	**KM459542**
2.	RRB-4	*Bacillus methylotropicus*	**KM459543**
3.	RRB-6	*Bacillus methylotropicus*	**KM459544**
4.	RRB-7	*Prolinoborus fasciculus*	**KM459545**
5.	RRB-10	*Bacillus methylotropicus*	**KM459546**
6.	RRB-31	*Brevibacterium halotolerans*	**KM459547**
7.	RRB-34	*Bacillus methylotropicus*	**KM459548**
8.	RRB-38	*Brevibacterium halotolerans*	**KM459549**
9.	CRB-B	*Brevibacterium halotolerans*	**KM459550**

Pot experiments for chickpea were conducted with characterized nine PGPR strains through bio-priming technique against *Macrophomina phaseolina and Fusarium oxysporum* f. sp. *ciceri* pathogens (Fig. 6). Bio-primed seed treatment with isolated PGPR bacteria gave better result in comparison to control (Fig. 7).

Fig. 6: Control showing wilt effect

Fig.7: Effect of bio-primed seed with PGPR

AMAAS project : Role of potential microorganisms in seed and crop health of rice, wheat and mustard

As per the objectives of the project, isolation of different microbes for growth promotion and disease management in wheat, rice and mustard from rhizosphere, phylloplane & endosphere; soil and plant samples from different agro-climatiic zones were collected i.e. Bellary district of Karnataka, Nadia from West Bengal, Bharatpur of Rajasthan, Hissar of Haryana, Ludhiana of Punjab and DSR-Mau of Uttar Pradesh states (Table 5). Soil samples were analysed and estimated for pH, organic carbon, potassium and phosphorus through soil analysis kit.

Table 5: Geographical coordinates & Agro-climate condition of sampling sites

State	Place	Geographical Coordinate	Agro-climate condition
Uttar Pradesh	DSR Agri. Farms	25.5354° N, 83.2917° E	Upper Gangetic Plains
Karnataka	Siruguppa & Meriyanda	15.6300° N, 76.9000° E	Western Plateau
West Bengal	Nadia	23.4000° N, 88.5000° E	Lower Gangetic Plains
Rajasthan	Bharatpur	27.2200° N, 77.4800° E	Western Dry Region
Haryana	Hisar	29.1400° N, 75.7000° E	Trans-Gangetic Plains
Punjab	Ludhiana	30°54'5"N, 75°47'53"E	Trans-Gangetic Plains

Bacterial and fungal strains were isolated from soil sample through serial dilution technique, from phyllosphere through leaf surface isolation & from endosphere through ooze out & syringe method over different nutrient media plates. Total 235 bacterial isolates were isolated and purified from three different crops viz. rice, wheat and mustard (Table 6). All isolated bacterial and fungal strains were purified by streak plate method and maintained on Nutrient Agar and Potato Dextrose Agar media respectively and preserved in glycerol at -20°C.

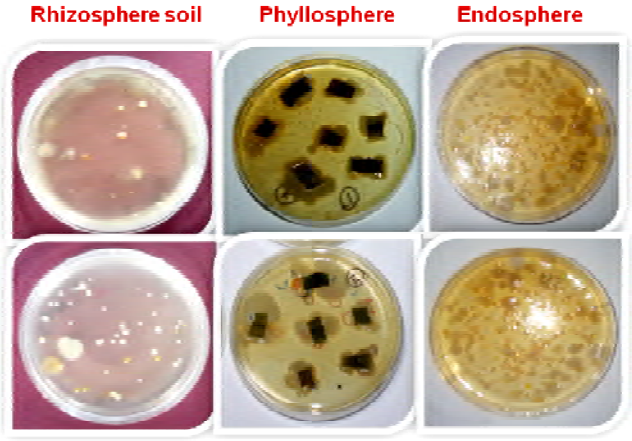


Fig. 8: Isolation of microbes by different techniques.

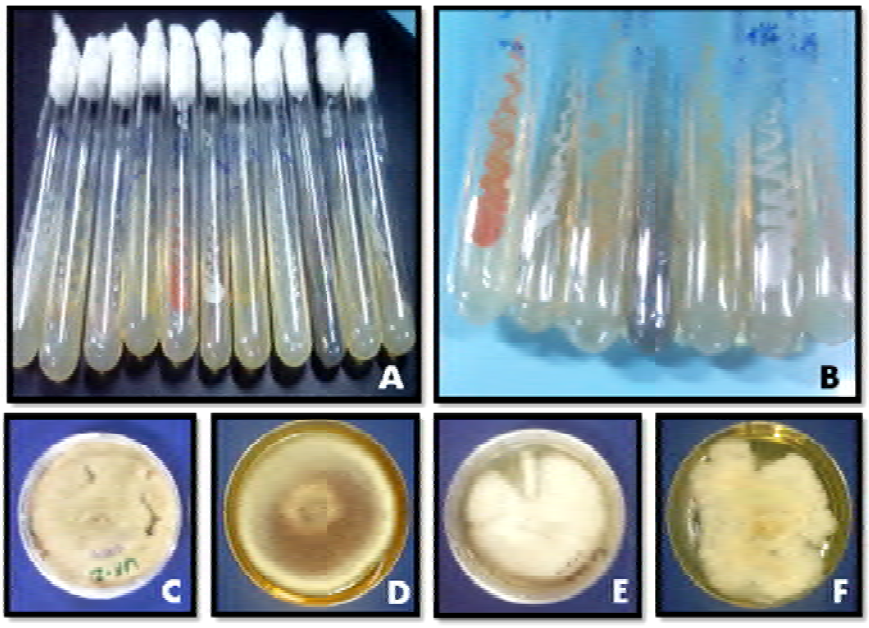


Fig. 9: Bacterial and fungal strains isolated from different techniques. A, B: Bacterial strains on nutrient agar slants; C, D, E, and F: Fungal strains on potato dextrose agar plate

Table 6: Microbial cultures isolated from different sampling site and potential PGP activity

Sampling sites/ State	Microbes (R+P+E) *	Siderophore Production	'P' solublization	Zinc solublization	IAA Production
Siruguppa (Karnataka)	16	12	0	0	2
Myrianda (Karnataka)	4	0	0	0	1
Nadiya (West Bengal)	21	19	2	1	12
Mau (Uttar Pradesh)	72	67	6	3	24
Bharatpur (Rajasthan)	82	70	8	2	YTT
Hisar (Haryana)	18	YTT	YTT	YTT	YTT
Ludhiana (Punjab)	22	YTT	YTT	YTT	YTT
Total	235	168	16	6	39

***R+P+E = Rhizosphre + phylloplane + endosphere, YTT - Yet to be tested**

All the purified microbial strains were morphologically characterized through microscopic examination by gram-stained preparation for its categorization. Plant growth promotion tests *i.e.* siderophore production, phosphate solubilization, IAA production and zinc solubilization were performed on Chrome azurol S agar, Pikovskaya's agar, Yeast Extract Mannitol broth and amended Pikovskaya's agar with 0.1% zinc media respectively (Fig. 10). Among them yet 168 were found positive for siderophore production, 16 for phosphate solubilization, 6 for zinc solubilization and 39 for IAA production.

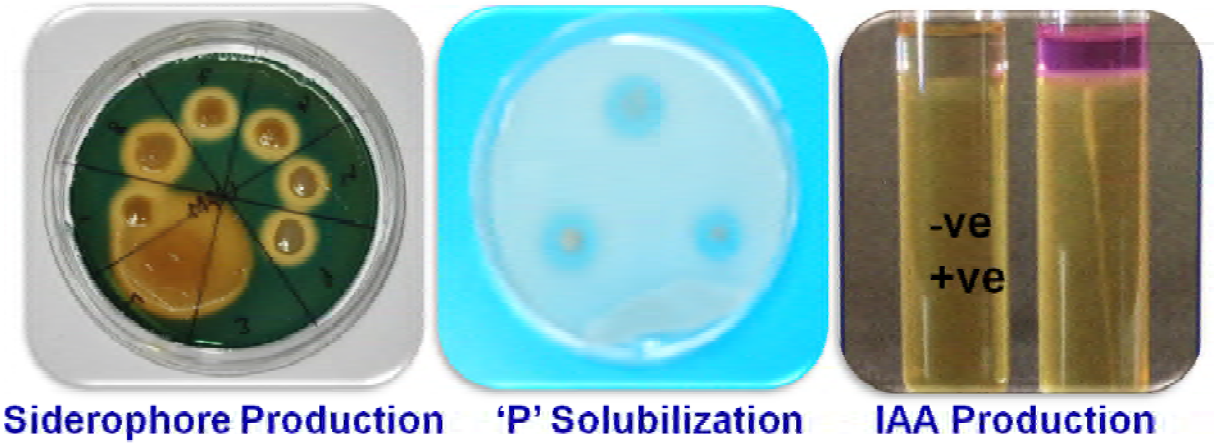


Fig. 10: Plant Growth Promotion activities of isolated strains

A total 10 fungal pathogen cultures causing several important diseases in rice, wheat and mustard were procured from NAIMCC- Mau and maintained for dual culture test with isolated PGPR (Table 7).

Table 7: Details of procured fungal pathogen cultures for dual culture test

Sl. No.	Fungal Pathogen Name	Disease and Host Plant	Source
1.	*Xanthomonas oryzae* pv. *Oryzocola*	Bacterial Leaf Streak/ Rice	NAIMCC
2.	*Cercospora sesame*	Brown leaf spot/ Rice	NAIMCC
3.	*Drechslera teramera*	Leaf blotch/ Wheat	NAIMCC
4.	*Colletotrichum gloeosporioides*	Circular spot/ wide host	NAIMCC
5.	*Sclerotium rolfsii*	Southern stem blight, white mold/ Wheat	NAIMCC
6.	*Fusarium oxysporum f. Sp. ciceri*	Wilt/ wide host	NAIMCC
7.	*Macrophomina phasceolina*	Root rot, stem rot/ wide host	NAIMCC
8.	*Ustilaginoidea virens*	False smut/ Rice	NAIMCC
9.	*Magnoperthea oryzae*	Blast/ Rice	NAIMCC
10.	*Rhizoctonia solani*	Root rot	NAIMCC

1.1.4.2. Biochemical characterization of insecticide resistance in major stored insect pests and their management

Insecticide bioassay was conducted with the insecticide, Deltamethrin to assess the resistance level in collected insect pests. All the insects collected from different NSC godowns showing high level of resistance. Among all, NSC Secenderabad population of *Rhizopertha dominica* and *Tribolium castaneum* recorded more resistance i.e. 2.7x and 5.156x resistance (LC_{50} 0.057 and 0.165) respectively compared to susceptible population (LC_{50}, 0.021 and 0.032), lowest resistance was recorded in *R. dominica* [LC_{50} 0.041(1.9x)] population from NSC, Bangalore and *T. castaneum* [LC_{50} 0.089 (2.7x)] population from NSC, Coimbatore.

Resistance ratio:

S.No.	NSC Centre	*Rhizopertha dominica*	*Tribolium castaneum*
1	Coimbatore (TN)	2.33	2.78
2	Palakkad (Kerala)	2.19	3.12
3	Bangalore(Karnataka)	1.95	3.71
4	Bellary (Karnataka)	2.38	4.25
5	Secenderabad (AP)	2.71	5.15

*Highest resistance was recorded in NSC Secenderabad population of *Rhizopertha dominica* and *Tribolium castaneum* i.e. 2.7x and 5.1x respectively

Various non-edible oils like, Neem (*Azadirachta indica* A. Juss), Pongamia (*Pongamia pinnata* L.), Citronella (*Cymbopogon nardus* L.), Jatropha (*Jatropha curcas* L.) and Lemongrass (*Cymbopogon citratus* Spreng.) and edible oils like, Palm (*Elaeis guinensis* Jacq.), Cotton seed (*Gossypium hirsutum* L.), Rice bran (*Oryza sativa* L.), Castor (*Ricinus communis* L.), Sesamum (*Sesamum indicum* L.) were evaluated for insecticidal activity at different concentrations of 100, 200, 400, 600, 800 and 1000. None of the plant oil tested was toxic when applied alone at a concentration upto 1000 ppm to both the insects *R. dominica* and *T. castaneum*. All the oils shown low level of synergistic activity against *T. Castaneum*.

Among all, the edible oil sesamum at 1000 ppm concentration exhibited high level of suppression with a SR of 74.48 per cent and rice bran oil suppressed deltamethrin resistance at moderate level with SR of 43.16 per cent for *R. dominica*.

Synergistic activity of edible oils with DD (2.37 ppm) of deltamethrin against *R. dominica*

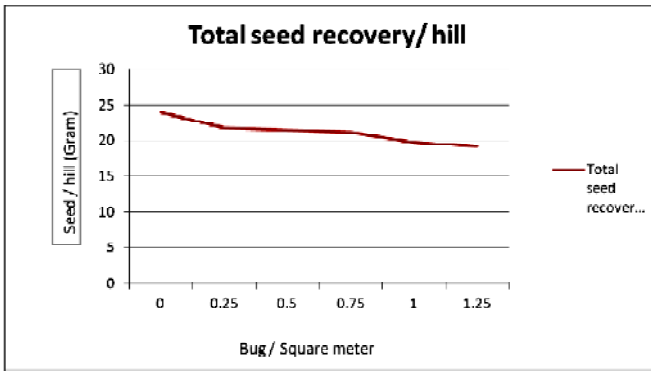
Oil Dose	Palm		Cotton seed		Rice Bran		Castor		Sesamum	
	PR ± SE	SR (%)	PR ± SE	SR (%)	PR ± SE	SR (%)	PR ± SE	SR (%)	PR ± SE	SR (%)
0	99.18±1.17 (85.77)^{d}	-	98.50 ±1.58 (83.27)^{d}	-	96.77 ± 2.30 (80.34)^{e}	-	99.18±1.17 (85.77)^{c}	-	98.00±1.82 (82.05)^{f}	-
100	98.50 ±1.58 (83.27)^{d}	0.68	95.00±2.84 (77.12)^{cd}	3.55	95.00 ±2.84 (77.12)^{de}	1.82	95.41±2.73 (78.43)^{bc}	3.80	95.00±2.84 (77.12)^{f}	3.06
200	98.33±1.67 (82.67)^{c}	0.85	95.00±2.84 (77.12)^{cd}	3.55	95.00 ±2.84 (77.12)^{e}	1.82	94.00±3.09 (77.93)^{bc}	5.22	86.67±4.43 (69.04)^{e}	11.56
400	96.67±2.34 (80.34)^{c}	2.53	90.00±3.91 (73.40)^{bc}	8.62	85.00 ±4.65 (67.57)^{cd}	12.16	93.34±3.25 (76.73)^{bc}	5.88	70.00±5.97 (56.81)^{d}	28.57
600	91.67±3.60 (76.39)^{b}	7.57	80.00±5.21 (63.76)^{ab}	18.78	80.00 ±5.21 (63.76)^{bc}	17.32	90.00±3.91 (73.40)^{abc}	9.25	58.34±6.42 (49.83)^{c}	40.46
800	88.34±4.18 (71.21)^{b}	10.92	75.00±5.64 (60.35)^{a}	23.85	70.00 ±5.97 (56.81)^{ab}	27.66	85.00±4.65 (67.57)^{ab}	14.29	48.34±6.51 (44.05)^{b}	50.67
1000	76.67±5.51 (61.55)^{a}	22.69	70.00±5.97 (56.81)^{a}	28.93	55.00 ±6.48 (47.87)^{a}	43.16	78.34±5.36 (62.31)^{a}	21.10	25.00±5.64 (30.00)^{a}	74.48
	S		S		S		S		S	

Figures in the parentheses are arcsine transformed values.
Means followed by common letter in a column are not significantly different at five percent level by LSD.
PR – Per cent Resistance; SE – Standard Error; SR – Suppression of Resistance; S – significant; NS – non significant; DD – discriminating dose
*Among all oils, Sesamum showed highest synergistic activity with SR of 74.48 against *R.domonica*

1.1.4.3 Estimation of economic threshold level of important insect pests in paddy and mustard seed crop

To determine threshold population of *Leptocorisa* spp. affecting quality parameters of paddy seed an experiment has been conducted. Experiment was with six treatments consisted of six different insect densities which were 0, 0.5, 1.0, 1.5, 2.0, and 2.5 adult *Leptocorisa* per meter square. Paddy was transplanted in 18 plots of size 2 x 2 meter. Spacing between row to row and pant to plant was 20 and 15, respectively. Just after flowering stage each plot was covered with nylon mesh cages with the help of erected bamboo sticks at four corners of plot to avoid natural infestation.

The required number of insects were released in cages and subsequently monitored alternately to maintain desired density up to the maturity of crop. Seed, damaged/ shrivelled seed, yield per plant from all the plots were observed. On the basis of observed data, yield loss (wt of infested/ wt of healthy seed x 100), Seed yield loss (seed recovery %) were calculated. Germination percentage and seed vigour were also determined. It was observed that seed recovery was affected with population density of *Leptocrisa* in following manner.



Paddy : under various Leptocrisa density

Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition

An experiment was conducted to evaluate newer molecules against major storage insect pest damaging wheat seeds. Treated wheat seeds with various insecticides were packed and kept at ambient condition. The observations on insect damage and seed germination were recorded after every 3 months.

After six months of storage, among all the tested insecticides only emamectin benzoate@ 2 ppm (40.0 mg/kg seed), and Spinosad @ 2 ppm (4.4 mg/kg seed) produced complete (100%) protection to wheat seed. Indoxacarb and Rynaxypyr @2 ppm also restricted insect damage within permissible limit.

Effect of insecticidal seed treatment on per cent insect infestation

Treatment		Storage duration			
		3 months		6 months	
		Seed germination (%)	Insect damage (%)	Seed germination (%)	Insect damage (%)
T1	Emamectin benzoate (Proclaim 5 SG) @ 2 ppm (40.0 mg/kg seed)	94.7	0.0	89.3	0.0
T2	Spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed)	92.7	0.0	88.0	0.0
T3	Indoxacarb (Avaunt 14.5 SC) @ 2 ppm (13.8 mg/kg seed)	94.7	0.0	88.7	0.1
T4	Rynaxypyr (Coragen 20 SC) @2ppm (0.01ml/kg seed)	91.3	0.0	86.7	0.1
T5	Chlorfenapyr (Intrepid 10 EC)@2ppm (0.02ml/kg seed)	97.3	0.4	90.7	0.7
T6	Profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed)	96.7	0.3	92.7	0.9
T7	Novaluron (Rimon 10 EC) @5ppm (0.05ml/kg seed)	94.7	0.4	90.7	0.7
T8	Deltamethrin 2. 8 EC @ 1.0 ppm (0.04 ml/kg seed)	91.3	0.1	86.7	0.7
T9	Untreated control	90.0	11.6	86.0	12.1
	CD at 5%	NS	0.47	NS	0.7

Percent Mortality of test insects released to 100 g treated seeds at different storage interval

Treatment		Storage duration								
		0 months			3 months			6 months		
		3 days after release	7days after release	15 days after release	3 days after release	7 days after release	15 days after release	3 days after release	7 days after release	15 days after release
T1	Emamectin benzoate (Proclaim 5 SG) @ 2 ppm (40.0 mg/kg seed)	80.0	93.3	100.0	23.3	100.0	100.0	20.0	100.0	100.0
T2	Spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed)	53.3	86.7	100.0	23.3	76.7	96.7	23.3	69.7	100.0
T3	Indoxacarb (Avaunt 14.5 SC) @ 2 ppm (13.8 mg/kg seed)	43.3	63.3	96.7	6.7	73.3	86.7	10.0	60.0	73.3
T4	Rynaxypyr (Coragen 20 SC) @2ppm (0.01ml/kg seed)	43.3	53.3	100.0	16.7	60.0	80.0	6.7	26.7	53.3
T5	Chlorfenapyr (Intrepid 10 EC)@2ppm (0.02ml/kg seed)	53.3	83.3	100.0	23.3	73.3	93.3	6.7	46.7	66.7
T6	Profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed)	36.7	76.7	100.0	16.7	53.3	76.7	6.7	23.3	56.7
T7	Novaluron (Rimon 10 EC) @5ppm (0.05ml/kg seed)	36.7	63.3	96.7	10.0	46.7	66.7	16.7	36.7	60.0
T8	Deltamethrin 2. 8 EC @ 1.0 ppm (0.04 ml/kg seed)	36.7	80.0	96.7	13.3	70.0	86.7	10.0	36.7	70.0
T9	Untreated control	0.0	6.7	20.0	3.3	13.3	26.7	3.3	10.0	13.3
CD at 5%		21.64	30.61	8.08	ns	22.87	14.36	12.7	44.3	34.14

To observe the residual toxicity of various insecticides, adults of *Rhizopertha dominica* were released in 100g of treated wheat seed. The mortality data on 3rd, 7th and 15th was taken after 0, 3 months and 6 months of seed treatment. The maximum residual property was observed in emamectin benzoate and Spinosad. Complete mortality was observed after 15 days of release of *R. dominica* into wheat seed treated with emamectin benzoate and spinosad before six months.

Survey and evaluation of seed health status of farmer's saved seed with respect to insect

To know the health status of farmers'saved wheat seed with respect to insect infested seed, samples were collected from the farmers just before the sowing on gratis basis.

Number of samples collected	Number of samples infected	Per cent seed damage (range)	Per cent seed sample with seed damage beyond permissible limit	Seed Moisture (%) (range)	Mean Seed Germination (%) with range in parenthesis	Per cent seed sample with seed germination within permissible limit	Mean vigour index (with range)
105	36	0 - 6.75	15.23	16.4 to 9.3	91.25 (98.66 to 71.33)	83.8	11.55 (6.29 to 17.33)

One hundred and five samples of wheat seed weighing 500 g were collected from farmers of Mau district before sowing on gratis basis. About 36 seed samples were found infested but only 15.23 % samples were infested beyond permissible limit. However, about 83 per cent seed samples were found with germination percentage with in permissible limit. The moisture contents in the seeds were in range from 9.3 to 16.4.

Quality seed production of berseem through insect pollination

To evaluate the seed quality of insect and self pollinated berseem crop under cage, the crop was grown in 100 sq. m. plots of 3 m x 2 m custom made for following three treatments and were replicated thrice.

1. Crop was covered with insect proof net cage at bud stage to get self pollinated seeds.
2. Crops was partially caged with honey bee colony to get bee pollinated seed.
3. Crops in natural condition to get open pollinated seed.

There is a shortage of quality seed in Berseem. Increasing the seed production per unit area may alleviate the problem. In India, there is a vast potential for enhancing the berseem seed yield. Use of pollinators like honey bee and cutting management of the seed crop can help in overcoming this obstacle.

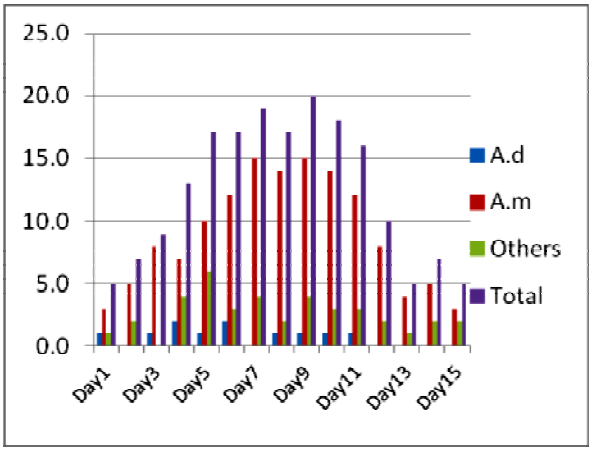
The maximum seed production (4.93 q/ha) was found in plots partially caged with honey bee colony followed by open pollinated (3.15 q/ha). In self pollinated crop the production was only 0.6q/

ha. It indicates that by introduction of bee colony the seed production could be increased by 56 %. The germination percentage of berseem seed was also found maximum for bee pollinated crops (92%) followed by open pollinated (84 %) and self pollinated crops (69 %).

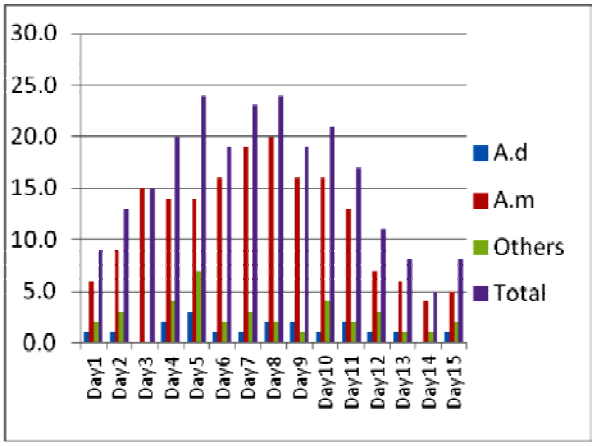
Among all insect pollinators honey bees were major pollinators (81.9%) in open pollinated plots. Frequencies of honeybees visit in 1 m^2 area were also observed during forenoon and afternoon for 15 days in flowering stage.

Mean No. of pollinators' visit/ m^2 /5 min during forenoon and afternoon

Forenoon



Afternoon



The visits of *Apis dorsata* (A.d), *Apis mellifera* (A.m) and other insects were at peak during mid of flowering stage. Total number of insect visited more during afternoon than forenoon.

Efficacy of insecticides and botanicals against storage insect of seeds and their influence on seed viability during storage under ambient condition

Various botanicals *viz.*, Neem Azal, Karanj (*Pongamia pinnata*) oil, citronella oil (*Acorus calamus*) TNAU formulation along with emamectin benzoate and deltamethrin were tested for wheat seed storage. After three months of storage, insect damage was not found in any of the treatment. All the treatments recorded high seed germination above IMSCS. Experiment is in progress.

Effect of new packaging material (insecticide impregnated bags) on storability of seed under ambient condition

Different type of packaging materials, treated bag, no lamination, no liner; treated bag, non treated lamination, non treated liner; treated bag, treated lamination, treated liner; untreated bag (same fabric *i.e.* PP Bag) and gunny bag (control) were assessed to store treated and untreated green gram seed. After 10 months of storage, only treated seeds stored in insecticide impregnated bags maintained seed germination above IMSCS.

Effect of interval of insecticidal application on storability of seed under ambient condition.

To find the integration effect of seed treatment and fabric treatment with emamectin benzoate against major storage insect pest in wheat seed, interval of treatment application was standardized. Seed treatment before storage and fabric treatment at 180 days after seed treatment was capable of providing complete protection to wheat seed up to 8 months of storage. However, the same treatment produced insect damage within permissible limit even after 300 days of storage.

Experiment of AICRP bio-control initiated at ICAR-DSR Seed Production Unit, Bengaluru

The observations and results of the experiments showed that increase in number of *Uscana* sp. is directly proportional to the level of parasitization. The highest parasitization of 42 per cent was observed in the treatment (T4) where 40 *Uscana* sp. adults were released. Lowest egg parasitization (18 %) was noticed in the treatment (T1-10 adults). Other treatments (T2-20 adults) and (T3-30 results) recorded parasitisation value of 28.67 and 38.33, respectively. Nil parasitization was observed in control (T5) with no *Uscana* sp released.

Bruchids emerged from all the treatments. The 100 % seed infestation was observed in T5 (control). Lowest infestation of seed was noticed in T4 (78.67 %) followed by T3 (82.67 %). Higher seed infestation of 90 and 87.67 % was observed in T1 and T2, respectively.Drastic increase in the moisture content was observed when the infestation started. The highest (15.50 %) moisture content was observed in control (T5) where as 12.17, 12.40, 13.67 and 14.50 % was recorded in T1, T2, T3 and T4, respectively. 10 % moisture content was noticed on the day of egg laying.

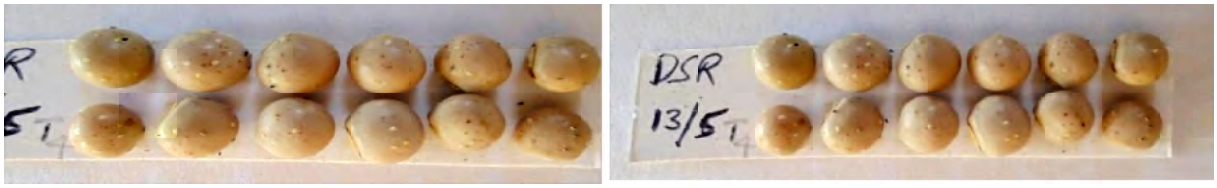
The germination of pigeon pea seeds was highest in T4 (82.33 %). There was a reduction after infestation and it was 75.00 % in T5 (control). The germination per cent was recorded as 80.00, 81.33 and 80.67 % in T1, T2 and T3, respectively. The insect infestation reduced the germination by10 % (initial germination 95 per cent).

The highest root length (11.70 cm) was recorded in the seedlings of T4 followed by 10.18 cm in the seedlings of T4. The lowest root length of 7.33 cm was recorded in T5 (control). The similar trend was observed with the shoot length. The lowest length of 6.77 cm was recorded in T5 (control) and highest with 10.63 cm in T4 seedlings. The results revealed that the infestation leads to deterioration of pigeonpea seed, affecting germination and vigour. The pigeonpea seeds germinate even after insect infestation when the infestation is in other than germ portion but with lesser vigour in the germinated seedling.

Parasitization effect of *Uscana* sp. on eggs of *Callosobruchus maculatus* in pigeonpea seed

Treatment	Parasitazation (%)	Seed infestation (%)	Moisture content (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Vigour Index
T1 (10 *Uscana* sp)	18.00 (4.24)	90.00 (9.49)	12.17 (3.49)	80.00 (8.94)	8.33	7.47	15.79	1263.2
T2 (20 *Uscana* sp)	28.67 (5.35)	87.67 (9.36)	12.40 (3.52)	81.33 (9.02)	10.17	8.60	18.76	1525.7
T3 (30 *Uscana* sp)	38.33 (6.19)	82.67 (9.09)	13.67 (3.70)	80.67 (8.98)	10.18	8.37	18.02	1453.4
T4 (40 *Uscana* sp)	42.00 (6.48)	78.67 (8.87)	14.50 (3.81)	82.33 (9.07)	11.70	10.63	19.96	1643.3
T5 (control)	0.00 (0.00)	100.00 (10.00)	15.50 (3.94)	75.00 (8.66)	7.33	6.77	14.09	1056.7
SEm±	**0.63**	**0.48**	**0.31**	**1.08**	**0.95**	**0.50**		
CD (0.05)	**3.12**	**2.41**	**1.54**	**5.32**	**4.68**	**4.47**		

*Highest parasitization of 42 per cent was observed in the treatment (T4) i.e. 40 *Uscana* sp released



***Uscana* sp. Parasitization on bruchid eggs**

1.1.5 Seed economics and policy research

1.1.5.1. Impact assessment of quality seed production: addressing scope and efficiency of certified seed production among seed growers

Analysis of primary data collected from groundnut growers of Chitradurga District, Karnataka have been made and major findings are as follows:

Economics of groundnut seed production

The cost and return of certified seed production of groundnut have been provided in Table 8. The ratio of fixed and variable cost in groundnut seed production was 23:77. Human labour was the major component of cost on inputs applied for seed production of groundnut. Its share in total costs was about 27 per cent. It was followed by bullock & machine labour accounting for about 26 per cent of the total cost of groundnut seed production. The share of seed cost to total input was about 11 per cent. Cost of manures & fertilizers used for crop accounted for about 8 per cent. The total cost in certified seed production of groundnut was ₹ 33245 per hectare. The average yield of groundnut seed was 15.2 quintal and by-product was 12 quintal. The gross return and net return was ₹ 63200 and ₹ 29955 per hectare respectively.

Table 8. Cost and return in certified seed production of groundnut (₹/ha)

Sl.	Particulars	Amount (₹)	Per cent
1	Human labour	9000	27.07
2	Bullock & Machine labour	8800	26.47
3	Seed	3640	10.95
4	Manures & Fertilizers	2800	8.42
7	Seed certification charges	1000	3.01
8	Interest on working capital	505	1.52
9	Total variable cost (₹)	25745	77.44
10	Total fixed cost (₹)	7500	22.56
11	Total cost	33245	100.00
12	Total yield		
a	Seed (q)	15.2	
b	By-product (q)	12.0	
13	Gross return (₹)	63200	
14	Net return (₹)	29955	
15	BC ratio	1.90	

Comparison in groundnut grain and seed production

The total cost of cultivation in groundnut seed production was around 18 per cent higher than grain production while, gross return was about 27 per cent higher in seed production (₹ 63200 /ha) than grain production (₹ 49600/ha). Consequently, net return from seed production of groundnut was 40 per cent (₹ 29955/ha) higher than grain production (₹ 21348/ha). Hence, production of certified seed has resulted higher yield and better quality of output. Because of seed production, seed producer fetched higher price than the grain in the marketing of produce. Graphical presentation of cost and return in groundnut grain and seed production has been made in Fig. 13.

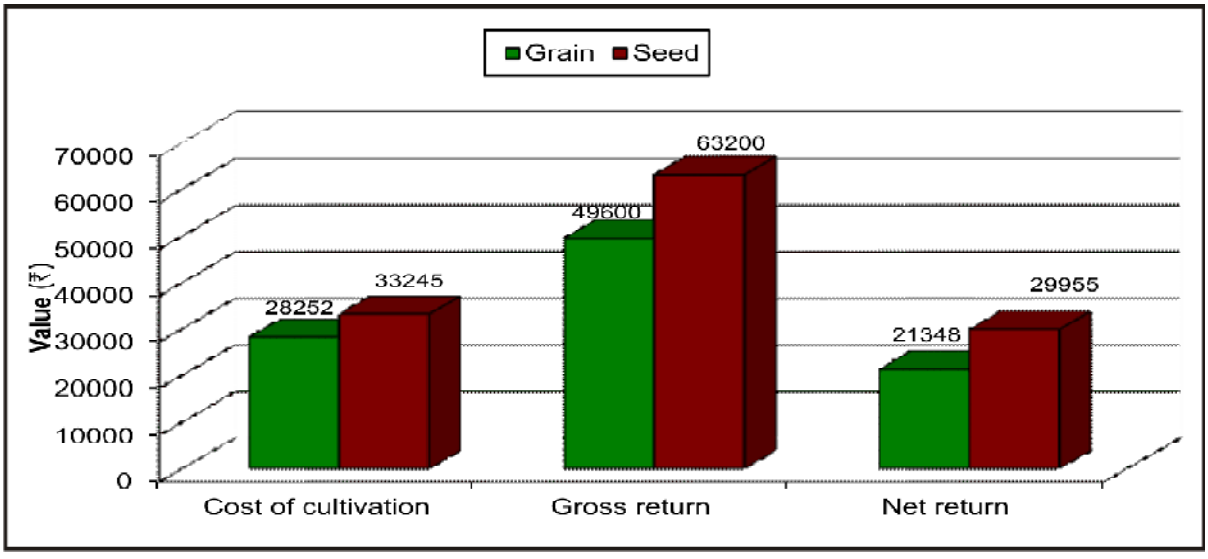


Fig. 13. Cost and return in groundnut grain and seed production

Gender role in seed production

Men and women are equally involved in every activity of groundnut seed production, though the frequency and levels of involvement varies by the task. Since groundnut production is labour intensive, it generated local labour demand and thus employment. These economic interactions generate income for the hired labour and family labour. In the groundnut production system, men do heavier jobs and women do the lighter jobs. Activity-wise involvement of male and female labour in groundnut seed production has been presented in Fig. 14. The overall ratio of male and female labour in groundnut seed production was 53:47.

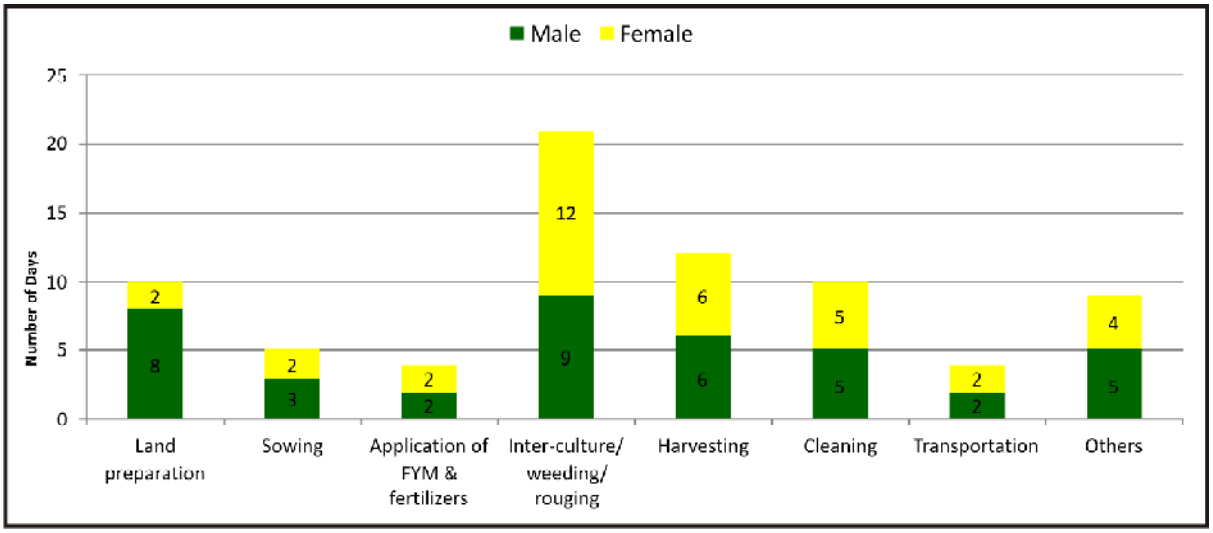


Fig. 14. Activity-wise involvement of labour in groundnut seed production

The list of certified seed growers of pigeonpea in Gulbarga district have been obtained from Karnataka State Seed Certification Agency, Bangalore. Survey has been conducted of one hundred farmers of pigeonpea (commercial grain producer and quality seed producer). Primary data were collected by personnel interview with the respondents using a well-structured and pre-tested interview schedule. Data on various socio-economic parameters, input used in the grain and seed production of pigeonpea and their costs and returns were collected for the agricultural year 2013-14. Analysis of survey data report is as follows:

Land holding

The data pertaining to average land holding of sample pigeonpea farmers have been given in Table 9. The analysis of data shows that majority of seed farmers belongs to medium category (4-10 ha) followed by large (10 ha and above) and semi-medium (2-4 ha) category. The overall average land holding size of pigeonpea seed farmers was 9.46 ha followed by grain farmers (3.71 ha) and district average (2.37 ha).

Table 9. Average land holding of sample pigeonpea farmers

Land holding particulars	Gulbarga district*	Sample pigeonpea farmers		
		Grain farmers	Seed farmers	Overall
Marginal (< 1 ha)	0.62 (20.71)	0.53 (16)	- (0)	0.53(8)
Small (1-2 ha)	1.47 (37.29)	1.46 (20)	1.51 (6)	1.47 (13)
Semi-medium (2-4 ha)	2.70 (28.21)	2.64 (28)	2.78 (26)	2.71 (27)
Medium (4-10 ha)	5.75 (11.97)	5.40 (28)	6.56 (38)	6.07 (33)
Large (10 ha and above)	13.54 (1.82)	13.6 (8)	20.53 (30)	19.07 (19)
Average/Total	2.37 (100)	3.71 (100)	9.46 (100)	6.59 (100)

Source: http://www.gulbarga.nic.in/dist_at_glance.pdf (*As per 2010-11 Census)
Note: Figures within the parentheses are percentage of farmers belonging to respective group.

Cropping pattern

The study area is dominated by Pigeonpea, Jowar and Bengal gram. Cropping pattern of the study area has been presented in Fig.15. The area under different crops shows that pigeonpea ranked 1st (38.10 % of gross cropped area) followed by jowar (21.38 %), Bengal gram (17.17 %), sunflower (3.67 %), black gram (3.11 %), green gram (2.25 %), bajra (2.15 %), wheat (1.70%) and others (10.47 %). The cropping intensity of the study area was 109.

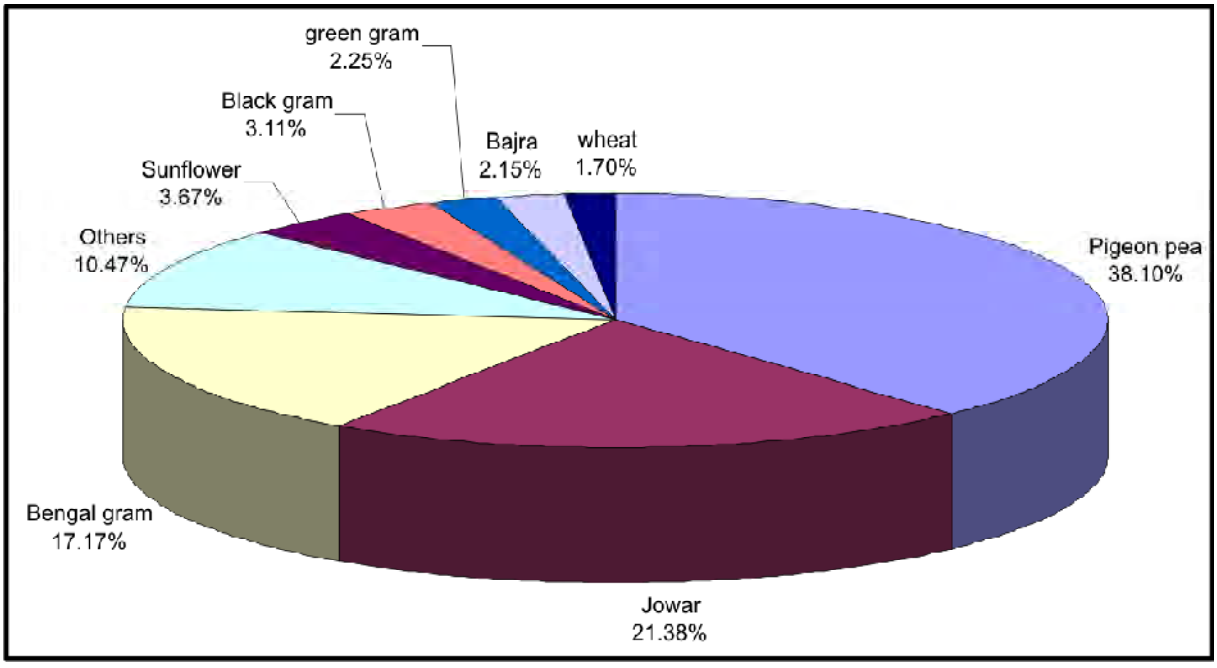


Fig. 15. Cropping pattern of study area

Economics of pigeonpea seed production

The cost and return of certified seed production of pigeonpea have been provided in Table 10. The ratio of fixed and variable cost in pigeonpea seed production was 32:68. Human labour was the major component of cost on inputs applied for seed production of pigeonpea. Its share in total costs

was about 32.46 per cent. It was followed by bullock & machine labour accounting for about 12.29 per cent of the total cost of pigeonpea seed production. The share of seed cost to total input was about 2.49 per cent. Cost of manures and fertilizers used for crop accounted for about 8 per cent. Cost of plant protection measures used for crop accounted for about 6.85 per cent. The total cost in certified seed production of pigeonpea was ₹ 39436 per hectare. The average yield of pigeonpea quality seed and rejected seed was 12.5 quintal and 1.7 quintal and by-product was 31 quintal. The gross return and net return was ₹ 73300 and ₹ 33864 per hectare respectively.

Table 10. Cost and return in certified seed production of pigeonpea (₹/ha)

Sl.	Particulars	Amount (₹)	Per cent
1	Human labour	12800	32.46
2	Bullock & Machine labour	4846	12.29
3	Seed	981	2.49
4	Irrigation	400	1.01
5	Manures & Fertilizers	3155	8.00
6	Plant protection chemicals	2703	6.85
7	Seed certification charges	1250	3.17
8	Interest on working capital	801	2.03
9	Total variable cost (₹)	26936	68.30
10	Total fixed cost (₹)	12500	31.70
11	Total cost	39436	100.00
12	Yield		
a	Seed (q)	12.5	
b	Rejected seed (q)	1.7	
c	By-product (q)	31.0	
13	Gross return (₹)	73300	
14	Net return (₹)	33864	
15	BC ratio	1.86	

Comparison in pigeonpea grain and seed production

The total cost of cultivation in pigeonpea seed production was around 23 per cent higher than grain production while, gross return was about 32 per cent higher in seed production (₹ 73300 /ha) than grain production (₹ 55700/ha). Consequently, net return from seed production of pigeonpea was 44 per cent (₹ 33864/ha) higher than grain production (₹ 23502/ha). Hence, production of certified seed has resulted in win-win situation for the farmers with higher yield and better quality of output. Because of seed production, seed producer fetched higher price than the grain in the marketing of produce. Graphical presentation of cost and return in pigeonpea grain and seed production has been made in Fig. 16.

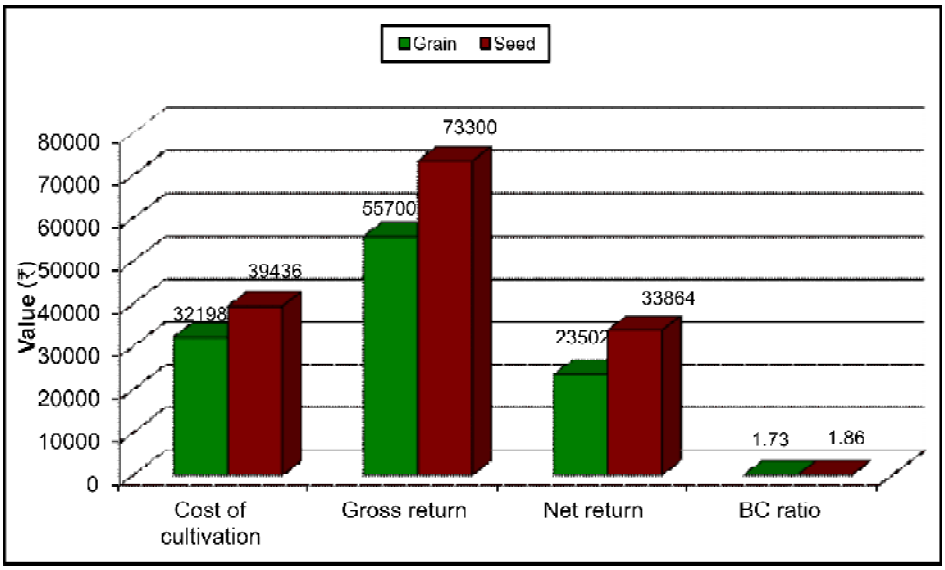


Fig.16. Cost and return in Pigeonpea grain and seed production

Constraints analysis

The factors constraining adoption of pigeonpea seed production technology as perceived by grain producers are presented in Table 11. Small holding size was the most important constraints hindering adoption of pigeonpea seed production technology, as opined by 76 per cent of the farmers respondents. The other reasons constraining seed production technology were non-availability of labour, non-availability of quality seed, high cost of cultivation, lack of knowledge and marketing of product, in that order.

Table 11. Factors constraining adoption of pigeonpea seed production technology by grain producer

Particulars	Number of farmers	Percentage
Small holding size	38	76
Non-availability of labour	34	68
Non-availability of quality seed	32	64
High cost of cultivation	32	64
Lack of awareness / knowledge	29	58
Marketing of product	22	44

1.1.6 Genetical studies for improving seed production efficiency and quality

1.1.6.1 Studies on field weathering among soybean genotypes

Humid, tropical environments are conducive to seed deterioration and make the production of high quality soybean seed difficult. Deterioration of seed in the field prior to harvest is usually referred to as "Field Weathering". Seed deterioration can be defined as "deteriorative alterations that increase the seed's exposure to external challenges and decrease the ability of the seed to survive". Seed

deterioration causes loss of seed quality with time. It is a natural process which involves cytological, physiological, biochemical and physical changes in seeds. These changes reduce viability and ultimately cause death of the seed. High temperature, humidity and precipitation play a crucial role in seed quality deterioration prior to harvest.

Humid, tropical environments are conducive to seed deterioration and make the production of high quality soybean seed difficult. Deterioration of seed in the field prior to harvest is usually referred to as "Field Weathering". Seeds of different genetic constitution may have different mechanism to prevent deteriorative alterations that decrease the ability of the seed to survive.

An experiment was laid out with 13 varieties of soybean in RCBD with three replications in field and in pots (10 pots for each variety with 3 plants in a pot) in net house.

Name of Variety	Days to Maturity	Plot Yield (g) (Plot size : 4.8 sq. mt.)			Pot Yield (g)
		RI	RII	RIII	
PS 1029	116	659	660	523	130
PS 1092	117	536	464	568	199
PK 416	105	694	669	575	136
PK 472	125	414	505	604	176
PS 1347	116	320	425	404	272
JS 20-34	93	289	459	448	230
JS 20-29	100	243	234	-	226
PS 1024	122	490	235	345	177
JS 335	105	241	333	549	249
JS 97-52	120	889	771	296	205
JS 95-60	95	45	-	-	180
JS 93-05	100	15	-	21	135
RKS 24	105	25	50	85	145

The agronomic performance of some varieties of central India viz., JS 95-60, JS 93-05 and RKS 24 in particular and the entire crop in general to some extent was affected on account of three factors :

1. Saline soil adversely affected the performance
2. Heavy incidence of Yellow Mosaic Virus in field
3. Water stagnation in the field owing to presence of hard pan in sub soil due to soil salinity.

Varieties released for Northern Zone viz., PS 1029, PS 1092, PK 416, PK 472, PS 1347, PS 1024 and some of the Central Zone varieties such as JS 97-52, JS 335, JS 20-34 performed comparatively well. However, in pots, owing to better possible management of soil salinity and water logging and freedom from YMV due to no incidence of vector infestation, all the varieties performed better than field. Harvested seed lots were subjected to field weathering in artificial conditions and the performance of control and field weathered seed in terms of germination and seedling vigour would be evaluated prior to planting to study the varietal differences for tolerance to adverse conditions.

Soybean varieties subjected to artificial field weathering

Soybean varieties grown under net house

1.6.1.2 Improving hybrid seed production efficiency through synchronization of flowering in maize (*Zea mays* L.)

Experimental material included both QPM and non QPM hybrids namely HQPM-1, HQPM-5, HM-8, HM-9 and HM-10, which are suitable for Eastern U.P. condition were grown. Among these hybrids HQPM-5, HM-8 and HM-9 had both the parental lines also included in the trial and experimental design followed was RBD with two replications in *Rabi* 2013-14 .

Flowering Behavioural Study:

- Hybrids namely, HQPM-5, HM-8, HM-9 and their parental lines were evaluated.
- Days to 50% tasseling and silking were recorded for hybrids and their parents.
- HQPM-5 female parent HKI-163 showed 50% of silking in 121.5 days. Whereas it's male parent HKI-161 showed 50% of tasseling in 122.5 days.
- In HM-8, female parent HKI-1105 showed 50% of silking in 121.5days, its male parent HKI-161 showed 50% of tasseling in 122.5 days.

- In these hybrids, common male parent HKI-161 showed 50% of tasseling late than respective female parents.

Pollen Viability Study:

Standardization of Pollen viability test was done through Aceto carmine solution. Aceto carmine was added to pollen grains and kept for 30, 60, 90 and 120 minutes. After completing respective

duration, viability was observed using microscope in 10x. Thirty minutes is the optimum time for the pollen viability study was standardized.

- Hybrid HQPM-5 showed 90.0% viability, whereas its male parent HKI-161 showed 86.5% viability.
- Hybrid HM-8 showed 90.9 % viability, its male parents HKI-161 showed 85.0% viability.
- In HM-9 hybrid recorded 94.6% viability, while its male parent HKI-1128 showed 94.3% of viability.
- Among common male parent HKI-161 of HQPM-5 and HM-8 pollen viability needs to be improved.

Tassel angle between main axis and lateral branches and orientation of lateral branches:

- The hybrid HQPM -5 showed **wide and curved angle,** while in its male parent HKI 161 it was **narrow & straight.**
- The hybrid HM-8 showed **wide and strongly curved** angle, whereas its male parents HKI-161 expressed **narrow and straight.**
- Both HM-9 and its male parents HKI-1128 showed **wide and strongly curved** angle**.**
- Hence, male parent HKI-161 needs to be improved for enhancing its pollen dispersability capacity to increase hybrid seed yield.

HKI-163 ----- Curved type **HKI-161 ----- Straight type**

1.6.1.3 Improving hybridization efficiency, seed set and development of male sterile lines for hybrid seed production in Finger millet [*Eleusine coracana* (l.) Gaertn]

In-house project entitled 'Improving hybridization efficiency, seed set and development of male sterile lines for hybrid seed production in Finger millet' has been started at Seed Production Centre, ICAR – Directorate of Seed Research, GKVK Campus Bengaluru. The plant material for the study of floral characteristics of finger millet consists of 39 genotypes, including 20 cultivars with distinct morphological characteristics & maturity durations and 19 wild accessions from 5 different species of genera *Eleusine*. All the plant materials were obtained from All India Coordinated Small Millet Improvement Project, which includes Nine accessions of *Eleucina africana* (EC541532/GE7123, EC541533/GE7124, EC541534/GE7125, EC541535/GE7126, EC541536/GE7127, EC541537/GE7128, EC541538/GE7129, EC541539/GE7130, EC541540/GE7131), 5 accessions of *Eleucina*

indica (EC516241/GE7134, EC516242/GE7135, EC516243/GE7136, EC516244/GE7137, EC516245/GE7138), 3 accessions of *Eleucina tristachya* (EC516247/GE7140, EC516248/GE7141, EC516249/GE7142), 1 accession of *Eleucina multiflora* (EC516251/GE714) and 1 accession of *Eleucina jaegeri* (EC516253/GE7144).Observations were recorded on variation in time of anthesis (Date of finger emergence from flag leaf, date of opening of fingers and date of full blooming) and sequence of floral opening.

Thirty nine genotypes were sown in pots as well as in the field.

2 All India Coordinated Research Project – NSP (Crops)

2.1 Breeder seed production

The progress of breeder seed production of improved varieties with superior attributes and distribution is taking place at an incredibly faster pace, as witnessed in increased breeder seed production of 89266.23q as against the indent of 84788.60q in 2013-14 (*Rabi*/Summer 2013-14 and *Kharif* 2014) (Figure 17). The breeder seed availability has improved the quality of seeds in subsequent generations in the seed multiplication chain and also resulted in increased Seed Replacement Rate (SRR) of varied crops.

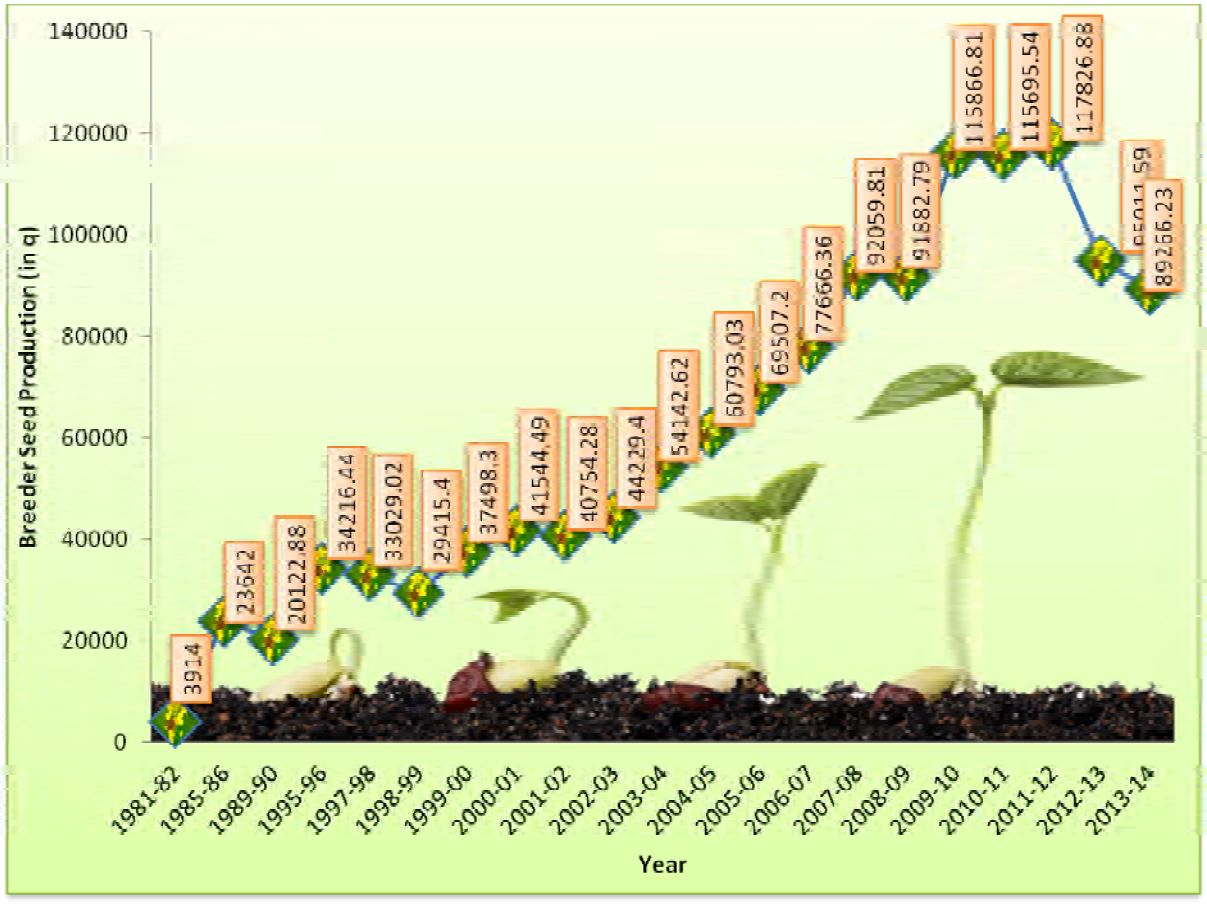


Fig. 17. Breeder Seed of field crops produced during 1981-82 to 2013-14

- Progress of breeder seed production during 2013-14 touched a production level of 89266.23q. However, slight shortfall in few crops was observed due to climate vagaries in refered year.

Crop-wise (total) breeder seed production for the year 2013-14 (*Rabi* / Summer 2013-14 and *Kharif* 2014)

(Figures in quintals)

Crop	GOI		State		Total	
	Indent	Production	Indent	Production	Indent	Production
CEREAL CROPS						
Rice	4154.60	5399.44	12334.00	13975.41	16488.60	19374.85
Wheat	16507.10	18159.22	11216.92	12357.48	27724.02	30516.70
Maize	120.07	441.60	59.47	130.91	179.54	572.51
Pearlmillet	3.07	13.16	2.63	53.65	5.70	66.81
Sorghum	64.29	161.25	25.26	207.61	89.55	368.86
Barley	919.48	917.64	130.45	142.80	1049.93	1060.44
Finger Millet	27.83	50.08	19.68	70.49	47.51	120.57
Foxtel Millet /Navane	0.00	0.00	18.50	2.50	18.50	2.50
Barnyard millet	0.00	0.00	0.53	0.03	0.53	0.03
Kodo	0.00	0.00	11.74	11.79	11.74	11.79
Littile Millet	0.50	0.50	4.43	4.35	4.93	4.85
Total Cereal Crops	**21796.94**	**25142.89**	**23823.61**	**26957.02**	**45620.55**	**52099.91**
PULSE CROPS						
Chickpea	5638.70	4691.46	801.78	1284.28	6440.48	5975.74
Pigeonpea	341.22	365.66	57.81	354.41	399.03	720.07
Field Pea	360.11	355.03	165.01	168.20	525.12	523.23
Mung	608.38	516.07	152.49	160.82	760.87	676.89
Urd	360.23	331.76	446.50	415.04	806.73	746.80
Lentil	265.56	257.60	151.54	172.28	417.10	429.88
Rajmash	15.06	14.40	12.24	23.76	27.30	38.16
Horse Gram	15.00	15.00	9.50	14.42	24.50	29.42
Beans	0.00	0.00	2.80	20.20	2.80	20.20
Cowpea	33.70	56.83	16.70	61.60	50.40	118.43
Lathyrus	0.00	0.00	20.00	21.38	20.00	21.38
Moth Bean	62.15	33.30	0.00	0.10	62.15	33.40
Guar/ Cluster bean	166.36	37.25	39.84	7.40	206.20	44.65
Indian Bean	4.00	6.00	0.00	0.00	4.00	6.00
Total Pulse Crops	**7870.47**	**6680.36**	**1876.21**	**2703.89**	**9746.68**	**9384.25**
OILSEED CROPS						
Soybean	11694.30	7434.95	1226.05	2171.85	12920.35	9606.80
Sunflower	3.27	11.28	1.61	9.27	4.88	20.55
Groundnut	10666.15	10322.42	4299.15	5681.08	14965.30	16003.50
Linseed	45.34	48.03	74.36	94.43	119.70	142.46
Safflower	19.27	21.94	66.40	318.27	85.67	340.21
Sesamum	38.55	30.22	122.79	106.19	161.34	136.41
Niger	5.88	9.95	1.40	1.43	7.28	11.38
Castor	7.12	7.96	50.93	52.62	58.05	60.58
Rapseed Mustard						
Mustard	52.38	55.17	51.20	55.45	103.58	110.62

Crop	GOI		State		Total	
	Indent	Production	Indent	Production	Indent	Production
Toria	11.84	15.61	53.75	72.68	65.59	88.29
Ghobi Sarson	0.25	0.60	0.75	5.57	1.00	6.17
Yellow Sarson	0.00	0.00	0.25	0.15	0.25	0.15
Brown Sarson	0.05	0.20	1.05	5.21	1.10	5.41
Raya	0.35	1.80	0.00	0.52	0.35	2.32
Rai	3.02	3.52	16.60	18.78	19.62	22.30
Karan Rai	0.00	0.00	0.00	0.41	0.00	0.41
Til	1.43	1.46	17.59	10.07	19.02	11.53
Taramira	1.30	0.00	0.00	0.00	1.30	0.00
Total Oilseed Crops	**22550.50**	**17965.11**	**5983.88**	**8603.98**	**28534.38**	**26569.09**
FIBRE CROPS						
Cotton	40.98	134.91	3.93	11.21	44.91	146.12
Jute	21.90	23.54	0.00	0.00	21.90	23.54
Mesta	0.00	0.00	0.50	1.00	0.50	1.00
Total Fibre Crops	**62.88**	**158.45**	**4.43**	**12.21**	**67.31**	**170.66**
FORAGE CROPS						
Oats	403.60	441.68	80.00	137.50	483.60	579.18
Maize	81.18	100.00	0.00	39.00	81.18	139.00
Sorghum	33.72	34.06	2.10	2.75	35.82	36.81
Pearl Millet	1.44	10.17	0.04	2.50	1.48	12.67
Lucerne	20.30	13.95	0.75	0.75	21.05	14.70
Cowpea	17.15	8.66	0.30	0.75	17.45	9.41
Grain Cowpea	0.00	0.00	1.00	1.00	1.00	1.00
Berseem	47.40	42.90	10.00	12.00	57.40	54.90
Rice bean	0.00	0.00	0.30	0.30	0.30	0.30
Guar	114.50	179.50	2.60	7.60	117.10	187.10
Metha	0.00	0.00	1.00	3.20	1.00	3.20
Guinea Grass	0.00	0.00	0.10	0.10	0.10	0.10
Daincha	0.00	0.00	2.00	2.00	2.00	2.00
Rye Grass	0.00	0.00	0.20	0.65	0.20	0.65
Stylo	0.00	0.00	0.00	0.50	0.00	0.50
Total Forage Crops	**719.29**	**831.72**	**100.39**	**210.60**	**819.68**	**1042.32**
Grand Total	**53000.08**	**50778.53**	**31788.52**	**38487.70**	**84788.60**	**89266.23**

2.2 Seed Technology Research

2.2.1 Seed Production and Certification

Integrated approach for maximization of seed yield

Crop: Hybrid Rice

- For hybrid PSD-3, mixed method of planting for male parent produced significantly higher hybrid seed yield as compared to alternate method of planting. Among different nutritional levels,

recommended dose of NPK along with foliar application of Zn @ 5 kg/ha showed significantly higher seed yield (11.08%).

- For JRH-5, mixed method of planting of pollen parent was found to be significantly superior over alternate method of planting for filled grain per cent (22.75%) and seed yield (5.34 q/ha). Spray of 0.25% Boron was found to be significantly superior over non spray for filled grain per cent (22.69%) and hybrid seed yield (5.37 q/ha).

Crop: Wheat

- In Wheat cv. PBW 502, sowing on ridge with fertilizer application of 150: 75: 50 NPK/ ha and 10 kg/ha Zinc sulphate as basal dose was found to be best integrated approach for enhancing seed yield (62.23 q/ha), seed recovery (95.98%) & seed quality parameters.
- For wheat variety HPW 236, ridge method was found superior over plain sowing for yield attributing and seed quality traits. Increase in tillers/plant and increase in the spike length were observed at higher doses of RDF+Zn. Raw seed yield /plot was more with 100% RDF+Zn and 150% RDF+Zn, but graded seed yield /plot was higher with 150% RDF+Zn .
- At CSAU&T, Kanpur for wheat variety PBW–343, ridge sowing with 125% RDF dose of fertilizer and 5 kg Zn/ha has been found significantly superior for getting maximum seed yield and seed quality parameters.
- In Hisar for wheat var. HD-2851, ridge sowing method showed superiority over plain sowing method by 4.9 per cent higher seed yield. Among fertilizer doses (125% NPK and 150 % NPK) exhibited superiority by 3.1 and 5.6 per cent higher seed yield, respectively.

Crop: Sunflower

- In ANGRAU for sunflower hybrid DRSH 1 (A- line: ARM 243A & R line: 6D-1), spray of zinc gave highest seed yield of 14.90 q/ ha followed by iron spray (13.82 q/ha) with 22.76 per cent improvement in seed yield over control.

Crop: Maize

- In hybrid Hema, higher seed yield (24.38 q/ha) and yield attributes *viz.*,plant height (139.52 cm), cob length (20.46 cm), no. of seeds / row (35.82), no. of seeds / cob (496.71) germination (95.6%) and vigour index (2521) were obtained by application of fertilizer dose 50 % > RDF (225:112.5:60 DAP kg/ha) +$ZnSo_4$ @ 10 kg/ha

Crop: Soybean

- At JNKVV Jabalpur, in combination of micronutrients application, seed treatment @ 1g ammonium molybdate/kg seed was found to be significantly superior resulting in enhanced seed yield (14.95q/ ha) and seed recovery percentage (86.05).
- In PDKV Akola, seed yield and quality parameters were found to be superior in recommended dose of DAP application along with micronutrient i.e., $ZnSO_4$ @30kg/ha soil application + $ZnSO_4$ @ 0.5 % foliar application.

Crop: Mustard

- At RAU, Durgapur; for mustard variety Bio-902, first fortnight of November sowing was found to be better as compared to first fortnight of October. Among nutrient management strategies, RDNPK + Gypsum + Zn ($ZnSO_4$ @ 25 kg/ha) + Fe ($FeSO_4$ @ 25 kg/ha) resulted in maximizing seed yield and seed quality parameters.

Crop: Moong

- At NDUAT, Faizabad, Moong cv. NDM 1 sown at seed rate of 25 kg/ha during second fortnight of March at 30 x 10 cm spacing along with microbial inoculation (*Rhizobium* @ 5g/kg and Phosphate Solubilizing Bacteria @7.5g/kg) followed by fertilizer @ 12.5 kg ha^{-1} N and 40 kg ha^{-1} P_2O_5, and Sulphur @ 20 kg/ha as basal dose showed higher seed yield, harvest index and seedling vigour during summer.
- At AAU, Jorhat, two moong varieties Prathap and GS 21-5 responded well for date of sowing (3rd March, 2014) and seed rate of 15 kg /ha with highest seed yield of 1512 kg/ha and 1478 kg/ha, respectively, along with higher yield attributing characters.

Crop: Clusterbean

- At CAZRI, Jodhpur, variety RGC 936 at 1st July sowing along with spacing 45 x 10 cm recorded minimum days for flowering with highest pods/cluster (5.13), clusters/plant (15.4), pod weight (11.4 q/ha), seed yield (7.63 q/ha) and seed recovery (66.5%).

Crop: Berseem

- At GBPUAT, Pantnagar, cultivars (Wardan & UPB 110) produced higher seed yield under normal (2nd fortnight of November) & late sown (2nd fortnight of December) conditions with spray of Borax @ 100 ppm and KNO_3 @ 2% at reproductive stage produced higher seed yield (5.11%).

Pilot project on alternative area for hybrid seed production of major crops in different seasons

Identified alternate area for hybrid seed production are :

Hybrid Rice	:	Bagpat in Madhya Pradesh; Dhamtari, Mahasamund & Gariaband in Chhattisgarh; Chilkalurpeta of Guntur district; Koppa, Kollegal in Karnataka.
Sunflower	:	Bagepalli, Gudibande & Gowribidanur, Sira, Challakere, Hiriyur in Karnataka.
Maize	:	Nandiyal in Telangana; Hiriyur and Sira in Karnataka
Pearlmillet	:	ARSS, Kumher, Bharatpur and SFCI, Sriganganagar in Rajasthan
Pigeon Pea Hybrid	:	Yeotmal region of Maharasthra
Jute	:	Tadikonda, Tulluru, Macherla, Sattanapalle of Telangana & Chilakalurpeta and Marturu in Andhra Pradesh.

Evaluation of SRI for enhanced seed yield and quality of hybrid rice

- In DRRH-3 hybrid seed production, SRI method (9.76 q ha^{-1}) resulted in 16.05% improved seed yield over conventional method (8.41 q ha^{-1}). The increase in yield in SRI method could be

due to increase in ear bearing tillers per hill, improvement in spikelet fertility and root characters like root length and root volume.

- The seed yield of Hybrid Indira Sona was found superior in SRI method (6.27q/ha) over conventional method (5.00 q/ha).

Hybrid seed production in Brinjal and Tomato under protected conditions

- At IARI, New Delhi; hybrid seed production under shed house condition in tomato hybrid (Pusa Hybrid-4) showed highest seed yield/plant (17.12g), Seed yield per hectare (481.25kg), Germination (86.98%) and SVI (1162) as compared to production under open field condition.

Standardization of seed production of multi-cut forage sorghum hybrids under north Indian conditions

- At Pantnagar, CSH 24MF produced significantly higher seed yield/plant and better seed quality than CSH 20MF because of less difference (3 days) in synchrony of male and female parent as compared to CSH 20MF parents (18 days). Among different dates of planting, 10th June planted crop recorded highest seed yield/plant (4.51g).

Standardization of alternative planting windows *vis a vis* climate change

Centre and crop	Planting window	Observation/highlights
UAS, Bangalore [Sunflower hybrids- KBSH-44 & KBSH-53]	15th January to 1st April	Maximum plant height, low incidence of diseases.
	1st May	Minimum days for 50% flowering.
	15th June to 15th August	Highest head diameter, seed set *per cent* and seed yield/plant (48.10g).
	1st August to 1st October	Higher incidence of diseases.
	1st November	Early flowering, low seed set.
	1st December	Higher seed set in R-line.
ANGRAU, Hyderabad [Sorghum- hybrid CSH-16]	1st October	Early flowering, high pollen viability, *cent per cent* seed set and higher seed yield.
	31st November	Early flower initiation, lower seed set.
Maize hybrid- [DHM-117]	15th June	Lower days to 50% pollen shed, first silking, 50% silking, pollen viability, tassel length, seed yield and shelling *per cent*.
	15th August	Higher pollen viability, tassel length, yield attributing characters and seed yield.
	15th September	Higher no. of rows/cob and no. of seed/row.
MPKV, Rahuri [Pearl millet hybrid- Shanti]	August onwards or 15th October to 15th December	Nearly 75% seed setting and more disease incidence.
	January	Nearly 85% seed setting.
	February or 1st June to 15th July	100% seed setting with low disease and insect pest incidence.
	March onwards	Only 40-50% seed setting.
	August and after February	Aphids, thrips, hopper, stem borer and disease incidence.

Pilot project on evaluation of rice genotypes for seedlings suitable for direct seeding

- At ANGRAU and DRR, Hyderabad in an experiment on sowing with drum seeder; varieties *viz.*, Rasi, Aditya and Krishnahamsa performed better and resulted in grain yield of 5.78 t/ha, 5.67t/ha and 5.58 t/ha, respectively.
- At Coimbatore; cultivars *viz.*, PHB 7, DRRH 2, Adithya and CO(R) 50 registered higher root length and root volume in wet as well as in dry seeding.
- At Bangalore, Hybrid KRH-4 recorded higher seed yield followed by cultivars MAS-26, KMP-175 and Rasi under aerobic condition, which revealed their suitability for direct seeding.

Evaluation of pollen flow and isolation distances in wheat

- The red glumed variety (PBW-154) was used as contaminant parent and planted in centre (plot size of 3m x 3m) whereas; Raj-3765 (White glumed variety) was used as test parent. The seed of variety Raj-3765 was collected from 1, 2, 4, 6, 8 and 10 m distances from all the sides at maturity and sown during *Rabi* 2014-15 to know the extent of out crossing (%).

2.2.2 Seed Physiology, Storage and Testing

- Higher speed of germination and rapid development of root and shoot and its components were higher among rice hybrid seed than their parents which resulted in higher number of tillers and leaf area index during pre-anthesis phase.
- In maize, SVI I and SVI II including several root parameters were higher in hybrids. Further, 1000 seed weight was found to be positively correlated with seed vigour and seed yield.
- SSR marker, RM 228 has been found to be unique for DRRH3 rice hybrid and can identify any potential contaminant from PSD1, PSD3, PRH10, NDRH2 and other thirty two rice varieties.
- RM 515 and RM 234 were identified as the specific SSR markers for paddy hybrid CORH 4 and CORH 4 respectively.
- RM81057, RM10103, RM9a2 are the unique SSR markers for rice hybrid KRH-4 and RM9310, RM9106 for rice hybrid KRH-2 which can also be multiplexed.
- Pulsed Electromagnetic Field (PEMF) treatment @ 50 Hz & 100 Hz improved germinability and vigour in tomato and green gram respectively.
- Among the seeds of Rice, onion, soybean and sunflower stored in airtight polythene bags (700 gauge) along with desiccant beads (Zeolite beads/silica gel), the seed quality attributes were recorded maximum even after 6 months of storage and least infestation of insect was observed.
- Groundnut seeds (off shell) stored in polythene bags (700 gauges) along with the 20% CO_2 (v/v) concentration maintained higher viability upto 6 months of storage period.
- Priming with KNO_3 @ 2.5% improved seed yield by 3.3-14.5% in different crops (wheat, paddy, pearlmillet, sorghum, mungbean, pigeonpea and chickpea).

- A total of 85 demonstrations of hydro-priming technology were organized at farmer's field across the centres and farmers were convinced upon this low cost technological intervention for maximizing grain yield.

2.2.3 Seed Pathology

- Standard Blotter method is best suited technique for detection of *Alternaria carthami* associated with safflower. Maximum counts of infected seeds recorded on 5 days incubated seeds at 22-24°C placed on top of wet blotters under alternate cycles of 12 hr. dark and 12hr light periods provided by 40W tube lights.
- As per IMSCS, rice bunt (*Tilletia barclayana*) is designated as objectionable seedborne pathogen in rice seed production. Its prevalence has not been reported in southern parts but was found to be a major problem in seed samples from northern parts of India.
- False smut (*Ustilaginoidea virens*) is a potential threat in paddy seed production. Field experiments conducted at 03 centers revealed that foliar application of propiconazole @ 0.1% at boot stage resulted in maximum disease control.
- Critical monitoring on new emerging seedborne diseases indicated presence of False head smut (*Ustilaginoidea virens*) on maize; Bean common mosaic virus disease in moong bean; Panicle blight of rice (*Burkholderia glumae*) and Bakane rice seedling disease (*Fusarium fujikuroi*).
- Investigations on farmers saved seed samples indicated alarming association of Karnal bunt with wheat (*Tilletia indica*) in Punjab, Haryana, Himachal Pradesh, and Uttarkhand; *Macrophomina phaseolina, Fusarium oxysporum* with soybean in Madhya Pradesh, Maharashtra and Rajasthan and *Aspergillus flavus* with groundnut in Gujarat, Maharashtra, Odisha and Andhra Pradesh.
- Standard blotter method for detection of *Macrophomina phaseolina, Fusarium oxysporum and Colletotrichum dematium* (*C. truncatum*) associated with moongbean, urdbean and soybean was found to be most suited detection technique.
- Seed wash technique was identified as a relatively quick method for detection of surface adhered spores of *Alternaria burnsii*, causal agent of blight in cumin.
- Effective prevention of transmission of *Alternaria carthami* from seed to plant is achieved through seed treatment with Thiram + Carbendazim (0.15% each) or Thiram + Carboxin (0.15% each).
- Biopriming of pearlmillet seeds with *Trichoderma harzianum* and *Pseudomonas fluorescens* enhanced seed germination and speed of germination, however, was unable to inhibit growth of pathogen *Sclerospora graminicola* responsible for downy mildew.
- For ecofriendly management of early blight of tomato, seed dressing with bioagent *Trichoderma harzianum* @ 10g /Kg seed was found promising under conditions of Uttarkhand and Himachal Pradesh where higher seed germination (81.5%) with least association of *Alternaria solani* (2%) was recorded.

- Application of Carbendazim + mancozeb @0.30% twice, first at pod formation and second at pre-harvest stage resulted in maximum (65.5%) control of pod blight disease caused by *Colletotrichum dematium* (*C. truncatum*).

2.2.4 Seed Entomology

Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition

- Among various newer insecticides evaluated along with standard chemical (Deltamethrin) against major storage insect-pests damaging cereals and pulse seeds, Emamectin benzoate @ 2 ppm, Spinosad @ 2 ppm were on par with Deltamethrin (Decis 2.8 EC) @1.0 ppm and provided insect control in cereals and pulses under different agro-climatic conditions up to 6 to 9 months. Profenofos @ 2ppm and Rynaxypyr @ 2ppm were also effective to some extent but not as effective as Emamectin benzoate, Spinosad and Deltamethrin.

Evaluation of packaging material and methodology to store seed in coastal region

- Paddy seeds treated with Flubendiamide @ 2 ppm, Emamectin benzoate @ 2 ppm, Spinosad @ 2 ppm, Deltamethrin @ 1 ppm were stored in three different types of packaging materials (Gunny bag, Super grain bags and HDPE bags) at Karaikal and Bhubaneswar centre. Paddy seeds treated with insecticides and stored in moisture impervious bags like super grain bags maintained seed germination above IMSCS with appreciable control of insect infestation up to 6 months period in.

Survey and evaluation of seed health status of farmers' saved seed with respect to insect infestation

- Samples of farmers' saved seed were collected by all cooperating centres and evaluated for seed health status, most of samples (72.2%) were having seed germination above IMSCS. About 36.1% of farmers' seed samples were infested with storage insect pests and 26.8% samples were having insect damage beyond seed certification standard.

Quality seed production through insect pollination

- Bee pollination played a major role in improving quantity of seed produced in berseem. Apart from seed yield, other parameters like seed germination and vigour improved substantially due to bee pollination. In case of pigeon pea, other pollinators like leaf cutter bee, carpenter bee played major role in pollination.

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

- CO_2 concentration of 50% (v/v) provide effective protection against *Khapra* beetle in wheat, rice weevil in paddy, groundnut beetle in groundnut and pulse bruchid in green gram, pigeon pea and chick pea without affecting seed quality up to 6-9 months storage.

Demonstration of efficacy of CO_2 treatment for management of insect pests of stored seeds in large capacity storage bin

- Effectiveness of CO_2 treatment in 200 L capacity containers for treating black gram seed has been successfully demonstrated at TNAU, Coimbatore. UAS, Bangalore also demonstrated efficacy of modified atmosphere storage in management of storage insects of paddy.

Effect of interval of insecticidal application on storability of seed under ambient condition

- Experiment was conducted to evaluate the integration effect of seed treatment as well as fabric treatments against major storage insect-pests damaging seeds. Suitable treatment schedules *i.e.* combination of seed treatment (emamectin benzoate @ 2ppm) and fabric treatment (emamectin benzoate @100ppm) for various crops at different centres have been developed for management of storage insect pests.

Effect of new packaging material (insecticide impregnated bags) on storability of seed under ambient conditions

- Three types of insecticide impregnated bags like (a) Treated bag, no lamination, no liner; (b) Treated bag, non-treated lamination, non-treated liner and (c) Treated bag, treated lamination, treated liner were tested along with Untreated bag (same fabric *i.e.* PP Bag) and Gunny bag as control. Insecticide impregnated bags were highly effective in management of storage insects of wheat, paddy, maize, chickpea and green gram except maize and maintained seed germination above IMSCS up to 8-10 months of storage.

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

- Various botanicals i.e., *Acorus calamus* TNAU formulation @ 10 ml/kg seed, *Vitex negundo* leaf powder @10g/kg seed, *Lantana camara* leaf powder@10g/kg seed and Citronella oil @ 5 ml/kg of seed were tested along with emamectin benzoate and deltamethrin and it was found that *Acorus calamus* TNAU formulation was on par with insecticidal seed treatment up to three months of storage.

Management of groundnut pod borer (*Caryodon serratus*) in groundnut pods during storage

- Groundnut pod borer causes great problem in storage and its managment in storage. Pod treatment with various insecticides *viz.*, Emamectin benzoate @ 2ppm, Spinosad@ 2 ppm, Thiodicarb@ 2ppm, Rynaxypyr@ 2ppm, Profenofos@ 2ppm, Novaluron@ 5 ppm and Deltamethrin @ 1ppm were evaluated and it was found that emamectin benzoate, spinosad and deltamethrin were highly effective as they provided complete protection upto 3-6 months and maintained seed germination above IMSCS.

2.2.5 Seed Processing

- Optimum sieve size for processing chickpea was found to be 5.00 mm (S) against recommended 5.50 mm (S) with maximum recovery (83.5 %) for *desi* varieties and 5.5 mm (S) against recommended 6.00 mm (S) for *Kabuli* types with maximum recovery (80.5%).
- Sieve of 2.3 mm and 2.75 mm(S) is effective and economical against existing size of 2.5mm (S) for grading wheat cultivars with highest recovery upto 90.3-95.1% with germination and physical purity well above IMSCS with minimum mechanical damage.
- The Sunflower hybrid KBSH-44 can be processed satisfactory by using sieve size 2.80 x 20 mm (S) against existing size of 2.40 x 20 mm (S) for better seed recovery and seed quality parameters.
- Redgram cv. BRG-2 could be processed satisfactorily by using grading sieve size of 5.00 mm (R) against use of existing 4.75 mm (R) for satisfactory seed recovery and quality parameters.
- For grading seeds of Sunhemp cv. Co 1, 7.0mm (R) sieve size can be used for obtaining the maximum seed recovery and germination.
- The seeds of Field bean cv. HA-4 could be processed by using 5.5 mm (R) grading sieve as against recommended size of 6.00 mm (R) for better seed recovery and seed quality parameters.
- Green gram variety BGS-9 processed with sieve size 2.4mm (R) against existing size of 2.60mm (R) registered highest recovery (94.81%) with physical purity (98.53%), germination (87.74%), 100 seed weight (4.76g) and pure live seed (87.97%), which were above the IMSCS.
- Among mungbean varieties Basanti, Satya and MH-421; grading by 2.4 mm (R) sieve size [existing size-2.6 mm (R)] was found effective and economical with maximum seed recovery (76.39, 77.35 and 78.39% respectively) and seed parameters above IMSCS.
- The use of combine harvester at 5 cm height of cutter bar from ground level and at 12% moisture content along with 500 rpm drum speed was found most economical and effective for maintaining seed quality during harvesting and threshing of soybean.
- Among paddy varieties threshing must be carried through traditional method *i.e.* harvesting with sickle and manual beating or by using combine harvester.
- Insect damaged seed can be effectively separated by needle separator. Reduction of insect damaged seed was to the tune of 57.1% by needle separator alone.
- In case of soybean, sun drying for 20 h was found highly economical as compared to heated air drying in reducing moisture from 33.93 % to safe level without affecting seed quality.

3 ICAR Seed Project - Seed Production in Agriculture

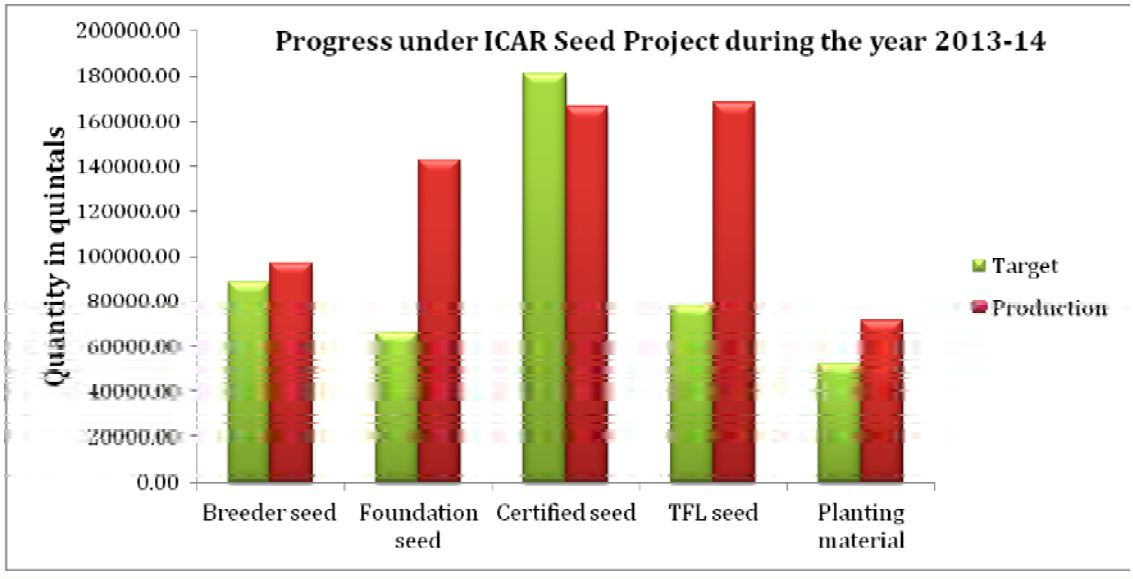
During the year 2013-14, total production of quality seed including all classes was 648325 quintals against the target of 475179 quintals. Production comprises 94953 quintals of breeder seed, 144369 quintals of foundation seed, 163465 quintals of certified seeds, 172351 quintals of truthfully labelled seed and 73185 quintals of planting material of field crops. In addition, 155.59 lakhs planting material and 5.60 lakh tissue culture plantlets of field crops were produced against the targets of 94.80 and 2.07 lakhs.

(in quintal)

S. No.	Particulars	In University/Institute		Participatory Seed Production		Total	
		Target	Production	Target	Production	Target	Production
1	Breeder seed	88529.19	94153.41	825.00	800.00	**89354.19**	**94953.41**
2	Foundation seed	58673.65	76375.22	10666.62	67993.88	**69340.27**	**144369.10**
3	Certified seed	36734.30	49598.65	143714.50	113867.16	**180448.80**	**163465.81**
4	TFL seed	47491.93	67469.75	35006.00	104881.77	**82497.93**	**172351.52**
5	Planting material	53538.00	73185.24	-	-	**53538.00**	**73185.24**
	Total	**284967.07**	**360782.27**	**190212.12**	**287542.81**	**475179.19**	**648325.08**

(in lakh)

S.No.	Particulars	Target	Production	Target	Production	Target	Production
1	Planting material	94.80	155.59	-	-	94.80	155.59
2	Tissue culture plants	2.07	5.60	-	-	2.07	5.60
	Total	**96.87**	**161.19**	-	-	**96.87**	**161.19**



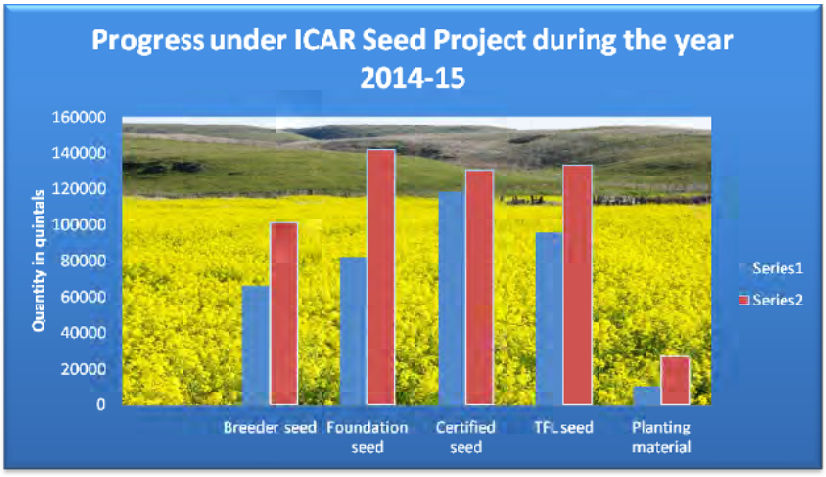
Targeted quantity of quality seed production under ICAR Seed Project during 2014-15 at a glance

(in quintal)

S. No.	Particulars	In University/Institute		Participatory Seed Production		Total	
		Target	Production	Target	Production	Target	Production
1	Breeder seed	64915.02	98861.34	1867.75	2053.40	**66782.77**	**100914.74**
2	Foundation seed	59325.78	69587.97	23258.50	72071.67	**82584.28**	**141659.64**
3	Certified seed	34734.40	41695.66	83858.00	88669.73	**118592.40**	**130365.39**
4	TFL seed	48662.36	67915.17	47272.50	65550.14	**95934.86**	**133465.31**
5	Planting material	10454.00	26818.33			**10454.00**	**26818.33**
	Total	**218091.55**	**304878.47**	**156256.75**	**228344.94**	**374348.30**	**533223.41**

(in lakh)

S. No.	Particulars	Target	Production	Target	Production	Target	Production
1	Planting material	87.80	54.18			87.80	54.18
2	Tissue culture plants	2.70	5.85			2.70	5.85
	Total	**90.50**	**60.04**			**90.50**	**60.04**



HRD/Capacity Building

Having a mandate of Human Resource Development in seed domain, various modules of trainings have been carried out by varied co-operating centres to cater the need of seed producing personnel including farmers, trainers and employees (field staff) of State Seed Certification Agency/ State Seed Corporation/ Seed Producer Companies and NGOs. Trainings were mainly focused on seed production, processing, storage, packaging, quality enhancement, quality control and seed health management. According to crop season, need and type of beneficiary, trainings were imparted under ICAR Seed Project on regular basis under Human Resource Development (HRD) component. Special training programmes on quality seed production for farmers of tribal areas were also started under Tribal Sub Plan component in selected cooperating centres across the country.

In toto 242 trainings/field days were organized for varied stakeholders during the year 2013-14. Similarly 93 Exhibitions/ Kisan melas/Kisan Goshtis were organized on diverse themes related to seed by different cooperating centres across the country.

Fund release during 2014-15

Field crop component		
	Non-recurring	**Amount (Rs. in lakh)**
1	Equipment	530.00
	Recurring	
2	TA	78.95
3	HRD	112.50
4	ORC	377.00
5	TSP	31.00
	Total	**1129.45**
Topical Seed Research and Quality Assurance Laboratory, Bengaluru		
	Non-recurring	
1	Equipment	50.00
	Total	**50.00**
	Grand total	**1179.45**

Quality Seed Production in Field Crops

Paddy-Ratnagiri-24

CSKHPKV, Palampur

Castor seed production plot AAU, Anand

Paddy KRH-2

Seed Stores at USF, Ladhowal, Ludhiana

Seed Stores at USF, Ladhowal

Kisan Mela

CSKHPKV, Palampur

IX Annual Review Meeting of ICAR Seed Project – Seed Production in Agricultural Crops held during 22nd-23rd September, 2014 at PJTSAU, Hyderabad

Ninth Annual Review meeting of ICAR Seed Project-"Seed Production in Agricultural Crops" was organized by DSR, Mau in liaison with PJTSAU, Telangana and ANGRAU, Andhra Pradesh. Prof. Swapan K. Datta, Hon'ble DDG (CS), ICAR graced the occasion as chief guest, aforesaid meeting was held under the chairmanship of Dr. A. Padma Raju, Vice-Chancellor, ANGRAU, Hyderabad. Dignitaries such as Dr. J. S. Chauhan, ADG (Seed) and Dr. V. Praveen Rao, Special Officer, PJTSAU, Hyderabad graced the dais. This meeting was attended by more than 160 participants encompassing nodal officers of various State Agricultural universities, ICAR institutes and scientists working in the field of seed science & technology. Dr. J.S. Chauhan, ADG (Seed), ICAR, in introductory remarks stressed upon the importance of quality seeds in safeguarding country's food and nutritional security and for developing effective need based seed programme. Dr. S. Rajendra Prasad, Project Director, DSR briefed the gathering about progress made by varied cooperating centres under this project during 2013-14 and presented action taken report of the previous year. In this meeting seed production achievements of various cooperating centres were reviewed by officials of ICAR and suggestions were given to accelerate the seed production activities to the respective cooperating centres.

During inaugural address, Hon'ble Dr. Swapan K. Dutta, DDG (CS), ICAR, New Delhi appreciated efforts mounted in making available quality seeds at farmers' doorstep. He further emphasized to deploy innovative modes of seed supply such as Automatic Vending Machine for vegetable seeds, e-purchasing of seeds for better outreach. He suggested gearing up seed production of pulses to minimize India's dependency on other countries *vis a vis* pulses availability. He suggested integrating information technology with agriculture to achieve prime minister vision of digital agriculture (e-marketing), remunerative agriculture (price surety) and real time agriculture. He further suggested providing seed crop insurance to overcome adversary of nature during seed production.

Dr. J. S. Chauhan, ADG (Seed), recommended renotification of old varieties as a special case considering demand of the particular variety. Further directives were given to formulate guidelines on production of nucleus seed by SAU's/ ICAR Institutes, other than originating breeder of the variety. As per the directives of council, awards for best performing centre under ICAR Seed Project were given to PAU, Ludhiana (SAU category) and DSR, Hyderabad (ICAR institute category), to honour excellence in seed production activities and capacity building under this project.

With an aim to sensitize scientists and researchers working in the field of seed technology, lecture encompassing diverse themes were organized. Shri. Sharath, Sure step Solutions delivered lead talk on Seed step –An enterprise mobile application designed for seed domain: and emphasized on e- commerce and measures to improve productivity per se. Dr. P. K. Ghosh, Director, IGFRI delivered lecture on exploring possibilities for promotion of fodder seed production: and emphasized on high density nurseries, methods for improving seed set in fodder crops. Dr. Nita Sachan delivered lead talk on Innovation, technology up scaling & entrepreneurship development: and emphasized on commercialization and entrepreneurship development in seed realm.

4 Tribal Sub Plan

4.1 DSR Main Scheme Achievements under Tribal Sub Plan

- A total amount of ₹ 76.00 lakhs has been released to six SAUs, one Central University and 3 ICAR Institutes for welfare of the tribal community through training / demonstration in quality seed production and storage activities, supply of quality seed, storage structure and micro-irrigation facility etc. during the year 2014-15.
- More than 1850 tribal farmers have been benefited through distribution of quality seed of paddy, wheat, pea, groundnut, moong, maize, chickpea, rapeseed & mustard, linseed, potato, soybean etc. of 20 districts of 6 states.
- A total number of 38 training programmes have been conducted for tribal farmers of six states on seed treatment, quality seed production, processing technology and safe seed storage of different field crops and vegetables.
- Regarding physical assets created in Tribal Sub Plan, a total number of 622 seed storage structure, 3 sprinkler irrigation system, 51 wheel hoe and 3 pump set have been distributed to tribal famers.

Photographs related to Tribal Sub Plan (DSR Main Scheme)

Training Programme on Seed Treatments at Dindori, Madhya Pradesh

Farmers participatory quality seed production of wheat variety JW 3211 and JW 3173 in district Dindori, M.P.


Training on use and fabrication of low cost medium term RC Seed bin in Manipur



Quality seed production of different crops in Manipur

4.2 Achievements of AICRP-NSP (Crops) under Tribal Sub Plan Programme (TSP)

With the objective of improving the livelihood of tribal farmers and, as per the direction received from the council for formulation, implementation and monitoring of TSP, the following cooperating centres of AICRP-NSP (Crops) were provided with funds under TSP as detailed below for the year 2014-15.

(Rs. in lakhs)

Sl. No.	Centre	AICRP –NSP (Crops) Tribal Sub Plan
1	SKUA& T, Srinagar	6.00
2	HPKVV, Palampur	5.00
3	AU, Kota	5.00
4	AAU, Anand	5.00
5	MPKV, Rahuri	7.00
6	PDKV, Akola	7.00
7	UAS, Bangalore	6.00
8	TNAU, Coimbatore	5.00
9	CRIJAF, Barrackpore	7.00
10	CAZRI, Jodhpur	2.00
11	CRRI, Cuttack	4.00
12	DRR, Hyderabad	2.00
13	DSR, Hyderabad	3.00
14	CICR, Nagpur	1.00
	Total	**65.00**

Various activities of the implementation of TSP program by selected cooperating centres of AICRP-NSP (Crops) along with details of the inputs provided to tribal farmers for taking up quality seed production, seed health and storage are given below:

PDKV, Akola

During the financial year 2014-15, the funds of ₹ 7.00 lakh were granted to Seed Technology Research Unit, Dr. PDKV, Akola (MS) under AICRP-NSP (Crops) Tribal Sub Plan for the welfare of tribal community.

Under this plan, the Seed Technology Research Unit, Dr. PDKV, Akola (MS) has prepared the following programmes for tribal farmers with the aim of increasing seed production in agricultural crops:

1. Training/demonstration to the farmers of tribal community.
2. Supply of quality seed, storage and other inputs.

In this regards, under STRU, Dr. PDKV, Akola a total of ten "One day farmers training" on "Seed production, processing and safe storage" were organized at 10 tribal villages of Chikhaldara taluk of Amaravati district from 6/11/2014 to 7/12/2015 benefiting 1101 farmers. The trainings included technical lectures on quality seed production of cereals, pulses, oilseeds and vegetable crops, processing, seed health and storage. Improved methods of cultivation for increasing production, seed treatment, drying, cleaning, grading, bagging and safe storage and improved agricultural implements were demonstrated successfully on farmer's field. During each training, five tribal farmers were selected from each village and the useful farm input like chickpea seed of JAKI-9218 were distributed to the selected tribal farmers. Total 750 kg chickpea seed of JAKI-9218 were distributed to 50 tribal farmers. The tribal areas where the seed was distributed are monitored by Seed Technology Research Unit during the different growth stages of crop for the feedback of above programme.

Under BSP unit, Dr. PDKV, Akola "One day farmers training" on seed production, processing and safe storage were conducted at seven tribal villages of Chikhaldara and Dharni taluk of Amaravati district from 3/2/2015 to 17/3/2015. The trainings included technical lectures on quality seed production of cereals, pulses, oilseeds and vegetable crops, processing, seed health and storage. Improved methods

Implementation of TSP and distribution of inputs at Dr. PDKV, Akola

of cultivation for increasing production, seed treatment, drying, cleaning, grading, bagging and safe storage and improved agricultural implements were demonstrated successfully on farmer's field. During each training, hundred tribal farmers were selected from each village and the useful farm input like Wheat seed of HD-2189 & AKW-381were distributed to the selected tribal farmers. Total 800 kg Wheat seed were distributed to 700 tribal farmers.

CAZRI, Jodhpur

Programme title: "Livelihood improvement of Scheduled Tribe Farmers through improved agricultural interventions"

Operational area: Motira village of Banswara tehsil in Banswara district of Rajasthan covering 120 farmers. The programme was implemented with the help of gram panchayat and state agriculture department. Looking to the needs of the farmers and after consultation with the agriculture supervisor of the village, improved seeds of wheat and fertilisers were provided to the ST farmers. Critical agricultural inputs like certified seeds of wheat var. Raj. 4037, DAP and Urea were provided to 120 tribal farmers. In total, 4800 kg certified seeds of wheat var. Raj 4037, 6000 kg urea and 6000 kg DAP were provided to the farmers for enhancing the agricultural productivity of the tribal farmers of the village.

Input distribution programme at Motira

MPKV, Rahuri

The quality seed acts as catalyst in improving crop productivity. Accordingly, Dr. PDKV, Akola distributed the quality seed of chickpea to the tribal farmers. Tribal Farmers are still using their farm saved seeds of traditional varieties of chickpea or land races available in their locality and most of the seed supplied comes from the informal seed sector. It was found that, quality attributes viz, purity, germination and seed health status of farm saved seeds is inferior as compared to certified seeds. Therefore, with an aim to accelerate use of quality seeds by the tribal farmers and to augment seed replacement rate (SSR) and Varietal replacement rate (VRR), certified / breeder seed of chickpea were distributed to tribal farmers from different tribal villages in Akole tahsil of Ahmednagar district. Three hundred sixty six farmers have been selected from five tribal villages *i.e.* Bari (50), Jahagirdarwadi (50), Waranghushi (135), Penshet (61) and Chinchodi (70) of Akole tehasils. Tribal farmers generally do not practice plant protection measures owing to lack of financial resources and technical knowledge

of plant protection. To ensure timely plant protection measures total of 1022 Knapsack Sprayers were distributed to the tribal farmers in 73 villages of Ahmednagar, Palghar and Nandurbar district. Field demonstrations and trainings were also arranged for the use of pesticides/insecticides to the tribal farmers.

Under this programme, farmers were trained for use of Knapsack Sprayer, safety measures to be taken during spraying of pesticides, preparation of formulation of different pesticides and insecticides, crop-wise safe dosage levels, for increasing the interest in implementation of plant protection measures on their farm in order to avoid losses in different crops.

Implementation of TSP in Village – Jahagirdarwadi, Tahasil-Akole, Dist-Ahmednagar

CSKHPKVV, Palampur

Financial statement and expenditures incurred in implementation of TSP at CSKHPKVV is given below:

Trainings on Seed Production Technology were imparted in two Tribal villages benefitting 85 farmers in Kinnaur district of Himachal Pradesh.

Name of the project	Amount earmarked of TSP (Rs. in lakhs)	Financial achievement during the quarter (Rs. in lakhs)	Physical achievement during the quarter			
			Number of individual/families/ colonies/villages benefited	Physical assets created	Type assets created	Any other information
Tribal Sub Plan (TSP) under AICRP-NSP (Crops)	1.50	First quarter (April-June, 2014)	-	-	-	-
		Second quarter (July-Sept., 2014)	Individual 85, in 3 villages	-	-	Imparted training on Seed Production Technology
		Third quarter (Oct.-Dec., 2014)	-	-	-	-

UAS, Bengaluru

Financial statement and expenditures incurred in implementation of TSP at UAS, Bengaluru is given below:

Name of the project	Amount earmarked of TSP (Rs. in lakhs)	Physical achievement during the quarter	
		No. of individual/ families/colonies/ villages benefited	Physical assets created
Tribal Sub Plan under AICRP-NSP (Crops)	1,00,000/-Last year	168 Families, 5 Colonies.	Ragi-780kg, Maize- 468kg, & Redgram-78kg
	6,00,000/- Current year	450 Families, 6 Colonies.	Ragi-2250kg, Maize- 450kg, Field Bean-225kg & Kitchen Garden-450packs
			--
Total	7,00,000/-		

TSP programme at Biligirirangana Hills on 5th July, 2014

National Seed Project (Crops), UAS, GKVK, Bengaluru had made an initial survey on 4th July, 2014 at the Biligirirangana hills, Yalandur taluk of Chamarajanagar district to identify the beneficiaries and also to know the requirements of tribal farmers of these areas accordingly, a training cum seed distribution programme was conducted on 5th July, 2014. The tribal's were educated to conserve their own seeds and use for the subsequent seasons, instead of depending on the government schemes. The resource persons have spoken on the various aspects of seed production technology to educate the farmers on how to cultivate the crops, selection and preservation of seeds, testing of seeds before sowing etc. After the training programme, the National Seed Project has distributed about 15 quintals of various seeds to the identified tribal farmers of different Podu/thanda (locality) of BR Hills.

Sl. No.	Name of the podu	No. of tribes (Families)	Ragi (kgs)	Maize (kgs)	Redgram (kgs)	Total (kg)
1.	Yaraknagaddepodu	80	5	3	0.5	680
2.	Seegebeetapodu	20	5	3	0.5	170
3.	Manjigundipodu	20	5	3	0.5	170
4.	K. Devrahally	18	5	3	0.5	163
5.	Bangle podu	30	5	3	0.5	255
	Total	168				1438

TSP programme at M.M. Hills

A survey was carried out to identify tribal beneficiaries at M.M. Hills and to know the seeds and planting materials required for the late *Kharif* 2014. The seed material requirements and the beneficiaries have been identified with the help of local tribal leaders and the officials of Myrada. It was decided to distribute seed materials for 450 tribal families living around MM hills area of Kollegal taluk, Chamarajanagar district.

Accordingly, the programme was scheduled on 30th August, 2014 at MM hills and organized one day training proramme on seed production programme. The crop cultivation practices for the crops like ragi, maize, field bean were explained by the resource persons drawn from National Seed Project. The seed material kits consisting of ragi, maize, field bean, bendi, amaranthus, chilly, tomato, pumpkin, ash gourd and beans were distributed to all the tribal farmers.

TSP activities held on 5th July, 2014 at BR Hills, Yelandur taluk, Chamarajanagar district

TSP activities held on 30th August, 2014 at MM Hills, Kollegal taluk, Chamarajanagar district

MAF, AU, Kota

A two day training programme for 60 tribal farmers from Kota district was organized at NSP, MAF, Kota. The training imparted techniques involved in various aspects of seed production technology to educate the farmers regarding cultivation of crops, selection and preservation of seeds, testing of seeds before sowing, use of Knapsack Sprayer, safety measures to be taken during spraying of pesticides, preparation of formulation of different pesticides and insecticides, crop-wise safe dosage levels etc. After the training programme, seed 60 storage bins of 4-5 quintal capacity and 60 knap sack sprayers were distributed to tribal farmers.

4.3 Achievements of ICAR Seed Project under Tribal Sub Plan Programme (TSP)

Budget allocation (Rs. lakh)	Trainings (Number)	FLDs (Number)	Exhibitions (Number)	Exposure visit (Number)	Beneficiaries (Number)	Supply of inputs (Type with units)	Asset created (Type & Number)
31.00	64	532	23	28	1465	Quality seed along with recommended fertilizers & pesticides; seedlings / samplings (banana and vegetables) were distributed.	Seed storage bins; Knapsack sprayers, Sickles; Manuals/technical bulletins and technology inventory pertinent to quality seed production were distributed.

Note: Progress report of IV quarter (2014-15) is still awaited from few cooperating centres

5 Extension Activities

Seed Village Scheme

Implementation of seed village scheme by improving of socio-economic status of farmers through seed technological intervention' (DoAC).

Objectives

- To improve the quality of farmers saved seed through use of different seed enhancement techniques.
- To ensure the disease & insect free quality seed production by use of suitable plant protection measures.
- To train the farmers about seed production technology, use of quality seed along with improved package of practices for different seed crops.

In order to promote quality seeds for improving production and productivity, Directorate of Seed Research, Mau is implementing Seed Village Scheme for development and strengthening of seed infrastructure facilities for production and distribution of quality seeds of DSR with financial support of Department of Agriculture & Cooperation (DAC), Government of India, Ministry of Agriculture, New Delhi.

No. of districts covered	:	**Mau, Ballia and Ghazipur**
No. of villages covered	:	**259 villages**
Area covered	:	**14630 acres**
Seeds distributed	:	**4159.65 quintals**
No. of farmers benefited	:	**14630 farmers**
Crops	:	

Pigeon pea (Bahar, NDA-1, NDA-2, MAL-13)

Paddy (MTU 7029, BPT 5204, Sarju-52, NDR-97, NDR-359, IR-36, MTU 7029, HUR105, Rajendra Sweta, Pusa Sugandh-5, IPB-1, KN-3, Pusa Basmati-1509, Pusa Basmati-4, Pusa Basmati–6)

Mustard (Pusa Tarak, Sweta, Rohini, Ashirvad, NDR 8501)

Lentil (Sherry, IPL 406, IPL 81, HUL 57, NDL 1)

Chick pea (Pusa 362, JG 11, JG 16, Udai, Avarodhi, Subhra)

Wheat (HD 2967, HD 2733 PBW 621, WH 711, K 307, PBW 343, PBW 502, PBW 550,

KRL 213, DBW 39, DBW 17, DPW 621-50, HUW 234, PBW 373, PBW 533, HD 2643, PBW 154, HI 1563, Unnat Halna, PBW 509, HI 1563 & WR 544).


Seed Sale Counter

- Breeder, foundation, certified and truthful seeds of the paddy varieties such as NDR 97, NDR 359, Sarju-52, KN-3, HUR 105, Improved Pusa Basmati-1, Pusa Basmati-4, Pusa Basmati-6, Pusa Basmati-1509, Pusa Sugandh-5, Rajendra Sweta, MTU-7029, BPT-5204 and pigeon pea varieties Narendra Arhar-1, Narendra Arhar-2 and Bahar were sold at seed sale counter at Directorate of Seed Research, Mau before *Kharif* 2014.


- Before the onset of *Rabi* season 2014, breeder, foundation, certified and truthful seeds of the **mustard** varieties Pusa Tarak, Ashirwad, Rohini & NDR 8501, **lentil** varieties DPL 62, IPL 406, HUL57, **chickpea** varieties Pusa 362, Avarodhi, KPG 59, JG 11 & JG 16, **field pea** variety KPMR 400 & Rachna, **barley** variety Gitangali and **wheat** varieties HD 2733, DBW 39, PBW 621, HD 2967, KRL 213, PBW 343, PBW 502, PBW 550, WH 711, PBW 373, PBW 154, PBW 509, DBW 17, HD 2643, WR 544, and Unnat Halna were sold at seed sale counter at Directorate of Seed Research, Mau.

Crop Cafeteria

- To enhance varietal replacement rate (VRR) and to create awareness among farmers of adjoining areas about the new varieties of crops, a crop cafeteria of various *Kharif* agronomical crops with different recommended and also locally suited sustainable varieties was raised at DSR farm. Considering 'seeing is believing', an overall face to face interaction with DSR scientists is very

useful for farmers, rural youth and farm women. Crop cafeteria in *Kharif* 2014 was put up for paddy varieties - MTU-7029, BPT-5204, Rajendra Sweta, HUR-105, Imp. PB-1, PB-4, PS-5, PB-6, Pusa basmati-1509, IR-36, IR-64, KN-3, Kala Namak 101, Naveen, Sampurna, Moti Gold, Moti Plus, Kaveri Silk, Rayal Bhog, NK 5258, NK 6302, Kaveri 9090, Ganesh Hybrid and CR Dhananjay varieties.

Field view of paddy crop

Similarly, a crop cafeteria of various *Rabi* crops with different recommended and also locally suited sustainable varieties was raised at ICAR-DSR farm with varieties viz., **Chickpea** : JG-11, JG-16, BGD-72, Pusa 362, Pusa 1088 (Kabuli), **Lentil**: DPL-15, Sherri, IPL-407, NDL-1, HUL-57, **Linseed**: Azad Alsi-1, Mustard- Pusa Bold, Pusa Tarak, Pusa Vijay, CS-54, Rohini, Ashirwad, **Field pea**: IPF 4-9, Aman, KPMR 400, Rachna, **Barley** : NDB-1173 & Gitanjali and **Wheat** : Under Timely Sown -HD 2967, HD 3086, HD 3059, KRL-19, HD 2733, WH-1105, WH-711, PBW-621, PBW-502, PBW-343, DBW 651-50, DBW 39, DBW 17, K-307 (Shatabdi), PBW 550, KRL-213, KRL-210, Kundan & Under Late Sown- HD-3118, DBW-71, DBW-107, Raj. 4120, HD 2643, PBW 509, PBW 373, HI-1563, HUW-234, PBW-154 & (VLS)- WR-544, Unnat Halna.

Field view of mustard, linseed, chickpea and wheat varieties

Kisan Mela 2015

Directorate of Seed Research (DSR) organized *Kisan Mela* on 02 March, 2015. The *Kisan Mela* was inaugurated by Dr. Gautam Kalloo Former DDG (Horticulture) Indian Council of Agricultural Research, New Delhi. As Special invitees Dr. Arun Kumar Sharma, Director National Bureau of Agriculturally Important Microorganism, Mau and Dr. Nepal Singh, Deputy Director, UP State Seed Certificate Agency, Mau were invited on this occasion. A number of dignitaries including consultants, experts from ICAR Institutes and Department of agriculture, Banaras Hindu University (BHU) actively participated in the deliberations of the *Kisan Mela*.

All ICAR Institutes located at Uttar Pradesh, Department of Agriculture, Banaras Hindu University, Regional Station and other government/private agencies displayed their exhibitions. Besides these, various banks like State Bank of India, Punjab National Bank and NGOs also displayed their exhibitions. On the occasion of Kisan Mela, a magazine full of useful information for farmers titled "**Prasar Patrika**" was released. Scientists interacted with the farmers, discussed and solved their rising agricultural related problems. About 3000 farmers from Uttar Pradesh and students from different schools were visited and benefited from this important function.

Model Village Scheme

Five villages viz., Onhaich, Paniara, Bagali, Khiria, kushmaur have been exclusively selected under the scheme for intensified extension activities. Various on and off campus trainings were organized for farmers of these villages. Quality seeds of wheat, mustard, gram and paddy were distributed on subsidized rate among 2000 farmers of selected villages for seed production. Various techniques, line sowing of wheat, application of GA_3 on wheat crop, vermicomposting were demonstrated on farmer's field in selected villages. Many progressive farmers are also associated with Directorate through participatory seed production. Front line demonstration on use of quality seed of barseem was conducted on 30 farmers' field.

Participation in Exhibition, *Kisan Goshthis* and farmers' training programmes

- DSR Scientists participated in *Goshthi* organized by Agriculture Department of Mau on 30.10.2014. DSR stall was put up in *Goshthi* which was appreciated by visiting farmers.
- DSR participated in *Mela* organised by on NEFORD, Mau on 31.10.2014 by putting the stall and seed selling counter. Seed selling Counter of DSR was the major attraction during *mela*.



- DSR stall was organised in *Rashtriya Kisan Mela evam Sabji pradarshni* on 30th and 31st January, 2015 organised by Indian Institute of Vegetable Research, Varanasi. About 220 farmers visited the DSR stall and took the information about use and source of quality seed.
- DSR stall has been put up in *Kisan Mela* organised by ICAR - Central Potato Research Station, Patna from 19th to 21st February, 2015. About 250 farmers visited the DSR stall.
- One exposure visit 30 girls of *Mahila Shikshan Kendra* (*Mahila Samakhya*) to ICAR-DSR, Mau was organized on 25.03.2015.
- Throughut the year number of farmers' training programme on and off the campus were organised to educate the farmers with technologies on quality seed production, processing and storage.

6 Quality Seed Production

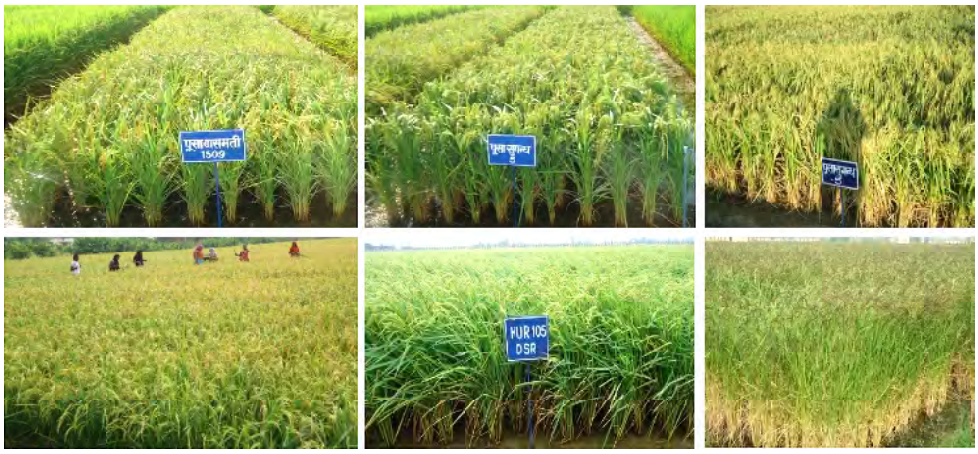
Revolving Fund Scheme

- About **378.0 quintals** (graded) of quality seed of paddy varieties such as MTU 7029, BPT 5204 & Sarju-52 during *Kharif season* 2014 were produced under Revolving Fund Scheme of ICAR-DSR, Mau and supplied to the farmers.
- About **1240.3 quintals** (ungraded) of quality seed of wheat varieties such as HD 2967, HD 3059, HD 3086, PBW 343, PBW 502, PBW 621, PBW 154, PBW 373, KRL 213, HD 2643 and PBW 509 during *Rabi season* 2014-15 were produced under Revolving Fund Scheme of ICAR-DSR, Mau and supplied to the farmers.

Quality Seed Production in DSR Farm

- About **39.0 quintals** (graded) of breeder seed of ***paddy*** varieties such as IR 36, IR 64, MTU 7029 and BPT 5204 during *Kharif season* 2014 were produced at DSR Farm.

- About **128.30 quintals** (graded) of foundation & TFL seed of ***paddy*** varieties such as Improved Pusa Basmati-1, CR Dhananjay, Pusa Basmati-4, Pusa Sugandh-5, Pusa Basmati-6, Pusa Basmati 1509, HUR 105, Naveen and Rajendra sweta varieties during *Kharif season* 2014 were produced at DSR Farm.



- About **58.0 quintals** (ungraded) of breeder seed of **wheat** varieties such as HD 2733 and HI 1563 during *Rabi* season 2013-14 were produced at DSR Farm.
- About **121.50** and **5.0 quintals** (ungraded) of quality seed of **wheat** and **barley** such as HD 2967, HD 3086, PBW 502, WH 1105, HD 2733, PBW 343, HI 1563, DBW-71, PBW 373, HD 3059, HD 3118, WR 544, DBW 107, Kundan & NDB 9443 during *Rabi* season 2013-14 were produced at DSR Farm and supplied to the farmers.
- About **15.0 quintals** of quality seed of **chickpea** (Pusa-362 & Shubhara), fieldpea (Rachna)**, lentil** (HUL 57 & DPL-62) and **6.50 quintals** of **mustard** (Pusa Bold & CS-52) and **linseed** (Azad Alsi-1) during *Rabi* season 2013-14 were produced at DSR Farm and supplied to the farmers.
- About **3.0 quintals** of quality seed of **potato** *(*Kufari Anand & Kufari Kanchan) during *Rabi* season 2014-15 were produced at DSR Farm.

7 Capacity Building – Training Programmes Conducted

International hands-on training on quality rice seed production-2014

The International Rice Research Institute (IRRI), Manila, Philippines in collaboration with Banaras Hindu University (BHU), Varanasi, India, ICAR-Directorate of Seed Research (DSR), Mau, India and National Seed Research and Technology Centre (NSRTC), Varanasi, India, organized joint training programme entitled ***"International hands-on training on quality rice seed production"*** at Institute of Agricultural Science(IAS), BHU, Varanasi, India from 06th-10th October, 2014. The aim of the training was to improve the technical skills of researchers and trainees in quality seed production and discussions with special emphasis on seed production problems encountered by farmers, researchers and other stake holders.

Thirty participants from seven South East Asia (Indonesia, Vietnam, Philippines, Laos, Papua New Guinea, Cambodia and Myanmar) and three South Asian (Bangladesh, India and Nepal) countries attended the training. Participants were exposed to a two-day rigorous hands-on training and modalities in nursery bed preparation, seed cleaning, field preparation, transplanting, rouging etc. The team visited the demonstration field and various laboratories at ICAR-Directorate of Seed Research for an overview of seed management activities and technologies involved in rice seed production.

Maintenance Breeding: Training–cum-Exposure Visit-2015

ICAR-Directorate of Seed Research (ICAR-DSR), Mau in collaboration with Indian Agricultural Research Institute-Regional Station (IARI-RS), Karnal organized a two day training programme entitled **"Maintenance Breeding: Training –cum- Exposure Visit"** for scientific staff of cooperating centers involved in Breeder Seed production activity under AICRP-NSP (Crops) and ICAR-Seed Project during 03-04 March, 2015 at IARI, RS, Karnal. Twenty two participants from various cooperating centers attended the training.

The lectures and interactive sessions highlighted the technique involved in maintenance breeding of concerned crops, factors responsible for varietal deterioration with special emphasis on residual heterozygosity & environmental stresses and its manifestation in occurrence of offtypes in the maintenance plots. Classroom interactions were followed by visit to the maintenance breeding and seed production plots.


Training on "Fodder Seed Production Technologies" at ICAR-DSR, GKVK Campus, Bengaluru

A five days advanced training programme on "Fodder Seed Production Technologies" was


organized by ICAR-Directorate of Seed Research, Mau in collaboration with National Dairy Development Board, Anand, Gujarat from 12th – 16th January, 2015 at both Regional Station, DSR, GKVK Campus and NBAIR, Bengaluru for 20 participants from different Milk Union across India. During training programme about 20 interactive lectures were organized from DSR faculties and also inviting experts on different aspects viz. advance seed production technologies, new varieties of fodder suitable for different region, seed quality assurance system in fodder seeds, participatory approach for seed production, new frontiers in seed quality enhancement technologies, use of information & communications technologies in seed production management etc. along with field visits to both public and private sector fodder seed farms. The programme was organized with financial support of NDDB, Anand, Gujarat.

8 Intellectual Property Rights

Patents

Three patents have been filed from ICAR-Directorate of Seed Research, Mau, UP. These are as follows:

1. Indian Patent Application Number 179/Del/2014 titled **"Three way Matrix Sampler"** dated 24 Jan., 2014.
2. Indian Patent Application Number 180/Del/2014 titled **"Three way Matrix gun"** dated 24 Jan., 2014.
3. Indian Patent Application Number 181/Del/2014 titled **"Three way Sampling Method for assessing genetic purity of parental seed of hybrids"** dated 24 Jan., 2014.

Capacity Building in IP Management

Training/Workshop/Seminar etc. organized

S.N.	Title	Organized by	Participants (No)
1	Poster Exhibition on 'Intellectual Property Rights-Current Scenario' on occasion of ICAR Foundation Day (16 July 2014)	one day	121
2	Sensitization programme and poster exhibition on IPR at ICAR-Directorate of Seed Research, Mau on 01.11.2014	ICAR-DSR, Mau	122
3	Sensitization programme and poster exhibition on IPR at ICAR-Directorate of Seed Research, Mau on 05.11.2014	ICAR-DSR, Mau	112
4	Awareness cum Training Programme on PPVFRA 2001 at ICAR-Directorate of Seed Research, Mau on 16.02.2015	ICAR-DSR, Mau	302

Participants at various IPR awareness trainings at ICAR-DSR, Mau

9 Other Important Activities

स्वच्छ भारत अभियान

निदेशालय में स्वच्छ भारत अभियान दिनांक 02 अक्टूबर, 2014 को महात्मा गाँधी की इस अवधारणा कि ''स्वच्छता आजादी से अधिक महत्वपूर्ण है'' को कार्यान्वित करने के उद्देश्य से प्रारम्भ किया गया। इस अवसर पर निदेशालय के सभी कर्मचारियों एवं अधिकारियों ने निदेशालय परिसर को स्वच्छ बनाने का संकल्प लिया। इस अवसर पर परियोजना निदेशक डा. एस. राजेन्द्र प्रसाद ने स्वच्छ भारत अभियान के महत्व एवं उद्देश्य पर प्रकाश डाला। निदेशक महोदय ने स्वच्छता को कर्मचारियों के व्यक्तिगत एवं सामूहिक प्रदर्शन हेतु सहायक बताया।

- निदेशालय द्वारा परिसर तथा आस–पास के क्षेत्रों में साफ–सफाई करने एवं उसके प्रति जागरूक बनाने के लिए एक विस्तृत कार्यक्रम तैयार किया है। इस कार्यक्रम के अन्तर्गत प्रत्येक सप्ताह में 02 घन्टे की अवधि निर्धारित की गयी है। इसका आयोजन दिनांक 09 जनवरी 2015 से नियमित रूप से किया जा रहा है।
- निदेशालय द्वारा पंचवर्षीय कार्यक्रम के तहत एक गांव को गोद लेने की योजना है। इसके अन्तर्गत उस गांव के साफ–सफाई के साथ जागरूकता कार्यक्रम भी आयोजित किये जायेंगे। इसी कड़ी में ग्राम पंचायत से चर्चा कर भावी कार्यक्रमों की रूपरेखा तैयार की जा रही है।
- निदेशालय द्वारा वर्ष भर कृषक प्रशिक्षण कार्यक्रम आयोजित किये जाते हैं। स्वच्छ भारत अभियान के प्रति जागरूकता फैलाने का कार्यक्रम कृषक प्रशिक्षण कार्यक्रम का अभिन्न अंग होगा।

Rashtriya Ekta Diwas (National Unity Day)

As per the directives of the Ministry of Home Affairs, Govt. of India, the birth anniversary of Late Sardar Vallabhbhai Patel was observed as "*Rashtriya Ekta Diwas* (National Unity Day)" on 31st October, 2014. This occasion provided an opportunity to reaffirm the inherent strength and resilience of our nation to withstand the actual and potential threats to the unity, integrity and security of our country. Accordingly, a Pledge taking ceremony followed by collective singing of the National Anthem took place at 11.00 a.m. on 31st October, 2014 in ICAR –DSR, Mau.

Vigilance Awareness Week

Vigilance Awareness Week was conducted at ICAR-DSR, Mau for the year 2014 from 27 Oct. to 1 Nov., 2014; various activities were organized at the institute with the mains focus on theme area "Combating Corruption- Technology as an Enabler". On Oct. 27, 2014 the Vigilance Pledge was administered to all the scientists, officers and staff of the Directorate by the Project Director, Dr. S. Rajendra Prasad, who also highlighted the background of the theme. On Oct. 29, 2012, a talk

Vigilance pledge taken at 11 a.m. on 27th Oct., 2014

on "Strategies for Mitigating Corruption- Technology as an Enabler" was delivered by the Dr. S. Rajendra Prasad, Project Director followed by interactive session in which Dr. Prasanna, Vigilance Officer, ICAR-IIVR, Varanasi who shared his valuable experience which was highly appreciated. On 30 Oct., 2014, an essay competition was conducted at the institute for all staff in Hindi and English medium on "Combating Corruption- Technology as an Enabler". On 31 Oct., 2014, "Anti-Corruption Slogan" delivery competition was organized in Hindi and English language for all staff of institute. Further, on 1 Nov., 2014 the vigilance awareness week concluded at the Directorate, Dr. S. Rajendra Prasad, Project Director delivered concluding remarks on the week long awareness activity followed by prize distribution for the winners of various activities organized during the week.

Talk on "Strategies for Mitigation of Corruption in Government Offices" by Dr. S. Rajendra Prasad

Yoga Programme

Following the traditional wisdom that a healty mind can dwell in a healthy body only, an Art of Living *Yoga* Classes were organised from 21.11.2014 to 25.11.2014 at ICAR- DSR, Mau. Staff members from ICAR-DSR and ICAR-NBAIM, Mau participated in this activity in a large number.

Art of Living Yoga Classes 21.11.2014 to 25.11.2014

DSR Foundation day

ICAR-Directorate of Seed Research celebrated its Foundation Day on 16th February, 2015 and on this occasion awareness cum training programme on Protection of Plant Varieties and Farmers' Rights Act, 2001 was organized. Dr. R.K. Chaudhary ex-O.S.D., ICAR-DSR, Mau delivered the Foundation Day lecture and emphasized upon the need for further enhancing the production of quality seed among various crops. A progressive farmer Shri Chandra Shekhar Singh, who has made significant contributions in varietal development and conservation of landraces was felicitated. Chief guest of the function, Dr. R. C. Agarwal, Registrar General, PPV &FRA, New Delhi highlighted the importance of conservation of landraces and presented a glimpse of activities being carried out by the authority. Dr. S. Rajendra Prasad, Project Director, ICAR-Directorate of Seed Research, Mau in presidential address highlighted the importance of quality seed and progress country has made in safeguarding the food security through ensured supply of quality seeds among field and horticultural crops and emphasized upon the technologies developed by the Directorate, in particular the work being carried out for farmers of Eastern Uttar Pradesh. During this occasion good number of farmers from neighboring villages along with scientists, officers and employees of ICAR-DSR and ICAR-NBAIM, Mau attended the function.


Monitoring team's visit to ICAR-DSR, Mau

Sports activities at ICAR-DSR, Mau on Independence day

Bhoomi Poojan **of Annexe building of ICAR-DSR, Mau**

IMC Meeting

QRT Meeting on 17-18.07.2014

RAC Meeting on 28.12.2014

Hon'ble DDG (CS) Dr. Swappan K. Datta Visiting ICAR-DSR Laboratory

IX Annual Review Meeting of ICAR Seed Project 'Seed Production in Agricultural Crops' on 22.09.2014 to 23.09.2014

Seed day on 28.10.2014

Farmers' Visiting Crop Cafeteria at ICAR-DSR, Mau

Hon'ble Member of Parliament Shri Harinarayan Rajbhar Visiting ICAR-DSR Stall at NEFORD *Kisan Mela*

10 राजभाषा का वार्षिक प्रगति प्रतिवेदन

हिन्दी दिवस का प्रतिवेदन

हिन्दी चेतना मास के अंतर्गत दिनांक 14.09.2014 को हिन्दी दिवस का आयोजन किया गया। कार्यक्रम का शुभारम्भ परियोजना निदेशक डा. एस. राजेन्द्र प्रसाद द्वारा दीप प्रज्जवलन के साथ हुआ। अपने उद्घाटन भाषण में डा. प्रसाद ने निदेशालय के विविध कार्यालयीन कार्यों सहित शोध एवं प्रकाशन गतिविधियों में हिन्दी के बढ़ते हुए प्रयोग पर संतोष व्यक्त किया तथा निदेशालय कार्मिकों द्वारा हिन्दी भाषा में किये जा रहे कार्यों की सराहना की। राजभाषा कार्यान्वयन समिति के सदस्य सचिव श्री अजय कुमार सोनी द्वारा निदेशालय में हिन्दी भाषा में हो रहे कार्यों की प्रगति रिपोर्ट प्रस्तुत करते हुए बताया कि निदेशालय में कार्यरत कुल 40 कार्मिकों में से 33 कार्मिकों को हिन्दी भाषा का कार्य साधक ज्ञान प्रापत हो चुका है जो कि कुल कार्मिकों का 82.50 प्रतिशत है। यह एक विशेष उपलब्धि है क्योंकि निदेशालय में कार्यरत कुल वैज्ञानिकों में 66 प्रतिशत गैर हिन्दी भाषी क्षेत्र से सम्बन्धित हैं। जबकि कुल गैर हिन्दी भाषी कार्मिक 40 प्रतिशत हैं। उद्घाटन समारोह के अन्त में हिन्दी चेतना मास के अन्तर्गत आयोजित होने वाले विविध आयोजनों की रूपरेखा प्रस्तुत की गयी तथा इनके सफल कार्यान्वयन तथा संचालन के लिए शुभकामना दी गयी।

हिन्दी सप्ताह/पखवाड़ा/मास के अंतर्गत आयोजित विविध कार्यक्रमों का प्रतिवेदन

हिन्दी चेतना मास के अंतर्गत आयोजित हिन्दी सप्ताह/पखवाड़ा के दौरान निम्न प्रतियोगिताएं आयोजित की गयी।

क्र.सं.	प्रतियोगिता का नाम	आयोजन की तिथि
1.	प्रश्नमंच प्रतियोगिता	25.09.2014
2.	हिन्दी टिप्पण/प्रारूप लेखन	26.09.2014
3.	हिन्दी अनुवाद प्रतियोगिता (प्रशासनिक पैराग्राफ 250 शब्दों का अंग्रेजी से हिन्दी अनुवाद)	27.09.2014
4.	निबंध लेखन प्रतियोगिता (हिन्दी भाषी)	30.09.2014
5.	निबंध लेखन प्रतियोगिता (गैर–हिन्दी भाषी)	01.10.2014
6.	कम्प्यूटर पर यूनिकोड में हिन्दी टंकण प्रतियोगिता (सभी वर्गों के लिए)	08.10.2014
7.	विशेष टिप्पण प्रतियोगिता (इस प्रतियोगिता में वर्ष के दौरान हिन्दी में सर्वाधिक कार्य करने वाले अधिकारियों/कर्मचारियों को पुरस्कृत किया जायेगा)	13.10.2014
8.	तात्कालिक भाषण प्रतियोगिता	13.10.2014
9.	काव्य पाठ प्रतियोगिता तथा पुरस्कार वितरण एवं समापन समारोह	16.10.2015

Hindi Chetna Mass on 25.09.2014 to 16.10.2014

एक दिवसीय हिन्दी कार्यशाला
''हिन्दी के बढ़ते कदम–कल से आज तक''

दिनांक 18.02.2015 को बीज अनुसंधान निदेशालय में एक दिवसीय हिन्दी कार्यशाला का आयोजन किया गया। जिसका विषय था ''हिन्दी के बढ़ते कदम–कल से आज तक''। कार्यक्रम का प्रारम्भ प्रातः 11:00 बजे हुआ। स्वागत भाषण करते हुए डा. अशोक कुमार सिन्हा, वरिष्ठ वैज्ञानिक ने मुख्य वक्ता के रूप में पधारे काशी हिन्दू विश्वविद्यालय के हिन्दी विभाग में कार्यरत सहायक प्राध्यापक डा. सत्यपाल शर्मा एवं अतिथि वक्ता के रूप में महात्मा गांधी काशी विद्यापीठ से पधारे सहायक प्राध्यापक डा. विजय कुमार रंजन का सभागार में उपस्थित जनों से परिचय कराया। इसके पश्चात डा. टी.एन. तिवारी, वरिष्ठ वैज्ञानिक ने हिन्दी एवं कृषि शोध के बीच समन्वय पर बल देते हुए कहा कि मातृभाषा में किया गया शोध जनसामान्य के लिए अधिक लाभकर होगा। डा. दिनेश कुमार अग्रवाल, प्रधान वैज्ञानिक ने हिन्दी भाषा के उज्जवल भविष्य की ओर संकेत करते हुए बताया कि वैश्वीकरण के प्रभाव में हिन्दी भी वैश्विक भाषा हो गयी है। इस क्रम में डा. अरविन्द नाथ सिंह, वरिष्ठ वैज्ञानिक ने हिन्दी भाषा के प्रयोग में आ रही अशुद्धता पर चिंता व्यक्त की, लेकिन यह भी समझाया कि अत्यधिक शुद्धतावाद पर बल देने से हिन्दी का प्रसार प्रभावित होगा।

अतिथि वक्ता डा. विजय कुमार रंजन ने हिन्दी के बाजारीकरण पर विस्तार से प्रकाश डालते हुए बताया कि हिन्दी को अपनाना एवं इसको निरंतर बढ़ाना बाजार की विवशता है, न कि आज ऐसा करके हिन्दी भाषा पर कोई कृपा की जा रही है। उन्होंने भाषा की शुद्धता पर जोर दिया तथा इंगलिश के बढ़ते प्रयोग पर चिंता व्यक्त की।

Hindi *Karyashala* on 18.02.2015

समारोह में पधारे अतिथि वक्ता डा. सत्यपाल शर्मा ने हिन्दी की प्राचीनता पर प्रकाश डालते हुए बताया कि हिन्दी कोई नई भाषा नहीं है, वरन् इसके बीज 9वीं शदी से ही मिलने लगते हैं। उन्होंने हिन्दी के क्रमिक विकास की यात्रा की जानकारी देते हुए हिन्दी तथा अन्य विदेशी भाषाओं के मिश्रण से बनी आधुनिक हिन्दी भाषा पर विस्तार से प्रकाश डाला। हिन्दी को वैश्विक भाषा बनाने में उन्होंने बाजारीकरण के प्रभाव का उल्लेख करते हुए बताया कि बाजार ने हिन्दी को हिन्दी भाषी प्रदेशों की सीमाओं से निकालकर न केवल गैर–हिन्दी प्रदेशों अपितु विदेश में रह रहे अनिवासी भारतीयों की भी संपर्क भाषा बना दिया है। उन्होंने राजभाषा अधिनियम की जानकारी देते हुए हिन्दी की संवैधानिक स्थिति को समझाया। हिन्दी के उज्जवल भविष्य की कामना करते हुए उन्होंने अपने भाषण का समापन किया।

तत्पश्चात् अध्यक्षीय भाषण देते हुए डा. एस. राजेन्द्र प्रसाद, अध्यक्ष, राजभाषा कार्यान्वयन समिति, बीज अनुसंधान निदेशालय, मऊ ने हिन्दी को लोक भाषा एवं कार्यालय की प्रधान कार्यभाषा बनाने का संकल्प व्यक्त करते हुए इस बात को रेखांकित किया कि हिन्दी आज गैर हिन्दी भारतीय प्रदेशों की भी संपर्क भाषा बन गयी है।

अंत में श्री अजय कुमार सोनी, सदस्य सचिव, राजभाषा कार्यान्वयन समिति, बीज अनुसंधान निदेशालय, मऊ ने कार्यशालय के अध्यक्ष, मुख्य एवं अतिथि वक्ता सहित सभागार में उपस्थित सभी सदस्यों को धन्यवाद करते हुए कार्यशाला के समापन की घोषणा की। कार्यशाला को सफल बनाने में राजभाषा समिति के सदस्यों डा. गोविन्द पाल, डा. मदन कुमार, श्री अरूण कुमार चतुर्वेदी एवं श्री सुधाकर श्रीवास्तव का सराहनीय योगदान रहा। कार्यक्रम में मंच संचालन का कार्य डा. टी.एन. तिवारी, वरिष्ठ वैज्ञानिक ने किया।

11 Awards

- Dr. Govind Pal received '**Award for Excellence in Research**' by EET CRS, Noida, Uttar Pradesh under Science and Technology Award – 2014.
- Dr. Govind Pal received '**Best Paper Presentation Award**' in the national seminar on Extension innovations and methodologies for market- Led agricultural growth and development during February 26-28, 2015 at RVSKVV, Gwalior, MP by Indian Society of Extension Education, New Delhi.
- Dr. Arvind N. Singh received best paper Award during International Conference on Agriculture, Veterinary & Life Sciencs – 2015.

Dr. A.N. Singh receiving Young Scientist Associate Award

Dr. Govind Pal receiving Best Paper Award

Shri Abhishek K. Rai, Senior Technician receiving 2nd prize during Central Zone Sports Meet of ICAR

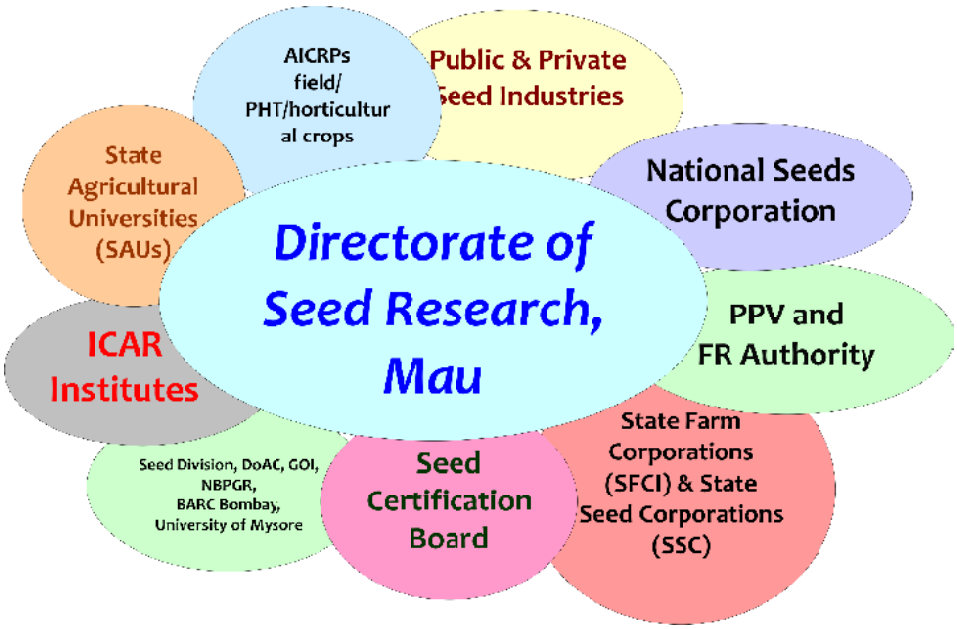
Shri J.K. Tripathi, Technical Assistant receiving Excellence in Leadership Award at NEFORD *Kisan Mela*

- Dr. Arvind N. Singh has been elected the Life Fellow of the Entomological Society of India, IARI, New Delhi.
- Dr. Arvind N. Singh received "Bioved Young Scientist Associate Award, 2015 " for outstanding contribution made in the field of "Entomology".
- Shri J.K. Tripathi, Technical Assistant receieved excellence in leadership award at NEFORD *Kisan Mela* on 27.05.2014.
- Shri Abhishek K. Rai, Senior Technician receivied 2nd prize in high jump event during central zone sports meet of ICAR at Nagpur (MS).

12 Linkages

National Linkages

The Directorate of Seed Research has active linkages with national agencies involved in the seed production and seed science research and development.



Linkages Proposed at National Level

1. There is need to strengthen better linkage and inter-action with All India Crop Improvement Projects.
2. Linkages are also required with research institutes like DSR, Indore for Soybean, DSR, Hyderabad for Sorghum and DRR Hyderabad etc. for better planning and implementation of the programme. Linkage should be strong with the Institutes like IIPR Kanpur for augmenting pulses seed production and IGFRI, Jhansi for strengthening the fodder seed situation in India.
3. The linkage is also required with other institutes related to similar type of research work like NBPGR, BARC Bombay and University of Mysore etc.

13 Library

DSR library is being strengthened with books from National and International publishers. Presently, it holds Annual Reports of different projects of DSR, and other ICAR institutes, Newsletters, Technical bulletins, National and International Journals and many books and manuals, which are as follows:

- 2446 numbers of books related to diverse field of agriculture and allied subjects (Agronomy, Pathology, Entomology, Seeds Science and Technology, Plant Breeding and Genetics, Horticulture, General agriculture, Bioinformatics, Nanotechnology, Animal Science, Biotechnology, Agricultural Extension Agricultural Economics, Agricultural Statistics, Molecular Biology, Crop Physiology, Biochemistry).
- Diagnostics Characteristics of Pearl millet, Soybean, Cotton, Groundnut, Rajmash, Rice.
- Working Sheets on Seed Borne Diseases- Karnal bunt of Wheat, Ear cockle of Wheat, loose Smut of Wheat, Grain mould of Sorghum, Ergot of Pearl millet, Bunt of Rice, Anthracnose, Chacoal Rot and Purple Stain of Soybean.
- Disease free Seed Production of Pearl millet, Castor, Cotton, Rice, Wheat, Sorghum and Soybean.
- Morphological, Chemical and Electrophoretic Descriptors of Soybean, Ground nut, Sunflower, Castor, Mung, Urd Pigen pea, Chickpea, Sorghum, Pearl millet.
- Guidelines for Nucleus and Breeder Seed Production of Field Crops.
- National Guidelines for Conduct of test for Distinctness, Uniformity and Stability.
- Laboratory protocol and training manuals.
- Research Highlights of AICRP – National Seed Project (Crops): 1979-2005 and AICRP –National Seed Project (Crops) XI Five Year Plan Accomplishment (2007-2012).
- Annual Reports of DSR, AICRP – NSP (Crops), ICAR Seed Production: Seed production in Agricultural crops and fisheries and other ICAR institutes.
- Annual Reports of preparation of Plant Variety Protection and DUS testing through ICAR –SAU System.
- Proceedings of different meetings in relation to various projects being coordinated and monitored by DSR.
- DSR Vision-2030, 2050.
- DSR Information Bank.
- Seed Regulations.

- Directory of Seed Research Workers.

Digital e-resources of DSR library

- Online free access of peer reviewed National and International journals through Consortium of *e*-Resources in Agriculture (CeRA).
- Recently, DSR Library has been digitalized, through LAN connection, now all the Scientist/staffs of DSR can view the list of books & their availability, details of books *etc*. through the web link http://dsrlibrary/webopac/
- CD version of various ICAR publications related to Agri-Horti-Animal-Fishery technologies.
- CD-ROM version of scientific literatures (CAB Abstracts) starting from 1979 to 2010.
- CD version of Indian Seed Industry Database 2011.

Library Automation

- The ICAR-DSR library is operating fully automated environment. The various activities of library have been computerized using integrated library software *total library software system*. The record of books and journals were entered in the database. Bar-coding of books for automated circulation is under active process. Online public access catalogue is made available for the library users.

14 Participation in Meetings / Trainings / Seminars / Workshops

Programmes organized by DSR, Mau

Sl. No.	Name of programme organized	Date	Place	Coordinator
International Trainings				
1.	International Hands-on Training programme on "Quality Rice Seed Production" jointly organized by IRRI, Philippines, BHU, Varanasi, DSR, Mau and NSRTC, Varanasi.	06.10.2014-10.10.2014	Institute of Agricultural Sciences, BHU, Varanasi	Dr. Rajiv K. Singh
National and in-house Trainings				
1.	Three days training on "Management Information System (MIS) and Financial Management System (FMS) in ICAR"	05.09.2014-08.09.2014	ICAR-DSR, Mau in collaboration with external agency Karvy India Pvt. Ltd.	Dr. Chandu Singh
2.	Training on "Maintenance Breeding: Training-cum-Exposure Visit"	26.09.2014-27.09.2014	IARI RS, Karnal and DSR, Mau	Dr. S. Natrajan
3.	NDDB sponsored advanced training on Fodder Seed Production	12.01.2015-16.01.2015	ICAR-DSR, Seed Production Centre, GKVK Campus, Bengaluru	Dr. S. Rajendra Prasad Dr. Dinesh K. Agarwal
Meetings				
1.	XXIX Annual Group Meeting (AGM) of AICRP –NSP (Crops)	24.04.2014-26.04.2014	SKUAS&T, Srinagar	Dr. S. Rajendra Prasad Dr. S. Natarajan Dr. Dinesh K. Agarwal Dr. T.N. Tiwari Dr. Rajiv K. Singh Dr. A.K. Sinha Dr. Dhandapani R. Sh. Raghuvendra D. Sh. Boraih K.M.
2.	Institute Research Committee (IRC) meetings	30.04.2014 & 05.05.2014	ICAR-DSR, Mau	All Intitute Scientists
3.	Introductory meeting of QRT with DDG (CS)	15.05.2014	Krishi Bhavan, New Delhi	ICAR-DSR QRT Members Dr. S. Rajendra Prasad Dr. S. Natarajan
4.	QRT meeting for Eastern Zone centres	17.07.2014-18.07.2014	DSR, Mau	ICAR-DSR QRT Members Dr. S. Rajendra Prasad Dr. S. Natarajan

5.	QRT meeting for Central Zone centres	18.08.2014-19.08.2014	JNKVV, Jabalpur	ICAR-DSR QRT Members Dr. S. Rajendra Prasad Dr. S. Natarajan
6.	IX Annual Review Meeting of ICAR Seed Project 'Seed Production in Agricultural Crops'	22.09.2014-23.09.2014	ANGRAU & PJTSAU, Hyderabad.	Dr. S. Rajendra Prasad Dr. S. Natarajan Dr. Dinesh K. Agarwal Dr. Rajiv K. Singh Dr. Govind Pal, Dr. Uday Bhaskar K. Sh. Umesh R. Kamble
7.	QRT meeting for Northern Zone centres	17.10.2014-18.10.2014	PAU, Ludhiana	ICAR-DSR QRT Members Dr. S. Rajendra Prasad Dr. S. Natarajan
8.	Organized the "Vigilance Awareness Week" (theme area: Combating Corruption Technology as Enabler) along with various activities pertaining to vigilance	27.10.2014 – 01.11.2014	ICAR-DSR, Mau	Dr. Sripathy K.V.
9.	QRT meeting for Southern Zone centres	11.12.2014-12.12.2014	UAS, Bangalore	ICAR-DSR QRT Members Dr. S. Rajendra Prasad Dr. S. Natarajan
10.	Research Advisory Committee (RAC) meeting	28.12.2014	ICAR-DSR, Mau	ICAR-DSR RAC Members Dr. J.S. Chauhan (ADG) Dr. S. Rajendra Prasad All Institute Scientists
Participation in Farmers' Trainings				
1.	Participated and delivered lecture on Application of modern techniques for improving and stabilizing productivity in climate change.	20.08.2014	Vill. Tajopur, Mau	Dr. T.N. Tiwari
2.	Off campus farmers training- delivered lectures on Integrated pest management in *Kharif* crops.	26.08.2014	Vill. Paniara, Mau	Dr. Arvind N. Singh Dr. T.N. Tiwari
3.	Farmers & Seed growers training - Delivered a lecture on "Measures to save *Kharif* Crops under prevailing drought condition" in farmers training organized at DSR, Mau on 27.08.2014.	27.08.2014	DSR, Mau	Dr. T.N. Tiwari
4.	Off campus farmers training- delivered lecture on seed production techniques in *Rabi* crops.	28.10.2014	Vill. Paniara, Mau	Dr. T.N. Tiwari

5.	Delivered lecture on "Seed enhancement technologies for increased germination and yield in Pigeon pea" at Seed Day programme and Kisan Ghosthi	28.10.2014	ICAR-DSR, Mau	Shri Umesh R. Kamble
6.	Delivered lecture on seed production in agricultural crops.	31.10.2014	Ailakh Emiliya, Ratanpura, Mau	Dr. T.N. Tiwari
7.	Delivered a lecture on "Integrated weed management in mustard, chickpea, lentil and wheat" in a training programme under SVS on "Quality seed production techniques of chickpea, mustard, lentil and wheat".	09.03.2015	ICAR-DSR, Mau	Dr. Hardev Ram
8.	Organized a one day farmers training programme under SVS on 10 March, 2015 at ICAR-DSR, Mau	10.03.2015	ICAR-DSR, Mau	Dr. Rajiv K. Singh
9.	Organized a one day farmers training programme under ICAR Seed Project-SPAC on 14 March, 2015 at Kushmaur, Block: Pardaha, Mau	14.03.2015	Kushmaur, Block: Pardaha, Mau	Dr. Rajiv K. Singh
10.	Delivered a lecture on "Resource conservation techniques for improving input use efficiency and crop productivity" in a training programme under SVS on "Quality seed production techniques of chickpea, mustard and lentil"	14.03.2015	ICAR-DSR, Mau	Dr. Hardev Ram
11.	Organized a one day farmers training programme under SVS on 17 March, 2015 at Onhaich, Block: Pardaha, Mau	17.03.2015	Onhaich, Block: Pardaha, Mau	Dr. Rajiv K. Singh
12.	Delivered a lecture on "Integrated nutrient management in chickpea, mustard and lentil" in a training programme under SVS on"Quality seed production techniques of chickpea, mustard and lentil"	17.03.2015	ICAR-DSR, Mau	Dr. Hardev Ram
13.	Organized a one day farmers training programme under ICAR Seed Project-SPAC on 23 March, 2015 at ICAR-DSR, Mau	23.03.2015	ICAR-DSR, Mau	Dr. Rajiv K. Singh
14.	Delivered a lecture on "Resource conservation techniques for improving input use efficiency and crop productivity" in a training programme under SVS on"Quality seed production techniques of chickpea, mustard and lentil"	23.03.2015	ICAR-DSR, Mau	Dr. Hardev Ram

Visits				
1.	Visited Seed production centre of DSR at GKVK Campus, Bangalore and monitored to make necessary arrangements for seed production/ farm developments/ research activities.	07.05.2014 & 12.05.2014	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
2.	IAMZ-CIHEAM Mediterranean Agronomic Institute of Zaragoza, Zaragoza, Spain	19.05.2014-30.05.2014	IAMZ, Zaragoza, Spain	Dr. Dinesh Kumar Agarwal
3.	Visited seed production & land development activities and arranged seed for Seed Production Centre, GKVK campus, Bangalore from 29th May – 03rd June, 2014.	29.05.2014-03.06.2014	Seed Production Centre, GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
4.	Visited IRRI, Philippines -Interacted with Dr. Matthew Morell, Deputy Director General Research and Dr. Abdelbagi Ismail, Principal Scientist about mandate of the institute and also research activities related to Rice Seed Research. ✓ Visited INGER, Seed Health Unit, International Rice Gene bank and Grain Quality and Nutrition Center interacted with concerned scientists. ✓ Discussed on STRASA project with Dr. Ismail and proposed for HRD programme on Seed Production Technology in Rice.	26.06.2014	IRRI, Philippines	Dr. S. Rajendra Prasad
5.	Visited Research & Development Unit of East-West Seed Company, Inc. Hortanova Research Center, Lipa City	27.06.2014	Hortanova Research Center, Lipa City	Dr. S. Rajendra Prasad
6.	Visited Seed Production Centre, monitored and attended sowing of cowpea and redgram, land delopment activities viz. opening of farm pond, land leveling and road construction	30.06.2014 - 03.07.2014 & 07.07 2014.	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
7.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore, monitored and made arrangement for sowing of pulses namely cowpea, red gram for seed production.	24.07.2014-26.07.2014 & 31.07.2014	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
8.	Visited Directorate of Weed Science Research, Jabalpur and discussed about weed seed research activities.	19.08.2014	Directorate of Weed Science Research, Jabalpur	Dr. S. Rajendra Prasad

9.	Visited BSP Centre of Agricultural University, Kota for monitoring Breeder Seed Production activities	31.08.2014	Kota	Dr. S. Rajendra Prasad
10.	Visited village under Revolving Fund Scheme to monitor seed plots of paddy	03.09.2014	Semri Jamalpur, Mau	Dr. T.N. Tiwari
11.	Visited BSP, STR and ICAR Seed Project centres of CSAUA&T, Kanpur.	04.09.2014	Kanpur	Dr. S. Rajendra Prasad
12.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore, monitored and made arrangement for seed production/research activities from 11th to 12th September, 2014.	11.09.2014-12.09.2014	Bangalore	Dr. S. Rajendra Prasad
13.	Visited Directorate of Soybean Research, Indore to monitor the ICAR Seed Project progress and discussed about soyabean seed research.	24.09.2014	Indore	Dr. S. Rajendra Prasad
14.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore for monitoring of seed production and research activities.	02.10.2014 & 04.10.2014	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
15.	Visited to Indian Institute of Soil Science, Bhopal along with ADG (Seeds), ICAR, New Delhi and discussed about the research programme/activities of the Institute.		Indian Institute of Soil Science, Bhopal	Dr. S. Rajendra Prasad
16.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore for monitoring of seed production and research activities.	14.11.2014-15.11.2014	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
17.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore and made necessary arrangement for harvesting and post harvest, management of seed crops, research activities. Held discussions with Superintendent Engineer, CPWD, Bangalore.	15.12.2014-16.12.2014 & 19.12.2014-20.12.2014	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
18.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore for monitoring of seed production and research activities. Discussed with Superintendent Engineer, CPWD for opening of bore well and chain link fencing, finalized plan and budget for construction of office for Regional Station, Topical Seed Research and Quality Assurance Lab. (TSRQAL) at Regional Station of DSR at GKVK campus, Bangalore	17.01.2015.	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad

19.	Visited breeder Seed production plots of wheat at DWR, Karnal. Visited Breeder and Nuclear seed production plots and Seed Processing Plant at IARI regional station, Karnal.	03.02.2015-04.02.2015	DWR, Karnal IARI regional station, Karnal	Dr. S. Rajendra Prasad
20.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore for monitoring of seed production and research activities.	05.03.2015 & 10.03.2015	Seed Production Centre of DSR at GKVK Campus, Bangalore	Dr. S. Rajendra Prasad
Seminars Delivered				
1.	Effect of climate change on seed biology	24.04.2014	ICAR-DSR, Mau	Dr. Madan Kumar
2.	Molecular aspects of seed dormancy	28.08.2014	ICAR-DSR, Mau	Shri Umesh R Kamble
3.	Professional attachment training presentation (on Nanotechnology)	28.08.2014	ICAR-DSR, Mau	Shri Sripathy K.V.
4.	Pre and Post harvest seed crop management techniques for improving productivity of agricultural and horticultural crops and their marketability"	03.01.2015	ICAR-DSR, Mau	Dr. Dhandapani Raju,
5.	Professional attachment training presentation (on Seed quality parameter, Biochemical test and hybridity test through molecular marker)	13.02.2015	ICAR-DSR, Mau	Shri Amrit Lamichaney., Scientist (Seed Science and Technology), IIPR, Kanpur
6.	Food security global and country (India) perspectives	23.02.2015	ICAR-DSR, Mau	Prof. P.G. Chengappa, Former Vice-Chancellor, GKVK, Bangalore
7.	Genomics and Proteomics of Plants and Microbes towards translational research	24.02.2015	ICAR-DSR, Mau	Dr. Udaya Bhaskar K
Other programmes				
1.	Research- Extension – Farmers Interface Programme	16.07.2014	DSR, Mau	Dr Arvind N. Singh Dr. Dinesh K. Agarwal
2.	Poster exhibition on IPR	16.07.2014	DSR, Mau	Dr. Arvind N. Singh
3.	Bharat Swachhata Abhiyan Programme	02.10.2014	DSR, Mau	Shri Deepak Singh
4.	Seed day	28.10.14	DSR, Mau	Dr. Arvind N. Singh
5.	Sensitizaion Programme on IPR	01.11.2014 & 05.11.2014	DSR, Mau	Dr. Arvind N. Singh
6.	Art of Living *Yoga* Classes	21.11.2014-25.11.2014	DSR, Mau	Shri Ramesh K.V.
7.	Institute Foundation Day	16.02.2015	DSR, Mau	Dr. Arvind N. Singh Dr. Dinesh K. Agarwal
8.	Training- cum- Awareness Programme on Protection of Plant Variety and Farmers' Right Act, 2001	16.02.2015	DSR, Mau	Dr. Arvind N. Singh
9.	One day *Kisan Mela*	02.03.2015	DSR, Mau	Dr. A.N. Singh

Programmes / Meeting / Training attended by DSR Scientists and Staff

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
International				
1.	International Breeding Programme-Multi Year Course III sponsored by GCP, CIMMYT, Mexico	19.05.2014-30.05.2014	IAMZ, Zaragoza, Spain	Dr. Dinesh Kumar Agarwal
2.	Participated in the International Conference on 'Indian Economy: Glimpses of Accomplishments Tribal'	21.06.2014-22.06.2014	Haridwar, Uttrakhand	Dr. Govind Pal
3.	International Training on "Pest Risk Analysis" at Hyderabad conducted by National Institute of Plant Health Management, India and USDA.	01.09.2014-05.09.2014	National Institute of Plant Health Management, Hyderabad	Dr. Arvind Nath Singh
4.	International Hands-on Training programme on "Quality Rice Seed Production" jointly organized by IRRI, Philippines, BHU, Varanasi, DSR, Mau and NSRTC, Varanasi.	06.10.2014-10.10.2014	Institute of Agricultural Sciences, BHU, Varanasi	Dr. Rajiv K. Singh
5.	Delivered a guest lecture on "Seed System in South Asia with special reference to India" in the international training on "Quality Rice Seed Production" held at Banaras Hindu University (BHU), Varanasi.	06.10.2014	BHU, Varanasi Institute of Agricultural Sciences, BHU, Varanasi	Dr. S. Rajendra Prasad
6.	International Seed Testing Association (Bassersdorf, Switzerland) organized workshop on seed sampling and quality assurance in sampling	17.11.2014-20.11.2014	Indo American Hybrid Seeds Pvt. Ltd. (Accredited laboratory), Bengaluru.	Dr. Udai Bhaskar K.
7.	Participated in International Conference on Agriculture, Veterinary & Life sciences .	30.01.2015-31.01.2015	Vikram University, Ujjain, M.P,	Dr. T.N. Tiwari Dr. Arvind Nath Singh
8.	International conference on "Next Generation Genomics and Integrated Breeding for Crop Improvement"	18.02.2015-20.02.2015	ICRISAT, Patancheru, Hyderabad	Shri S.P. Jeevankumar
National				
1.	Orientation training module under revised FOCARS	21.04.2014 – 22.05.2014	ICAR-DSR, Mau	Shri Shripathy K.V.
2.	Three months professional attachment training for developing technical skills in major and associated fields. Second Phase at Department of Nano Science and Technology, TNAU, Coimbatore	24.5.2014-06.07.2014 08.07.2014-22.08.2014	Tamil Nadu Agricultural University (TNAU), Coimbatore.	Shri Sripathy K.V.

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
3.	Training on "Foundation course for Agricultural Research Service (FOCARS)"	01.07.2014 - 30.09.2014	ICAR-NAARM, Hyderabad	Shri S.P. Jeevan Kumar
4.	Attended the seed distribution and training programme as a Chief Guest & resource person at B.R.Hills, Yelandur Taluk, Chamarajanagar district under TSP programme, organized by UAS, Bangalore.	05.07.2014	B.R.Hills, Yelandur Taluk, Chamarajanagar district	Dr. S. Rajendra Prasad
5.	MDP on Technology Management for Researchers.	19.08.2014-23.08.2014	NAARM, Hyderabad	Dr. Dinesh Kumar Agarwal
6.	Delivered Key Note address in National Seminar on Climate Change and Environmental Threat to public Health & Sustainable Agriculture	30.08.2014-31.08.2014	Sunbeam College for Women, Varanasi	Dr. S. Rajendra Prasad Dr. Dinesh K. Agarwal
7.	Participated in National Seminar on Climate Change and Environmental Threat to public Health & Sustainable Agriculture organized at Varanasi.	30.08.2014-31.08.2014	Sunbeam College for Women, Varanasi	Dr. Arvind Nath Singh
8.	Training on "Management Information System (MIS) and Financial Management System (FMS) in ICAR"	05.09.2014	ICAR-DSR, Mau	Dr. Chandu Singh Sh. D. Raghuvandra Dr. Madan Kumar Shri Shripathy K.V. Dr. Elayaraja K.
9.	Short course (10 days) on "Principle and practices of direct seeded rice"	22.09.2014-01.10.2014	CCSHAU-RRS, Karnal	Dr. Hardev Ram
10.	Training on "Maintenance Breeding: Training-cum-Exposure Visit"	26.09.2014-27.09.2014	IARI RS, Karnal and DSR, Mau	Dr. S. Natarajan
11.	Short course (10 days) on "Bio-fortification of food crops" .	04.10.2014-14.10.2014	IIPR, Kanpur	Dr. Hardev Ram
12.	Refresher course on Agricultural Research Management during 10 - 22 November, 2014 at National Academy of Agricultural Research (NAARM), Hyderabad.	10.11.2014-22.11.2014	NAARM, Hyderabad	Dr. Rajiv. K. Singh Dr. Arvind Nath Singh
13.	Attended Refresher course on Agricultural Research Management during 10 - 22 November, 2014 at National Academy of Agricultural Research (NAARM), Hyderabad.	22.11.2014	NAARM, Hyderabad	Dr. Arvind Nath Singh

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
14.	Training on "Professional Attachment Training (PAT)"	01.12.2014 - 05.03.2015	ICRISAT, Patancheru-Hyderabad	Shri S.P. Jeevankumar
15.	Short term training course on "Genomics and proteomics in plants and microbes towards translational research"	21.01.2015 – 10.02.2015	ICAR – IISR, Calicut	Dr. Uday Bhaskar K.
16.	Delivered two invited guest lecture on "conventional and molecular techniques in seed testing" and "Use of SSR marker for genetic purity testing" in national training on "seed testing-conventional & non conventional methods' at NSRTC, Varanasi organized during 27-31, January, 2015.	28.01.2015	NSRTC, Varanasi	Dr. Dhandapani R.
17.	Presented a paper 'An Analysis of Sources and Management of Paddy Seed in Eastern Uttar Pradesh' in National Seminar of Indian Society of Extension Education	26.02.2015-28.02.2015	RVSKVV, Gwalior, MP	Dr. Govind Pal
18.	Attended and involved in successful organizing of training programme "Maintenance Breeding-cum-Exposure Visit" for scientist involved in BSP under AICRP-NSP (Crops) and ICAR Seed Project	03.03.2015 -4.03.2015	ICAR-IARI RS Karnal	Shri Shripathy K.V.
19.	Attended Field Day and Training Programme on Seed Production of Groundnut & Onion as a Chief Guest and attended as External Examiner for final viva of Ph. D. student of Seed Science and Technology at UAS, Dharwad.	08.03.2015-09.03.2015	UAS, Dharwad	Dr. S. Rajendra Prasad
20.	Delivered lectures : 1.Pre- harvest management and physiological maturity in seed crops 2.Post harvest deterioration under storage In National training on Pre and post harvest management techniques for seed quality assurance.	10.03.2015	NSRTC, Varanasi	Dr. T.N. Tiwari

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
Meeting/workshop				
1.	Meeting regarding starting of integrated UG Programme on seed technology as a member of the committee and monitored the Breeder Seed Production and ICAR Seed Project activity.	10.04.2014-12.04.2014	UAS, Dharwad	Dr. S. Rajendra Prasad
2.	Institute Technology Management Committee (ITMC) of NBAIM Mau	16.04.2014,01.11.2014 & 01.01.2015	NBAIM Mau	Dr. Arvind Nath Singh
3.	Conference of the Vice Chancellors of SAUs and Directors/Joint Directors of ICAR Institute.	28.04.2014	A.P. Shinde Hall, NASC Complex, New Delhi	Dr. S. Rajendra Prasad
4.	Meeting of the Principal Investigator of different discipline of Seed Technology Research (STR) of AICRP-NSP (Crops) and ISST.	16.05.2014-17.05.2014	NASC Complex, New Delhi	Dr. S. Rajendra Prasad
5.	Workshop on Priority Setting Monitoring and Evaluation in National Agricultural Research System: Status, Experiences and Way forward.	27.05.2014	New Delhi	Dr. S. Rajendra Prasad
6.	Regional Workshop on “Research priorities and reconciliation in Eastern Region”.	28.05.2014	RC for Eastern Region, Patna, Bihar	Dr. S. Natarajan
7.	NAIP-IFPRI two days workshop on "Impact of capacity building programmes under NAIP"	06.06.2014-7.06.2014	NASC Complex	Dr. S. Rajendra Prasad
8.	Meeting with Joint Secretary (Seeds), DAC, New Delhi and discussed & submitted of AUC and report of Annual Oilseed Scheme for release of balance amount.	18.06.2014	New Delhi	Dr. S. Rajendra Prasad
9.	XXIX Annual Group Meeting on AICRP Biological control	27.06.2014-28.06.2014	OUAT, Bhubaneshwar	Sh. D. Raghuvendra
10.	Workshop on “Biosafety and Detection of GM Crops”	11.08.2014-16.08.2014	NBPGR, New Delhi	Dr. Madan Kumar Shri Ramesh K.V.
11.	53rd All India Wheat and Barley Research Workers Meet	22.08.2014-25.08.2014	JNKVV, Jabalpur	Dr. A.K. Sinha
12.	Annual Chickpea Group Meet as Co-Chairman, in Session VI: Breeder Seed allocation & Seed Production and monitor the AICRP Seed Technology Research Activities	01.09.2014	Rajasthan Agricultural Research Institute, Durgapura, Jaipur	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
13.	XXII Meeting of ICAR Regional Committee No. IV	05.09.2014-06.09.2014	Indian Institute of Sugarcane Research, Lucknow	Dr. S. Rajendra Prasad
14.	Interaction meeting with Dr. Jose Graziano da Silva, Director General, FAO.	08.09.2014	A.P. Shinde Symposium Hall, NASC, New Delhi	Dr. S. Rajendra Prasad
15.	Meeting of Committee to verity/vetting of Handbook on OECD Varietal Certification in India under the Chairmanship of ADG (Seeds).	8.09.2014	Krishi Bhawan, New Delhi	Dr. S. Rajendra Prasad
16.	Interaction meeting with Hon'ble Agriculture Minister at Indian Institute of Vegetable Research, Varanasi on 21.09.2014	21.09.2014	IIVR, Varanasi	Dr. T.N. Tiwari Dr. Arvind Nath Singh
17.	Principal Investigator meeting of STR and discussed about the progress of technical programme of seed technology research.	21.09.2014	STCR, ANGRAU, Hyderabad	Dr. S. Rajendra Prasad
18.	One day workshop on Consortium on e-resources in Agriculture (CeRA) conducted by Directorate of Knowledge Management in Agriculture (DKMA)	29.09.2014	NASC Complex, New Delhi	Dr. Elayaraja K.
19.	Central Variety Release Committee meeting	20.10.2014	Krishi Bhavan, New Delhi	Dr. S. Rajendra Prasad
20.	Workshop on Open Access to Agricultural Knowledge for Inclusive Growth and Development	29.10.2014-30.10.2014	NAARM, Hyderabad	Dr. Dinesh Kumar Agarwal
21.	Consultation meeting on "Quality Fodder Seed Production and Availability: Opening New Vistas"	07.11.2014	IGFRI, Jhansi	Dr. S. Rajendra Prasad
22.	Brainstorming Workshop on Evolving Relevant Seed Systems for Rainfed Agriculture at MANAGE, Hyderabad	07.11.2014	MANAGE, Hyderabad	Dr. S. Natarajan
23.	Meeting to review the status of Vision 2050 & Institute based research projects.	10.11.2014-11.11.2014	Krishi Bhawan, New Delhi	Dr. S. Rajendra Prasad
24.	ISTA Workshop on Seed Vigour at Bangalore	11.11.2014-13.11.2014	Bangalore	Dr. S. Rajendra Prasad
25.	Meeting on Fodder and visit to Rani Laxmi Bai Central Agricultural University (RLBCAU)	17.11.2014	IGFRI, Jhansi	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
26.	ISTA workshop on seed sampling	17.11.2014-20.11.2014	Bengaluru	Dr. Uday Bhaskar K.
27.	Workshop and chair the technical session on "Capacity building of the implementation of ITPGRFA.	18.11.2014	Deendayal Research Institute, Chitrakot	Dr. S. Rajendra Prasad
28.	Mid term Review Meeting of RFD Nodal Scientists of CS Division	21.11.2014	ICAR, New Delhi	Dr. Dinesh K. Agarwal Dr. T.N. Tiwari
29.	Interaction meeting between seed producers of Gujarat state and Castor Scientists of SDAU and DOR	27.11.2014	SDAU, S.K. Nagar, Gujarat	Shri Umesh R. Kamble
30.	Discussed about DSR research activities and Annual Breeder Seed Review meeting with ADG (Seed)	09.12.2014	New Delhi	Dr. S. Rajendra Prasad
31.	Workshop on "Interfacing Innovation and IPR for Licensing and Commercialization of Technology in the Changing Global Scenario with Special Reference to Microbial Genetic Resources Agricultural"	18.12.2014-20.12.2014	ICAR-NBAIM, Kushmaur, Mau	Dr. Rajiv K. Singh
32.	Annual Breeder Seed Review Meeting	07.01.2015-09.01.2015	NEH Region, Umiam, Barapani, Meghalaya	Dr. S. Rajendra Prasad Dr. S. Natrajan
33.	12th Agricultural Science Congress (ASC)	03.02.2015-05.02.2015	NDRI, Karnal	Dr. S. Rajendra Prasad Dr. Rajiv K. Singh Dr. Hardev Ram
34.	Meeting of Scientific Advisory Committee of Krishi Vigyan Kendra, Mau as the member	04.02.2015	KVK, Mau	Dr. Arvind Nath Singh
35.	Meeting on "Benchmarking varieties of important agricultural and horticultural crops"	05.02.2015	Karnal	Dr. S. Rajendra Prasad
36.	Participated in exhibition in Eastern Zone Regional Agriculture Fair organized	19.02.2015-21.02.2015	ICAR-CPRI regional station, Patna, Bihar	Dr. Hardev Ram
37.	17th Indian Agricultural Scientist & Farmers' Congress on Agri-Innovation for enhancing Production & Rural Employment	21.02.2015-22.02.2015	Allahabad	Dr. Arvind Nath Singh
38.	Meeting of Scientists merit promotion/placement as a Member of the Selection Committee.	04.03.2015	Board Room, Director's Officer, IARI,, New Delhi	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
39.	Interactive workshop on "Challenges in Enhancing the Quality Seed Production of Soybean in Karnataka" for sustainable productivity	07.03.2015	Agricultural Research Station (Hallad Kere Farm), Bidar, Raichur	Dr. S. Rajendra Prasad
40.	Meeting for discussion on various projects to be established in Africa under the Indo-Africa Forum Summit (IAFS)-II.	16.03.2015	ICAR, New Delhi	Dr. S. Rajendra Prasad
41.	Attended the Comments of CCEA note of EFC of DSR Mau at New Delhi		New Delhi	Dr. S. Rajendra Prasad
Monitoring				
1.	To address the issue of non-synchronization of flowering in paddy var. PB 1509 in field of KVK, Jaunpur	5.09.2014	KVK, Jaunpur	Dr. S. Natarajan Dr. Dinesh K. Agarwal Dr. A.K. Sinha Dr. Rajiv K. Singh Dr. Dhandapani R.
2.	Involved in monitoring of North Group Zone II. Cooperating centres of AICRP- NSP (Crops) and ICAR Seed Project Monitoring team also reviewed status of Seed Technology Research experiments under AICRP-NSP (Crops) at various cooperating centres.	07.10.2014-14.10.2014	IARI, New Delhi, DMR, New Delhi, CSSHAU, Hissar, DWR, Karnal, RRS. IARI, Karnal, SBPUA&T, Meerut, GBPUA&T, Pantnagar and VPKAS Almora	Dr. Umesh R. Kamble
3.	Monitoring team member of ICAR-DSR, Mau, involved in BSP monitoring of rice varieties	21.11.2014	ICAR-DSR, Mau	Dr. Chandu Singh
4.	As a member of monitoring team of North Eastern Region of India, Examined seed production status, evaluated the research experiments allotted under NSP (Crops), facilities created under ICAR Seed Project and also examined status of TSP at North Eastern Region of India	29.11.2014-08.12.2014	UBKV, Pundibari; AAU, Jorhat; ICARRC NEH Barapani; Meghalaya and CAU, Imphal	Dr. Chandu Singh
5.	Monitoring of Breeder Seed Production plots	05.01.2015 & 09.01.2015	CRIJAF, Barrackpore; BCKV, West Bengal	Dr. S. Rajendra Prasad Dr. S. Natarajan
6.	Monitored the ICAR Seed Project activity at CRIJAF, Barrackpore	10.01.2015	CRIJAF, Barrackpore	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
Other programmes attended by DSR staff				
1.	Participated in the Seed Summit for Enhancing the Seed Supply Chain in Eastern India	14.05.2014	Patna, Bihar	Dr. S. Rajendra Prasad
2.	*Kisan Mela* conducted by NEFORD	27.05.2014	NEFORD, Mau	Dr. Arvind Nath Singh
3.	Attended the Foundation day lecture of NAAS on 5th June 2014	05.06.2014		Dr. S. Rajendra Prasad
4.	Reviewed the progress of collaborative project on "Seed Quality enhancement through Pulse Magnetic Field.	14.07.2014	Madras Institute of Magneto Biology, Chennai	Dr. S. Rajendra Prasad
5.	Attended 86th Foundation Day and Award Ceremony – 2014 of ICAR.	29.07.2014	NASC Complex, New Delhi	Dr. S. Rajendra Prasad
6.	Delivered a lecture on "Seed Quality Assurance System in India" for Nepali delegates in the workshop on "Indian Seed Sector-An overview".	02.09.2014	NSC, New Delhi organized by IFPRI	Dr. S. Rajendra Prasad
7.	Acted as expert in annual review meeting of the Institute Research Council (IRC-II) for the discipline of Seed Science & Technology.	03.09.2014	IARI, New Delhi	Dr. S. Rajendra Prasad
8.	Participated in Asian Solanaceous Round Table 2014 meeting organized by Asia and Pacific Seed Association (APSA) & Society for Promotion of Horticulture (SPH).	09.09.2014-10.09.2014	Bangalore	Dr. S. Rajendra Prasad
9.	Participated as Lead Speaker in Technical Session-III and delivered a lecture on the topic "Constraints and prospects in production of Breeder Seed and maintenance in supply chain" in 7th National Seed Congress.	25.09.2014-27.09.2014	MPSDC, Bhopal	Dr. S. Rajendra Prasad
10.	Kisan Mela organised by Deputy Director Office, Mau	30.10.2014	Nagar Palika Community Centre	Dr. Arvind Nath Singh
11.	*Kisan Mela* organised by NEFORD, Mau	31.10.2014	NEFORD, Mau	Dr. Arvind Nath Singh
12.	Attended Workshop cum Annual Review Meeting of AMAAS	22.01.2015-23.01.2015	NASC Complex, New Delhi	Dr. Madan Kumar

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
13.	Meeting with Dr. Anupam Barik, Additional Commissioner (Oilseeds), DAC, New Delhi. Meeting DDG (CS) and ADG (Seed), ICAR, New Delhi regarding finalization of Annual Group Meeting of AICRP-NSP (Crops).	26.01.2015-28.01.2015		Dr. S. Rajendra Prasad
14.	Meeting with Hon'ble Director General, DDG (CS) and ADG (Seed), ICAR, New Delhi on progress of DSR and Annual Group Meeting of AICRP-NSP (Crop).	17.03.2015	New Delhi	Dr. S. Rajendra Prasad

15 Publications

Publication in Research Journals

- Ambika, R., Arunachalam, M., John. J., Ponnusam.y S., Dhandapani, R. Heterotic grouping and patterning of quality protein maize inbreds based on genetic and molecular marker studies *Turk. J. Biol.*, 38, (2014), 10-20.
- Asad Ali, Bhanita Talukdar and Bhojaraja Naik, K. (2014). Induced genetic variability for seed germination and other yield parameters in kidney bean (phaseolus vulgaris l.). *Ind. Streams Res. J.*, 4 (7): 1-5. ISSN 2230-7850.
- Avinash Kumar Pathak, Dhandapani, R; Ambika Rajendran; MadanKumar; Natarajan, S and S. Rajendra Prasad (2014). Transferability of RiceSSR markers in Wheat (*T. aestivum*). Current Trends and Biotechnology & Pharmacy. Vol. 8(2): 204-212.
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- ए.के. सिन्हा, टी.एन. तिवारी, अरविन्द नाथ सिंह, मदन कुमार, चंदू सिंह एवं डी. राघवेन्द्र। उत्तर प्रदेश के लिए सरसों की अनुकूल प्रजातियाँ और संकर किस्में (प्रसार/2015/07)।
- मदन कुमार, टी.एन. तिवारी, राजीव कु. सिंह, चन्दु सिंह, रमेश के.वी. नेहा पाण्डेय एवं एस. राजेन्द्र प्रसाद। सूक्ष्मजीवों द्वारा बीजों का जैविक उपचार।
- टी.एन. तिवारी, दिनेश कुमार अग्रवाल, उमेश काम्बले एवं एस. राजेन्द्र प्रसाद। बीज परिवर्धन, बीज सुरक्षा एवं बीज उत्पादन सम्बन्धी तकनीकी संस्तुतियां।
- टी.एन. तिवारी, डी.के. अग्रवाल, अरविन्द नाथ सिंह एवं उमेश काम्बले 2015। बीज परिवर्धन, बीज सुरक्षा एवं उत्पादन सम्बन्धी तकनीकी संस्तुतियां (प्रसार/2015/08)।
- अरविन्द नाथ सिंह, ए.के. सिन्हा, डी. राघवेन्द्र एवं उमेश काम्बले 2015। कीट प्रबन्धन में नीम। (प्रसार 2015/05)।
- अरविन्द नाथ सिंह, राजीव कुमार सिंह एवं उदय भास्कर 2015। कीट नाशकों का प्रयोग करते समय सावधानियां (प्रसार/2015/04)।
- अरविन्द नाथ सिंह, डी.के. अग्रवाल एवं टी.एन. तिवारी 2015। धान के मित्र कीट (प्रसार/2015/03)।

Radio/Doordarshan Talk

Name of Scientist	Topic- TV Talk	Date
Dr. D.K. Agarwal	Importance on quality seed	15.12.2014
Dr. Hardev Ram	Cultivation of late sown wheat under zero tillage condition	15.12.2014 & 29.12.2014
Shri Sripathy K.V.	Quality Seed and its Testing Procedure	22.01.2015
Dr. D.K. Agarwal	Quality seed scenario	02.03.2015
Dr. Rajiv K. Singh	Seed production technology in summer mungbean	02.03.2015
Dr. T.N. Tiwari	Beejon ka parivardhan kar beejotpadan evam beej suraksha sunishichit karen	02.03.2015
Dr. A.K. Sinha	Arhar ki kheti ke liye samsamyik prabandhan aur flower drop rokanne ke Upay	02.03.2015

16 Distinguished Visitors

- Dr. D.L.N. Rao, Project Coordinator (Biofertilizers), Indian Institute of Soil Science, Bhopal (11.07.2014).
- Dr. Khin Thawda Win, Post-Doctoral Fellow Agronomist Crops and Environmental Sciences Division, IRRI, Myanmar (09.10.2014).
- Dr. Donalcne Palaganas, Megino, MSA (9.10.2014).
- Dr. S.K. Datta, DDG (Crop Science) ICAR, New Delhi on 27.12.2014.
- Dr. P.G. Chengappa, Former Vice-Chancellor, UAS, Bangalore & National Professor of ICAR, ISEC Bangalore (23.02.2015).
- Dr. B.N. Tripathi, Director, NRCE/UTCS, Hissar, Haryana (21.05.2015).

17 Committee of RAC, QRT & IMC; List of Personnel

17.1. Research Advisory Committee

Dr. S.K. Rao	:	Chairman
Dr. J. S. Chauhan	:	Member
Dr. S. Rajendra Prasad	:	Member
Dr. M. Bhaskaran	:	Member
Dr. M.A. Shankar	:	Member
Dr. S.N. Sharma	:	Member
Dr. Ashok Gaur	:	Member
Dr. S.R. Maloo	:	Member
Dr. Dinesh K. Agarwal	:	Member Secretary

17.2. Quinquennial Review Team (2009-2013)

Prof. M. Mahadevappa	:	Chairman
Dr. Prafulla K. Das	:	Member
Dr. S.S. Pandey	:	Member
Dr. T.N. Venkota Reddy	:	Member
Dr.S.Rajendra Prasad	:	Member
Dr. S. Natarajan	:	Member Secretary

17.3. Institute Management Committee (IMC)

Dr. S. Rajendra Prasad	:	Chairman
Dr. J.S. Chauhan	:	Member
Dr. D.K. Srivastava	:	Member
Dr. Dheerendra Khare	:	Member
Dr. H.B. Singh		Member
Shri Shantanu Pratap Singh	:	Member
Shri Prabhunath Mall	:	Member
Dr. Shushil Pandey	:	Member
Dr. T.K. Srivastava	:	Member
Dr. P.M. Singh	:	Member
Dr. D.K. Yadav	:	Member
Shri Ashish Srivastava	:	Member
Shri Ajay Kumar Soni	:	Member Secretary

17.4. List of Personnel

Research Management Position (RMP)

Dr. S. Rajendra Prasad	**-**	**Project Director**

Scientific Staff

Dr. S. Natarajan	-	Principal Scientist (Seed Technology)
Dr. Dinesh Kumar Agarwal	-	Principal Scientist (Genetics & Plant Breeding)
Dr. T.N. Tiwari	-	Senior Scientist (Plant Physiology)
Dr. A.K. Sinha	-	Senior Scientist (Plant Breeding)
Dr. Rajiv K. Singh	-	Senior Scientist (Agronomy)
Dr. A. N. Singh	-	Senior Scientist (Entomology)
Dr. Govind Pal	-	Senior Scientist (Economics)
Dr. Dhandapani R.	-	Scientist (Plant Physiology)
Dr. Asit K. Mandal	-	Scientist (Plant Pathology) (Till August 2014)
Dr. Udaya Bhaskar K.	-	Scientist (Seed Technology)
Shri Chandu Singh	-	Scientist (Plant Breeding)
Dr. Madan Kumar	-	Scientist (Plant Physiology)
Shri Umesh Ravindra Kamble	-	Scientist (Seed Technology)
Dr. Hardev Ram	-	Scientist (Agronomy)
Shri Deveramane Raghavendra	-	Scientist (Entomology)
Mrs. Radhika C.	-	Scientist (Economics)
Dr. Elayaraja K.	-	Scientist (Plant Breeding)
Sh. Ramesh K.V.	-	Scientist (Plant Physiology)
Dr. Bhojraja Naik	-	Scientist (Plant Breeding)
Dr. S.P. Jeevankumar	-	Scientist (Agri. Biotechnology)
Shri Vijaykumar HP	-	Scientist (Seed Technology) (on study leave)
Shri Somusundaram G.	-	Scientist (Seed Technology) (on study leave)
Shri Boraiah K.M.	-	Scientist (Plant Breeding) (on study leave)

Technical Staff

Shri S.A.M. Rizvi	-	Technical Officer (T-5)
Shri Nanhak Singh	-	Technical Officer (T-5)
Shri J. K. Tripathi	-	Technical Assistant (T-3)
Shri Arun Kumar Chaturvedi	-	Technical Assistant (T-3)
Shri Abhishek Kumar Rai	-	Senior Technician (T-2)
Shri Ambrish Dubey	-	Senior Technician (T-2)
Shri Sudheer Kumar Singh	-	Senior Technician (T-2)
Shri Sunil K. Kannujiya	-	Technician (T-1)
Shri Rajesh Chauhan	-	Technician (T-1)

Administrative Staff

Shri Ajay Kumar Soni	-	Administrative Officer
Dr. Govind Pal	-	I/C Finance & Acounts Officer
Shri Dipak Kumar Singh	-	AAO
Shri Sudhakar Srivastava	-	Assistant
Shri Anupam Kumar Chaubey	-	Assistant
Shri Lal Singh Bisth	-	UDC
Smt. Ranjana Kumari	-	LDC

Supportig Staff / Skilled Supporting Staff (SSS)

Shri Vikash Singh	-	SS Grade I

18 Staff Position

Manpower

At present the Directorate has 02 principal scientists, 05 senior scientists, 17 scientists, 06 administrative, 09 technical, one supporting staff and a few contractual staff. The Directorate urgently needs to fill-up the vacant positions for smooth functioning. The Directorate also needs to be strengthened in view of being a new establishment and importance of quality seed production for overall development of Indian agriculture. The details of positions sanctioned and filled is given below:

Table: Staff Position at DSR, Mau

Category	No. of Sanctioned post	In position as on 31.03.2015
Project Director	01	01
Scientist	37	24
Technical	22	09
Administrative	15	06
Supporting	08	01
Total	**83**	**41**

19 Financial Statement

Budget

The budget outlay of the directorate for the XI & XII Plan

(Rs. in lakh)

Head	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Total
A. Recurring									
Pay & Allowances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TA PC/ Directorate Monitoring	6.00	8.00	13.50	15.94	16.00	16.00	21.67	23.31	97.11
HRD	1.00	2.00	4.50	0.00	1.00	1.81	4.21	4.57	14.52
Contingencies	120.00	100.00	138.60	206.98	163.47	204.19	249.12	268.12	1182.36
Total (A)	**127.00**	**110.00**	**156.60**	**222.92**	**180.47**	**222.00**	**275.00**	**296.00**	**1293.99**
B. Non – Recurring									
Equipments	120.00	46.00	185.90	232.39	45.16	52.05	70.96	80.23	752.46
Works	10.00	0.00	1.38	24.99	58.79	117.69	0.00	9.72	212.85
Library	20.00	10.00	8.26	11.99	15.58	24.10	6.55	8.64	96.48
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fixture & furniture	23.00	0.00	7.07	11.46	0.00	19.63	4.59	1.41	65.75
Total (B)	**173.00**	**56.00**	**202.61**	**280.83**	**119.53**	**213.47**	**82.10**	**100.00**	**1127.54**
Grand Total (A+B)	**300.00**	**166.00**	**359.21**	**503.75**	**300.00**	**435.47**	**357.10**	**396.00**	**2421.53**

Budget details of DSR, Mau

DSR Plan

Year	Budget	Expenditure
2007- 08	300.00	136.11
2008- 09	166.00	108.26
2009-10	360.00	359.16
2010-11	504.00	503.75
2011-12	300.00	300.00
2012-13	449.00	435.47
2013-14	357.50	357.10
2014-15	396.00	396.00

DSR Non-Plan

Year	Budget	Expenditure
2007- 08	153.00	152.99
2008- 09	195.00	196.10
2009-10	227.00	224.07
2010-11	188.50	188.44
2011-12	216.00	216.00
2012-13	275.64	275.64
2013-14	342.80	329.28
2014-15	376.80	374.80

20 List of in-house Research Projects (2014-15)

Seed Molecular Biology

1. Assessment of genetic purity in major crops including hybrids through molecular tools and techniques.

(Dhandapani R)

2. Molecular regulation of dormancy and seed longevity in rice and soybean.

(Dhandapani R.)

3. QTL mapping for seed vigour in rice (*Oryza sativa)*.

(Chandu Singh and Madan Kumar)

4. Molecular mapping of quantitative trait loci (QTL) for bruchids resistance in chickpea (*Cicer arietinum* L.).

(Boraih K.M., S. Rajendra Prasad, Hari D. Upadhyay and Raghuvendra D.)

Seed Physiology, Storage and Testing

5. Studies on gibberellins in regulation of source-sink relations in wheat under different moisture regime.

(T. N. Tiwari and A.K. Sinha)

6. Enhancing Seed Quality Parameters in Rice and Soybean with Smoke Water.

(Ramesh K.V., Madan Kumar, Chandu Singh, Sripathy K.V. and Asit K. Mandal)

7. Studies on the impact of priming agents on the improvement of physiological parameters and their relationship with seed yield in chickpea (*Cicer arietinum* L.).

(A.K. Sinha, T.N. Tiwari, Rajiv K. Singh and Hardev Ram)

Seed Production and Certification

8. Devising agro-techniques for reducing the seed rate of wheat.

(Rajeev Kumar Singh, T. N. Tiwari and H.S. Meena)

9. Effect of various bioactive chemicals on traits favoring out crossing and their molecular characterization in hybrid Rice (*Oryza sativa* L.).

(Madan Kumar and Chandu Singh)

10. Comparative study of floral biology in CMS, chemically induced male sterile and protogynous (self incompatilble) lines of Indian mustard (*Brassica junceae*).

(Boraiah, K.M., Dhandapani R., M. Ventriventhan and D. Raghvendra)

11. Improving hybridization efficiency in castor through exogenous application of Plant Growth Regulators.

(Umesh Kamble, Chandu Singh and Uady Bhaskar)

12. Impact of genotypes and conservation tillage on seed quality and productivity of wheat in the eastern-UP.

(Hardev Ram, Rajiv Kumar Singh and Umesh Kamble)

13. Hydropolymers : As regulatory switch for germination and smart delivery system in hybrid seed production of maize.

(Uday Bhaskar K., Umesh R. Kamble, S. Rajendra Prasad and Rachika C.)

Seed Protection

14. Bio-priming for seed born disease management and seed quality enhancement of rice and chickpea.

(A. K. Mandal, A.N. Singh and Madan Kumar)

15. Biochemical characterization of insecticide resistance in major stored insect pest and their management.

(Deveramane Raghvendra, Arvind N. Singh, Dhandapani R. and Boraiah, K.M.)

16. Estimation of economic threshold level of key insect pests in paddy and mustard seed crops.

(Arvind N. Singh, Deveramane Raghvendra and S. Rajendra Prasad)

Seed Economics and Policy Research

17. Impact assessment of quality seed production: Addressing scope and efficiency of certified seed production among seed growers.

(Govind Pal, Radhika C., Rajiv Kumar Singh and Udaya Bhaskar K.)

Crop Improvement

18. Studies on field weathering among soybean genotypes.

(D.K. Agarwal and T.N. Tiwari)

19. Improving hybrid seed production efficiency through synchronization of flowering in maize (*Zea mays* L.).

(Elayaraja K., Boraih K.M., Rajiv K. Singh and Umesh Kamble)

20. Improving hybridization efficiency, seed set and development of male sterile lines for hybrid seed production in Finger millet [*Eleusine coracana* (l.) *Gaertn*].

(Bhojraja Naik K, S. Rajendra Prasad, Ravishankar P. and Chandu Singh)

21 ISO Certificate and ISTA Membership Certificate

ROYALCERT

CERTIFICATE

Royalcert, certifies that the management system of the organization has been assessed and found to be in accordance with the requirements of the related standard

ISO 9001:2008

DIRECTORATE OF SEED RESEARCH
(Indian Council of Agricultural Research)

Village – Kushmaur, Post – NBAIM Campus, Mau (U.P.) 275101, India.

Scope

- Conducting basic, applied, strategic and anticipatory research in diverse fields of seed science and technology.
- Functioning as apex centre for coordination of quality seed production under NARS across the country.
- Undertaking HRD through imparting training to field staff & scientists in different fields of seed production, testing & certification in field crops.

Certification No	: DIR09D
Initial Certification Date	: 28.03.2014
Issue Date	: 28.03.2014
Expiration Date	: 27.03.2017

General Manager
Namik Sezgin

IAF DAkkS Deutsche Akkreditierungsstelle
D-ZM-18590-01-00

This certification was conducted in accordance with RoyalCert auditing and certification procedures and is subject to regular surveillance audits.
Certification period is 3 years. Verifiable at www.royalcert.com. Original certificates carry a gold label.
RoyalCert International Registrars, Kölner Strasse 44, D-60327 Frankfurt am Main Germany. T/F +49 69 410 20 720/683

Certificate of Membership

International Seed Testing Association

ISTA

declares that:

ICAR - Directorate of Seed Research
Mau, Uttar Pradesh, India, DARE
Pradesh
India

is a **Laboratory Member** of the Association

Member Code INML3500

Bassersdorf, 01.01.2014

On behalf of the Association

ISTA President

Certificate of Membership 2014

This certificate is only valid with the corresponding sticker

22 Performance Evaluation Report in Respect of RFD 2014-2015

Annual (April 1, 2014 to March 31, 2015) Performance Evaluation Report in Respect of RFD 2014-2015 of RSCs i.e. Institutes

Name of the Division : Crop Science

Name of the Institution : ICAR – Directorate of Seed Research, Mau

RFD Nodal Officer of the RSC : Dr. Dinesh K. Agarwal, Principal Scientist (Genetics & Plant Breeding)

S.No.	Objective (s)	Weight	Action(s)	Success Indicator (s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	*Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
1.	Development of technologies for improving seed yield and quality in different field crops	40	Development of practices/techniques for maximizing seed yield	Management practices/techniques evaluated for maximizing seed yield	Number	9	07	06	05	04	03	06	90	8.1	100.00	
			Development of technologies for seed quality enhancement and management practices for seed borne diseases and storage insect pests	Seed quality enhancement technologies tested	Number	8	05	04	03	02	01	05	100	8.0	125.00	
				Management practices for the control of seed borne diseases and storage pests evaluated	Number	9	08	07	06	05	04	07	90	8.1	114.29	
			Development of seed testing methods for quality assurance	Seed testing methods standardized	Number	8	04	03	02	01	0	03	90	7.2	100.00	
				Varietal purity testing protocols standardized/ revalidated	Number	6	04	03	02	01	0	05	100	6.0	166.66	
2.	Production and supply of breeder and other quality seeds	25	Production of breeder seed of different crops	Quantity of breeder seed produced	Metric Tones (MT)	13	12600	10500	8400	6300	4200	9429	80	10.4	89.80	Production of breeder seed is taken up in response to Govt. of India indent as such is 100 % in terms of demand.
			Production of quality seed including all classes	Quantity of quality seed produced including other classes	Tones	12	72000	61000	48000	36000	24000	64838	90	10.8	106.29	

S.No.	Objective (s)	Weight	Action(s)	Success Indicator (s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	*Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
3.	Capacity building and transfer of technology	15	Trainings of stakeholders	Scientific and technical staff trainings conducted	Number	5	18	16	14	12	10	20	100	5	125.00	
				Farmers trainings conducted	Number	2	20	16	12	08	04	34	100	2	212.50	Owing to drought like situation in *Kharif* 2014-15, as per council's directives extra programmes were taken at villages.
			Dissemination of seed production technology to the farmers	Field demonstrations conducted	Number	2	11	09	07	05	03	15	100	2	166.66	
				Farmers fairs/ghosthi/Field days organized	Number	2	16	13	10	07	04	20	100	2	153.84	
				Radio/Doordarshan Talk delivered	Number	2	11	09	07	05	03	12	100	2	133.33	
				Popular articles/Technical bulletins published	Number	2	18	16	14	12	10	23	100	2	143.75	
*	Publication/Documentation	5	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	No.	3	14	12	10	08	06	05	0	0	0	Institute have many scientists who have joined quite recently, hence the target was difficult to achieve.
			Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	2	30.06.2014	02.07.2014	04.07.2014	07.07.2014	09.07.2014	24.05.2014	100	2		
*	Fiscal resource management	2	Utilization of released plan fund	Plan fund utilized	%	2	98	96	94	92	90	99.72	100	2		
*	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD for 2014-2015 for Approval	On-time submission	Date	2	May 15, 2014	May 16, 2014	May 19, 2014	May 20, 2014	May 21, 2014	11.02.2014	100	2		
			Timely submission of Results for 2013-2014	On-time submission	Date	1	May 1 2014	May 2 2014	May 5 2014	May 6 2014	May 7 2014	01.05.2014	100	1		

S.No.	Objective (s)	Weight	Action(s)	Success Indicator (s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	*Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
*	Enhanced Transparency / Improved Service delivery of Ministry/Department	3	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	2	100	95	90	85	80	100	100	2		
			Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	1	100	95	90	85	80	100	100	2		
*	Administrative Reforms	7	Update organizational strategy to align with revised priorities	Date	Date	2	Nov.1 2014	Nov.2 2014	Nov.3 2014	Nov.4 2014	Nov.5 2014	Nov.1 2014	100	2		
			Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of implementation	%	1	100	90	80	70	60	100	100	1		
			Implementation of agreed milestones for ISO 9001	% of implementation	%	2	100	95	90	85	80	100	100	2		
			Implementation of milestones of approved Innovation Action Plans (IAPs)	% of implementation	%	2	100	90	80	70	60	100	100	2		

Total Composite Score: 91.6

Procedure for computing the Weighted and Composite Score

1. **Weighted Score of a Success Indicator = Weight of the corresponding Success Indicator x Raw Score / 100**
2. **Total Composite Score = Sum of Weighted Scores of all the Success Indicators**

***Mandatory**

NOTE

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agri search with a human touch

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Towards second green revolution through use of quality seeds

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