DSR

वार्षिक प्रतिवेदन
Annual Report
2013–14

बीज अनुसंधान निदेशालय
DIRECTORATE OF SEED RESEARCH
(भारतीय कृषि अनुसंधान परिषद्)
(Indian Council of Agricultural Research)
Kushmaur, Mau 275 101 (UP)
ISO 9001 : 2008 Certified Institute

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Edition : 2014 Tech. Bulletin No. ISBN : 978-81-925128-4-4

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Preface

Food security is fundamental for any kind of progress and for India with a billion plus population, is of utmost priority. Seed is prime input having the capacity to ensure food security by means of seed security. Our nation has witnessed an estimated food grain production of 264.38 million tonnes during 2013-14 from meager 50.5 million tonnes during 1950-51, which 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, which explicitly entails for continuous and improved efforts towards quality seed accessibility to our farmers at reasonable price and at right time. Launching of AICRP – NSP (Crops) was a phenomenal milestone in Indian seed sector which has led to seachange, as witnessed by increase from a meager breeder seed production of 3,914 quintals during 1981 – 82 to a level of 95,011.59 quintals during 2012-13, 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 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. During 2012-13 there was a significant achievement in breeder seed production with a production of 95,011.59 quintals.

In a 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 and was continued with field crops component alone during XI plan period. This project has ushered significant positive impact on enhancing quality seed production to aid seed security vis a vis food security. During XI plan period, enhancement in seed replacement rate (SRR) was to the tune of 0.2-0.4 % per annum *i.e.* cumulative increase of 2 % was achieved. During 2013-14, total quality seed production including all classes was 6.30 lakh quintals against the target of 4.61 lakh quintals.

As far as research activities of Directorate is concerned, altogether 18 in-house research projects are 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 subjects of reported year 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, fine tuning of seed production technologies for hybrid rice under eastern UP conditions, priming and coating techniques for enhancing seed germination, initial vigour and growth, deployment of molecular tools and techniques to ascertain genetic purity of varieties, QTL mapping for seed vigour and bruchid resistance and optimum seedling age and planting geometry for rice cultivation through SRI method 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. With the available limited infrastructure, directorate has produced 568.40 quintals quality seeds in rice, 1,268.50 quintals of wheat, 35.86 quintal of pulses, 3.50 quintal of mustard and 14.75 quintal barley including the seed produced under revolving fund scheme. Produced seed was sold to the farmers and other government organizations in eastern UP in order to popularize quality seeds among farming community. Apart from this, DSR has also generated revenue of Rs. 55.0 lakhs from the sale of quality seeds.

While presenting the Annual Report 2013-14 of Directorate of Seed Research, I convey my thanks to the staff of DSR, who worked commendably for coordination of network projects as well as for execution of in-house research projects. The genial support of Dr. S. Ayyappan, Hon'ble Secretary DARE & Director General ICAR is gratefully acknowledged and we hope that under his able stewardship, directorate would excel in the arena of seed science research. Guidance, support and kind gratitude of Prof. Swapan K. Datta, Hon'ble Deputy Director General (Crop Science) is also gratefully placed on the record. I also express my sincere thanks to Dr. J.S Chauhan, ADG (Seed) and staff of the seed unit, crop science division for their support in smooth conductance of research and development of the institute. I firmly believe and trust that DSR would come up as a centre of excellence in seed science research in near future and would provide leadership in seed research domain for the sake of attaining seed security, which is pivotal for food security and prosperity of the country.

Maunath Bhanjan
Date : 24.05.2014

(S. Rajendra Prasad)
Project Director

1 Introduction

To have successful agriculture, quality seed constitute the most important component. For realization of the full potential of all other inputs in agriculture, seed must be of good quality. Keeping this in the backdrop the Indian Council of Agricultural Research has been according due priority to quality seed production and supplying them to entrepreneurs right from the beginning by launching National Seed Project (NSP) in 1979-80, which has been operating in major three phases. The Directorate of Seed Research started operating since 31st December 2004 at village Kushmaur in the district Mau, Uttar Pradesh by upgrading the erstwhile AICRP- NSP (Crops) to the status of a full fledged Project Directorate. Directorate that has made modest beginning, has now 02 principal scientist, 05 senior scientists, 15 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.

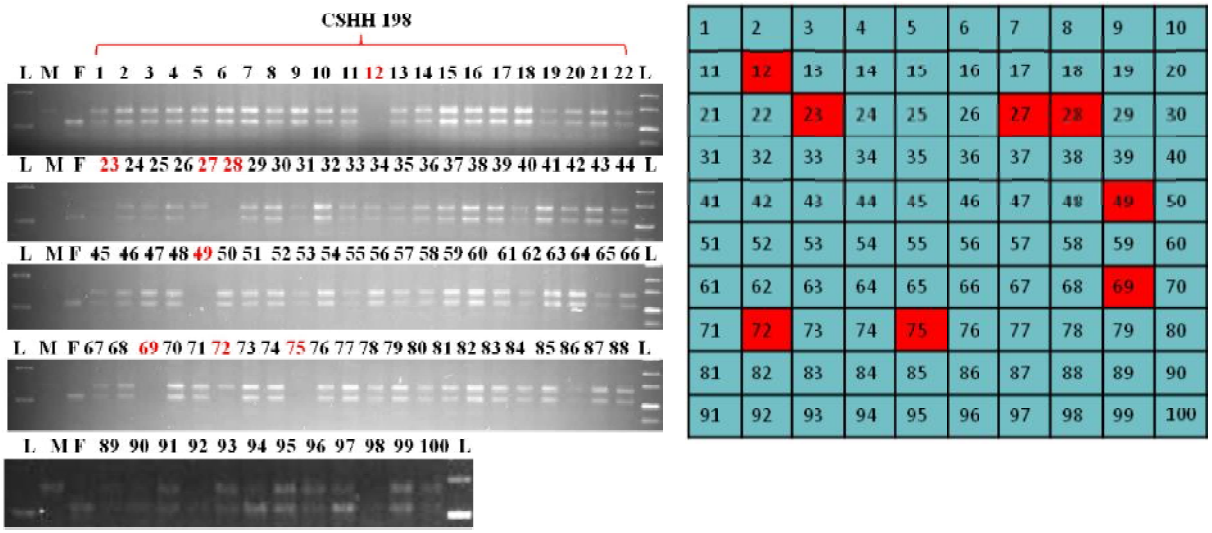
Directorate of Seed Research is a unique institute of ICAR, engaged exclusively in coordination and conduction of seed science research countrywide. Besides its mandate for undertaking seed production and seed technology research, the institute is deem to undertake training and capacity building in this 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 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.

Mission

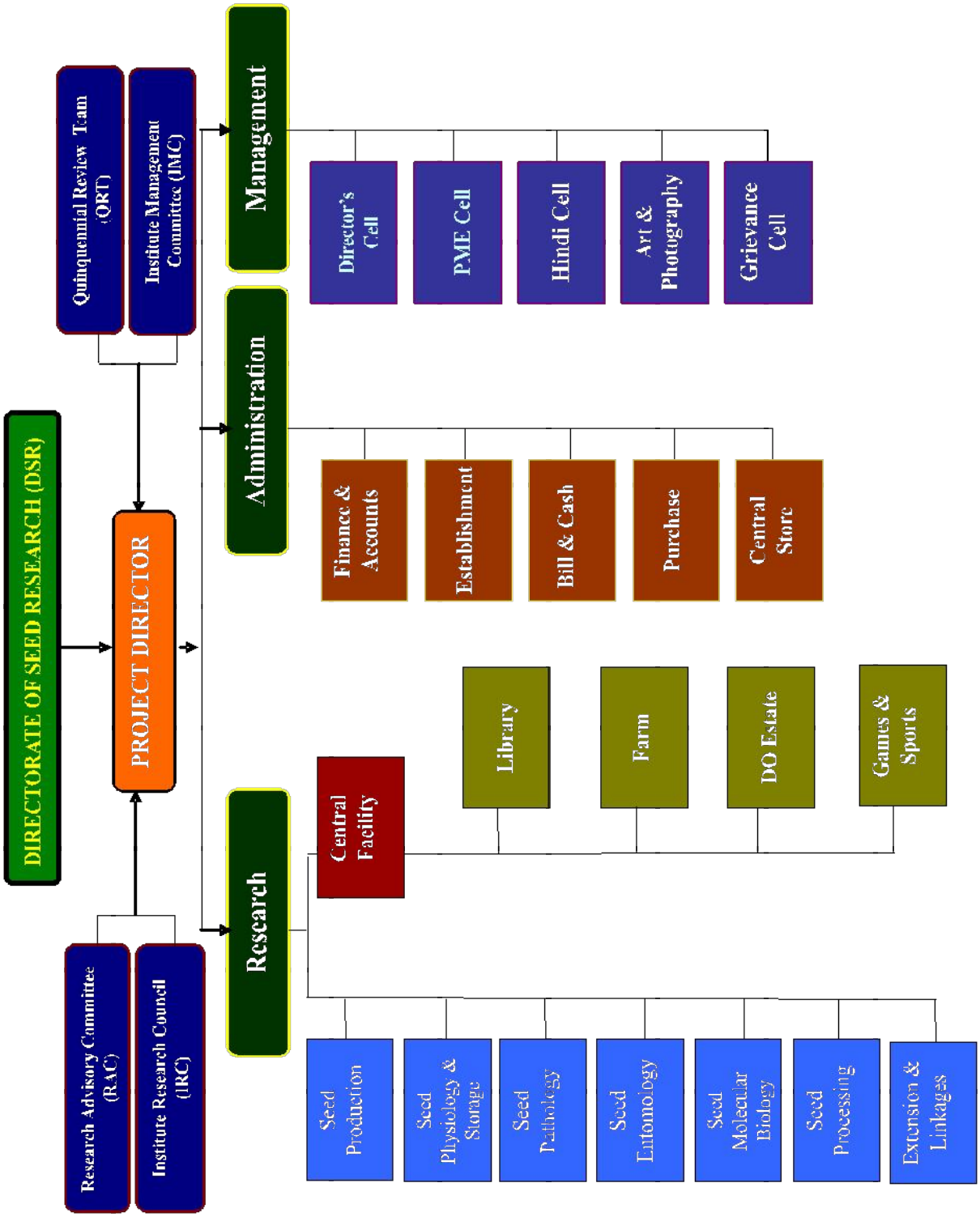
Enhancing genetic and physical characteristics of seed for increased productivity, quality and sustainability.

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.



Genetic purity testing of CSHH 198 cotton hybrid using SSR marker


DIRECTORATE OF SEED RESEARCH (DSR)
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 made significant achievements during 2013-14 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 95011.59 quintals in addition to 6.30 lakh quintals of quality seed production of field crops under the project 'Seed production in agricultural crops.

Directorate, with the 22 number of scientists has started research work with 18 in-house research projects. With the limited infrastructure and small farm, the directorate has produced 568.40 quintals quality seeds in rice, 1268.50 quintals of wheat, 35.86 quintal of pulses, 3.50 quintal of mustard and 14.75 quintal barley including the seed produced under revolving fund scheme. Those 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. Apart from this DSR has also generated resource of more than Rs. 55.0 lakhs from the sale of quality seeds.

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, QTL mapping for seed vigour and bruchid resistance and optimum seedling age and planting geometry for rice cultivation through SRI method are a few to name. 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 the avert disease and insect problems. The salient research achievements during 2013-14 in DSR are as under.

- Molecular characterization of CSHH 198 cotton hybrids along with their parents was done using breeder seed to assess the genetic purity by using microsatellite SSR marker at genomic level. Out of sixty cotton SSR markers analyzed, 15 markers were found to produce polymorphism ranging 20-33%, amplifying a total of 29 alleles, with an average of ±1.9 allelic variants per SSR locus. Most of the bands are found to be monomorphic across the genotypes tested, indicating substantial homogeneity in respect to the cotton genome.
- Three SSR markers showed amplification of an allele, which was very specific and unique to a particular parental line and not amplified in any other cotton 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 and indicate true blend of both the parents.

- Effect of insecticidal seed treatment on seed viability during storage under ambient condition" was evaluated and all the treatments failed to maintain insect damage percentage below the IMSCS except emamectin benzoate (Insect damge-0.45%).
- Genetic purity assessment of DRRH2 rice hybrid and its A and R line using informative SSR markers is completed.
- Prepared two project proposal drafts entitled "Identification of seed production zones and popularization of new hybrids/varieties for enhancing productivity in selected field crops in eastern India" and Maintenance Breeding in Quality Seed Production"
- Seed priming of one year old pigeon pea seeds with GA_3 @ 100 ppm and KNO_3 @ 0.2% concentration for 12 h significantly enhanced the seed quality parameters like germination, seedling length, dry weight and vigour indices over unprimed control.
- Primary analysis of survey data recorded in 2013-14 in Ghazipur district of Uttar Pradesh showed that cost of cultivation for certified seed production of wheat was Rs. 31,900/- per hectare. Human labour constitutes major share (29.78 %) followed by machine labour (26.65 %), manures and fertilizers (14.11 %), irrigation (10.97 %), seed (9.40 %), plant protection chemicals (4.39 %), seed certification and other charges (4.70 %). Gross return in certified seed production of wheat was Rs. 65200/- and net return was Rs. 33,300/- per hectare. The BC ratio is 2.04.
- Bacterial isolates of healthy rice rhizosphere have been isolated for evaluation of seed borne disease management and seed quality enhancement of rice.
- Evaluated the Phosphate solubilization traits of isolated bacterial cultures and one isolate was found to have the phosphate solubilization activities.
- New packaging material "insecticide impregnated laminated bags" could able to maintain the insect infestation below 0.5% up to 04 month of storage under ambient condition.
- Maize seed coated with Flowable thiram (Royal flow 40SC) @ 2.4 ml/kg showed least deterioration in seed quality parameters with HDPE interwoven non laminated bags than the gunny bags after 02 month of storage.
- Evaluated the IAA production traits of isolated bacterial cultures for seed quality enhancement of rice and chickpea.
- Base-line survey of ten farmers has been made in Semari Jamalpur village of Mau district under Seed Village Scheme.
- Seed sectioning for seeds of *Cenchrus cilairis, Lasiurus sindicus, Panicum maximum* and *Brachiaria spp* is being carried out through microtomy methods for easier evaluation of seed viability status.
- Chickpea seeds primed with GA_3 @ 100 ppm concentration showed early germination over unprimed seed.

- Insecticides namely emamectin benzoate and spinosad were found effective to restrict the insect damage below IMSCS (0.5%) in wheat seed after 6 months of storage.
- Artificially aged seed of hybrid paddy (KRH 2) and hybrid maize (Hema) showed deterioration in seed quality parameters with increasing ageing period and increasing storage period.
- Primers were designed for linked marker with seed vigour trait QTLs (Earlier identified, which includes minor QTLs and major QTLs of seed vigour traits).
- Evaluated the antagonistic effect of isolated bacterial cultures on *Macrophomina phaseolina* causing root rot of chickpea using dual culture technique and three isolates were found effective against *Macrophomina phaseolina*.
- Hybrid maize seed (HQPM-1) coated with Vitavax 200 (Corboxin 37.5% + Thiram 37.5%) @2.0 g/kg seed enhanced the seed germination and maintains the seed quality parameters up to 04 month of storage over uncoated control.
- Evaluated the antagonistic effect of isolated bacterial cultures on *Fusarium oxysporum* f.sp. *ciceri* causing wilt of chickpea using dual culture technique and five isolates were found effective against *Fusarium oxysporum* f.sp. *ciceri*.
- Emamectin benzoate was found effective to restrict the insect damage below IMSCS (0.5%) in wheat seeds after 240 days of storage under ambient condition.
- Evaluated the antagonistic effect of isolated bacterial cultures on *Ustilaginoidea virens* causing False smut of rice using dual culture technique and 8 isolates were found effective against *Ustilaginoidea virens*.
- Under storage condition to maintain the seed quality parameters in maize seeds, coating of seed with Flowable Thiram (Royal Flo 40 SC)@2.4 ml/kg seed was found most effective followed by Vitavax 200 (Containing Thiram 37.5% and Carboxyl 37.5%) @ 2 g/kg seed up to 4 month of storage period. Among the packaging material, HDPE bag was better than Gunny bag.
- Under Seed Village Scheme, farmer's trainings regarding seed production Technologies in rabi crops were conducted at DSR, Mau and other places on different dates and large number of farmers participated and benefitted.
- Biochemical characterization test has been done for 15 isolated bacterial cultures having antagonistic effect on fungal pathogens.
- Effect of insecticidal seed treatment on seed viability during storage under ambient condition was studied and Spinosad and emamectin benzoate was found to produce minimum insect damage in wheat seed after 9 months of storage.
- Under maintenance breeding 20 q. breeder seed of 4 rice varieties namely IR 36, IR 64, BPT 5204 and MTU 7029 were produced as per the allocated target at DSR Farm Mau.

During the year 2013-14, 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)

Breeder Seed Production

Progress of breeder seed production during 2012-13 was touching a production level of 95011.59 q. However slight shortfall in few crops was observed due to climate vagaries in referred year

Seed Technology Research

I. Seed Production and Certification

a. Integrated approach for maximization of seed yield

Rice

In case of JRH 5 hybrid rice seed production, the alternate method of planting pollen parent with application of recommended dose of NPK along with micronutrients Boron + Sulphur + Zinc was the best treatment combination in increasing the seed yield with highest C:B ratio of 1:1.60.

The hybrid seed yield of CORH 4 was significantly highest (10.32 q/ha) in case of mixed planting of male parent (CB 174R) and applications of micronutrient Boron @ 0.02% spray at panicle initiation stage.

In case of KRH-4 hybrid seed production, application of 125:75:75 kg NPK/ha and foliar application of Boron @0.5% at the time of panicle exertion has significantly increased (8%) the seed yield at TNAU, Coimbatore.

At KAU, Pattambi, irrespective of hybrids (DRRH 2 and DRRH 3) alternate/ mixed planting of staggered pollen parent maximized seed set in hybrids.

Wheat

At Kanpur, plain sowing along with application of 1.25 × RDF (recommended dose of fertilizer) and 5 kg Zn / ha exhibited maximum seed yield (69.76 q/ha), quality seed recovery percentage and benefit cost ratio of 2.88. In case of PBW 502 (Faizabad), Ridge planting with 150: 75: 50 NPK/ ha and 10Kg/ha zinc sulphate as basal enhanced seed yield and C:B ratio to 1:1.68. At Hisar, in cv WH-102, the ridge sowing method increased seed yield by 3.49 % over conventional sowing method. Mn and Zn enhanced yield by 3.19 to 5.32 percent and 8.39 to 9.09 per cent respectively. At Dharwad, in GW-322, ridge method of sowing and application of 1.50 x RDF showed significantly higher plant growth parameters and seed yield (47.2q/ha).

Groundnut

At ANGRAU, Hyderabad, var. Kadiri 9, application of FYM @ 7.5 t/ha + RDNPK + gypsum @ 500 kg/ha at pegging recorded higher sound mature kernels (74.90%), pod yield (45.53 q/ha) and germination (92%). At OUAT, Bhubaneswar, in TAG 24, application of FYM 7.5 t/ha + RDNPK of 20:40:40 + Borax @ 15 kg/ha recorded the highest seed yield (12.49 q/ha) with 13.8 and 5.84% increase over RDNPK and FYM + RDNPK application respectively with increased Shelling %. Gypsum application @ 300 kg/ha the highest seed yield of 12.53 q/ha which was 17.1, 11.5 and 11.1% higher than control, 2% urea spray at 30 DAS and 2% urea spray at 30 and 60 DAS, respectively.

Sunflower

At ANGRAU, Hyderabad, in APSH 66, soil application of sulphur @ 10 kg/ha and soil application of borax @ 1 kg/ha increased yield by 39% (11.27 q ha-1) and 36.33% (10.65 q ha-1) over control (6.78 qha-1). Soil application of sulphur @ 10 kg/ha increased germination, root length, shoot length, seedling length and seedling vigour index I by 34, 41.17, 3, 25.34, 68.53% respectively against control. At UAS, Bangalore, in KBSH-53, highest seed yield (8.2 q/ha) was recorded by application of 20% >RDF (75:90:75 NPK kg/ha) + zinc sulphate @ 10 kg/ha (soil application) + boron @ 0.2% (Foliar spray at ray floret initiation stage) over control (7.3 q/ha) with recommended RDF without micronutrient application.

Maize

In maize hybrid Hema (NAI-137 x MAI-105) at Bangalore, application of 40% >RDF (210: 105:56 NPK kg/ha) + ZnSO4 @10 kg/ha in the form of 40% N basal + 30% N at 8 leaf stage + 30% N at tasseling increased seed yield (25.05 q/ha) by 25.50% over the recommended NPK kg/ha (150:75:40 NPK kg/ha) + ZnSo4 @10kg/ha in the form of 40% N basal + 60% N at tasseling.

Soybean

At Rahuri, 1000 seed weight (144.7 g), seed yield (37.20 q/ha), number of pods per plant (73) and seed quality parameters viz., germination (91.00%) and dry matter content (0.57 g), root shoot length (30.10 cm) and vigour index II (50.98) were significantly superior in the ridge sowing with application of 150% dose than recommended fertilizer dose and application of 5 kg chelated Zn/ha over the other treatment combinations with highest B:C ratio (2.45).

Ridge sowing + recommended DAP + soil application of $ZnSo_4$ @ 30 kg/ha + foliar spray @ 0.5% at 52 and 60 DAS was found significantly superior for number of pods/plants (84), seed yield/ha (29.61 q), seed recovery (96%) and vigour index (84.93) with a C:B ratio of 1:2.7 over other treatment combinations at Akola centre.

In UAS, Raichur, 40:80:25 NPK kg/ha + S-40kg + Zn -5kg increased seed yield (1636 kg/ha) by 20% over control (1359kg/ha). Ridges furrow method increased germination (77%), seedling length (20.8 cm), seedling vigour index (1568) over flat bed method.

At JNKVV, Jabalpur, the treatment 150% NPK resulted in higher processed seed yield (1196kg/ha), 100 seed weight (7.88), seed recovery (85%), germination (84%) and vigour index (2550). Application of NPK+ S + Zn+ B+ Mo increased processed seed yield (1298kg/ha), 100 seed weight (8.04g), seed recovery (87%), germination percent (86%) and vigour index (2671). Ridge and furrow cultivation had highest C:B ratio of 1:2.

Mustard

At Kanpur, in cv Urvashi, Application of 7.5 kg Zn ha-1 and Seed treatment with Carbendazim @ 2 g/kg of seed showed significantly highest seed yield (29.17 q ha-1) with 98.9% of seed recovery and Benefit: Cost of 2.15:1.

In Durgapura, application of RDNPK + Gypsum + Fe ($FeSO_4$ @ 25 kg/ha) + Zn ($ZnSO_4$ @ 25 kg/ha) recorded highest Seed yield (35% more), 1000-seed weight (6.25 g) and seedling vigour index (3711) compared to the RDNPK application.

Berseem

Normal sowing (15th October), Cutting at 10 days before normal last cut (75 DAS) and nutritional spray (KNO3 @ 2% and Borax @ 100 ppm) at the reproductive stage resulted in higher seed yield of 1.24 q/ha at Rahuri centre.

In Jabalpur, second date of sowing (15th January), cutting at 10 days after normal last cut and spray of KNO3 @ 2 % was found to be significantly superior for increase in seed yield.

At Pantnagar, under both normal and late sown conditions, 10 days before last cut+ Borax spray @ 100 ppm at reproductive stage is equally effective for obtaining more yields in both genotypes (Wardan and Jawahar Berseem 1). The borax application @ 100 ppm at reproductive stage just 10 days before last cut as well as 10 days after last cut is found very effective for getting more seed yield followed by spray of KNO_3 @ 2% at reproductive stage just 10 days before last cut.

Cluster bean

At Coimbatore, in Pusa Navbhar, 45 x 20 cm spacing and sowing on July 1st resulted in better growth parameters, seed yield and seed quality characters. At Jodhpur, in cv. RGC 936, incidence of diseases like, wilt, blight and powdery mildew and insect pests, leaf cutter, white fly and aphids were observed more in 10th and 20th July sowing compared to sowing done on 1st July. At Durgapura, in RC 1038, Plant height and seedling length were affected by sub effects i.e. different row spacings. Higher seed yield (13.31 q/ha) was observed in crop geometry 30 x 30 cm sown on 01.07.2013. Seed yield in 1 July (12.79 q/ha) and 11 July (11.83 q/ha) sowing were at par being significantly superior to the late sowing on 21.07.2013 (7.44 q/ha).

b. Pilot project on alternative area for hybrid seed production of major crop in different seasons

Crop	Hybrid	New Areas	Cost: Benefit	Seed Yield (q/ha)
Rice	JRH 5	Balaghat, Madhya Pradesh	1:1.86	
	KRH 4	Sira , Karnataka T. Narasipura , Karnataka	1:1.13 1:1.12	11.92 10.58
	NDRH 2	Faizabad, Chhattisgarh plains		
	PSD 3	Areas outside of Pantnagar, Uttarakhand		
Pigeon pea	ICPH 2671	Seoni, Madhya Pradesh	1:1.4	4.2
	AKPHM-11303	ZARS, Yeotmal, Maharashtra	1:1.56	6.43
Pearl millet	RHB-173 (ICMA 93333A x RIB 192)	Bharatpur, Rajasthan		
Maize	Hema	Sira, Karnataka Hiriyur taluk, Karnataka Siraguppa, Karnataka	1:1.75 1:1.72 1:1.70	22.50 21.70 21.25
	HQPM 1	Pathera village, Karnal dist, Andhra Pradesh	1:1.73	
Castor	GAUCH-1 and GCH-4	Surendranagar dist, Gujarat Gadwal in Mahboobnagar district, Reddipalli area of Ananthapur, Nandyal and Banaganapally, Kurnool dist, Andhra Pradesh	1: 0.71	

c. Studies on cutting management for seed yield and its quality in *Cenchrus ciliaris*

The genotypes CAZRI 2221 and CAZRI 2178 are the better genotypes for seed production and its related traits, and also for fodder production. Among the genotypes, CAZRI 2178 recorded maximum pure seed yield (82.8 kg/ha) whereas, CAZRI 2221 recorded maximum green fodder yield (12603 kg/ha) and dry matter production (4025 kg/ha). Uncut crop had maximum pure seed yield (102.4 kg/ha) i.e. 43% higher seed yield and 18% more dry matter than foliage cutting at 45 days. Overall foliage cutting reduced the seed yield, hence not advisable for seed production in *C. ciliaris* under hot arid climate.

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

In case of DRRH 3 hybrid, SRI method resulted in yield improvement of 18.04% over the conventional method at ANGRAU, Hyderabad and DRR, Hyderabad due to increase in ear bearing tillers per hill, spikelet fertility and root volume. At PAJANCOA&RI, Karaikal, CORH 4 performed better and produced 37.96% higher seed yield than DRRH 2 with the improvement in yield contributing components viz., number of effective tillers/hill, number of filled grains/panicle, percentage spikelet fertility and single plant seed yield. Irrespective of the hybrids studied, 28% higher seed yield was recorded with SRI method. At Jorhat, seed yield of Hybrid Indira Sona was found superior in SRI method (6.56 q/ha) over conventional method (5.40 q/ha).

e. Hybrid seed production in Brinjal and Tomato under protected conditions

At UAS, Dharwad, in case of tomato- Pusa hybrid 2, higher seed yield of 187.1kg/ha was recorded under shade house condition with higher seed quality parameters at spacing of 60 x 60 cm compared to open field conditions. In brinjal hybrid PH9 at number of fruits per plant (3.58) and fruit set (19.90%) were higher under shade house condition whereas seed weight per fruit was maximum under open field condition. 60 cm x 75 cm spacing recorded maximum seed yield under both conditions with better seed quality recorded under shade house condition.

Seed production of Brinjal Hybrids namely, Pusa Hybrid 5, Pusa Hybrid 6 and Pusa Hybrid 9, under net house condition resulted in profitable Cost benefit ratio of 1:1.9 with better seed quality at IARI, New Delhi.

f. Optimization of seed production technology in mungbean for maximizing seed yield

In mungbean, var. NDM 1, sown between 15th July and 1st August, spacing of 30 x 10 cm and treatment of seed with Rhizobium and Phosphate Solubilizing Bacteria + RDF as basal dose + Borax spray (100 ppm) was found optimum for maximizing seed yield at Faizabad and Jabalpur.

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

At Pantnagar, Hybrid H 2 (CSH 24MF) produced significantly higher yield/plant and higher seed quality than Hybrid H 1 (CSH 20MF) because of less difference (3 days) in time taken for 5% flowering in male and female parent of H 2 hybrid as compared to H 1 hybrid parents (18 days). Because of greater difference in male and female parent flowering in H 1seed set per cent was very poor. It is, therefore, suggested that staggered planting of male parent be also included in the experiment in order to achieve nicking and synchronization in flowering between male and female parent for better seed set and seed quality. Among different dates of planting treatments, 10th June and 10th July planted crop recorded highest and lowest seed yield/plant, respectively, with no significant influence on seed quality parameters.

h. Standardization of alternative planting windows *vis-s-vis* climate change

Centre and crop	Planting window	Observation/Highlights
Rahuri Pearl millet (Shanti)	August onwards or 15th October to 15th December	70%- Seed setting and disease viz., *Helmenthosporium* leaf spot, Ergot, *Alternaria* blight and Rust incidence (August sowing)
	January	80%- Seed setting
	February or 1st June to 15th July	100%- Seed setting with low disease and insect pest incidence (June – July sowing)
	March onwards	70-50%- Seed setting
	August and after February	Aphids, Thrips, hoppers and stem borer infestation
Bangalore Sunflower Parental lines of hybrid KBSH-44, KBSH-53	1st March	Superior seed yield and yield attributing characters
	July and August	Higher incidence of diseases
	1st May	Lower seed yield per plant and seed setting
	1st June	Lowest seed setting
ANGRAU Sorghum (CSH14)	October	Early flowering, high pollen viability, cent per cent seed setting and highest seed yield
	November	Early flower initiation, lower seed setting

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

At ANRAU, Hyderabad and DRR, Hyderabad sowing with drum seeder had no significant impact on root characters at active tillering stage and grain yield. Among the varieties Rasi, Aditya and Krishnahamsa performed better with drum seeder and resulted in grain yield of 5.78 t/ha, 5.67 t/ha and 5.58 t/ha, respectively.

At Coimbatore, cultivars PHB 7, DRRH 2 and COI 50 registered higher root length in wet as well as in dry seeding. Root volume was higher in DRRH 2, PHB 71 and Aditya in both whereas vasumathi registered low volume in wet seeding. At Bangalore, seed yield and crop performance was better in hysic condition in all the 22 cultivars. Hybrid KRH-4 recorded the highest seed yield followed by cultivars MAS-26, KMP-175 and Rasi under aerobic condition and is more suited for the direct seeding. At Faizabad, the grain yield ranged from 28.4 q/ha (Rasi) to 45.5 q/ha (PHB 71). At Jorhat, all fifteen tested varieties differed significantly for all the characters with highest seed yield of 2852 kg/ha recorded by variety JR 16 and Manoharsali with highest (318) tillers/m2.

II. Seed Physiology, Storage and Testing

- First count of germination showed significant positive correlation with field emergence and may be used as an index to assess the planting value of hybrid maize, cotton and paddy.
- Accelerated ageing for 96 hrs (hybrid maize), 48 & 72 hrs (hybrid cotton) and 96 hrs (hybrid paddy) showed high significant correlation with storage potential and may be used as an index of storability.
- Polymer coating @ 3ml/kg seed in combination with flowable thiram (2.4 ml/kg) or vitavex 200* @ 2g/kg seed (Thiram 37.5 % + Carboxyl 37.5 %) or polymer in combination with vitavex 200* were found at par in maintaining the seed quality of hybrid paddy and hybrid maize for one planting season.
- SSR markers (RM 19, RM 336, RM 204, RM 202) have been validated and revalidated for hybridity and genetic purity testing of paddy hybrid DRRH-2, DRRH-3 and KRH-4.
- SSR marker (ORS-878) has been identified to distinguish the parents of sunflower hybrid APSH-66 amplifying female parent at 220 bp and male at 235 bp.
- Exposure of seeds to Pulsed Electromagnetic Field (PEMF) @ 100 Hz significantly improves the seed quality as well as seed yield of mungbean, paddy and maize.
- A total of 105 demonstrations of hydro-priming technology were organized at farmer's field across the centres.
- Hydro-priming technology improves seed yields by 6-11.5% in different crops (Wheat, paddy, pearl millet, sorghum, mungbean, pigeon pea & chickpea).

III. Seed Pathology

- Bacterial Panicle Blight disease of rice (*Burkholderia glumae*) by GBPUA&T, Pantnagar, Uttarakhand; Viral disease caused by *Bean Common Mosaic* on cluster bean/ guar (*Cyamopsis tetragonoloba*) and false head smut (*Ustilaginoidea virens)* of maize from Anand (Gujarat) are reported as new emerging seed-borne diseases.
- *Burkholderia glumae* is found responsible for Bacterial Panicle Blight (BPB) disease in rice and also causes bacterial grain rot. The most susceptible period for floret infections is during panicle emergence and flowering. The infected seeds are poor in germination, give reduced grain weight and poor plant stand.
- The bacterium is isolated both from discoloured and even from healthy looking seed, collected from infected crop. The pathogen is readily seed-borne and is successfully isolated on King's B medium from infected seeds when incubated at 28^{0}C for 48 h. The bacterium survives in seed from year to year.
- The fungus *A. porri* survives in infected seed, collected from infected umbels for >20 months under dry and cold conditions. However, the longevity of *A. porri*, in infected seeds, under ambient conditions is noticed only up to a period of 12 months.
- The seed treatment with both the bio agents (*T. harzianum and Ps. Fluorescens* @ 10g/kg of seed (1:1) are found effective in improving germination but did not manage the seed borne infection of *A. porri* in Onion crop.
- Heat treatment of onion bulbs at 35°C for 8 hours before planting helps in reducing the purple blotch infection.
- The seeds when treated with different concentration of biocontrol agents, *Trichodema viride* and *Ps. Flurorescens*, the CFU/g seed decreased with the increase in storage period at ambient room temperature.
- Biocontrol agent *Ps. Fluroscence,* on artificial inoculation in tomato seedlings induce resistance against Alternaria blight infection.

IV. Seed Entomology

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

Newer insecticide molecules viz. emamectin benzoate 5 SG@ 2 ppm (40.0 mg/kg seed), spinosad 45 SC @ 2 ppm (4.4 mg/kg seed), indoxacarb 14.5 SC @ 2 ppm (13.8 mg/kg seed), rynaxypyr 20 SC @2ppm (0.01 ml/kg seed), chlorfenapyr 10 EC@2ppm (0.02 ml/kg seed), profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed), novaluron (Rimon 10 EC) @ 5ppm (0.05 ml/kg seed) were evaluated along with standard chemical (deltamethrin) against major storage insect-pests damaging cereals and pulse seeds. This experiment was modified last year and Profenofos was included.

All newer insecticides especially emamectin benzoate (Proclaim 5SG) @ 2 ppm (40.0 mg/kg seed), followed by spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed), rynaxypyr (Coragen 20 SC) @2ppm (0.01ml/kg seed), profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed), chlorfenapyr (Intrepid 10 EC) @2ppm (0.02ml/kg seed), indoxacarb (avaunt 14.5 SC) @ 2 ppm (13.8 mg/kg seed) and novaluron (Rimon 10 EC) @ 5ppm (0.05ml/kg seed) were found at par with deltamethrin (Decis 2.8 EC) @1.0 ppm and provided control of storage insects infesting wheat, pearl millet, and maize under different agro-climatic conditions up to three to six months.

2. Evaluation of packaging material and methodology to store seed in Coastal region

Paddy seeds treated with flubendiamide (Fame 480 SC) (4.2 mg/ kg seed), emamectin benzoate (Proclaim 5SG) @ 2 ppm (40.0 mg/kg seed), spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed), deltamethrin 2.8 EC (0.04ml /kg seed) were stored in three different types of packaging materials (Gunny bag, Super grain bags and HDPE bags) at Karaikal and Bhubaneswar centre.

Paddy seed treated with deltamethrin @ 1.0 ppm and spinosad @ 2 ppm and stored in moisture impervious bags like super grain bags maintained seed germination above IMSCS with appreciable control of insect infestation up to 12 months period at Karaikal.

3. 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 with special reference to insect infestation. Most of samples (76.3%) were having germination above IMSCS. In contrast, large proportion (about 36.9%) of farmers' seed samples were infested with storage pests and intensity of damaged seed usually varied from 0.1to10% while in some cases it had gone up to 32%.

4. Quality seed production through insect pollination

Bee pollination plays a major role in improving the quantity of seed produced in case of sunflower. Apart from seed yield, parameter like vigour and oil content improved substantially due to bee pollination. In case of pigeon pea other pollinators like leaf cutter bee, carpenter bee play major role in pollination.

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

Seed storage at 50% CO_2 treatment can provide complete protection against khapra beetle in wheat, groundnut beetle in groundnut and pulse bruchid in green gram and chick pea without affecting seed quality up to 6-9 months storage. Thus, CO_2 can be a good alternative to use of chemical treatments including fumigants for preventing storage pests in wheat, groundnut, chickpea and green gram.

6. 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 50L capacity containers for treating black gram seed has been successfully demonstrated at TNAU, Coimbatore. This clearly indicated that large scale would be equally effective in controlling storage pests.

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

This experiment was conducted to evaluate integration effect of seed treatment as well as fabric treatments against infestation of major storage insect-pests damaging seeds.

Treatment schedules i.e. combination of seed treatment (emamectin benzoate 5SG @2ppm a.i.) and fabric treatment (emamectin benzoate 5SG@100ppm a.i.) at various centres have been developed for management of storage insects of seeds having better storage life (good storer) but prone to insect damage.

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

Different types of insecticide impregnated bags like treated bag, no lamination, no liner; Treated bag, non treated lamination, non treated liner and treated bag, treated lamination, treated liner were tested along with untreated bag (same fabric i.e. PP Bag) and gunny bag (control).

Preliminary results showed that different types of insecticide impregnated bags are quite effective for management of storage pests. But storage of treated seed (seed treatment with emamectin benzoate @ 2ppm) in insecticide impregnated bags has shown better insect pest management.

V. Seed Processing

- The use of combine harvester at 500 rpm of drum speed is found most economical and effective for maintaining seed quality during harvesting and threshing of soybean. Similarly for minimum field losses and maximum seed quality use of combine harvester at 15 to 20 cm height of cutter bar from ground level was found effective and economical.
- The ODV seeds in paddy seed lot can be effectively removed to the acceptable limit by using specific gravity separator in addition to seed cleaner and grader.
- There is urgent need to modernize the seed processing plants in most of the places. The condition of the many seed processing plant is not encouraging. Nearly 80 % of the plants are single machined plants i.e. having seed cleaner cum grader only. Most of the plants do not have basic machinery like moisture meter, etc. In most of the plants specific gravity separator is not either available or not in use. The efficiency of the machines is not satisfactory and the percentage of the rejection is more than 20 % in major crops. In most of the plants there is no proper seed storage facilities and in most of the places the seed protection measures like fumigation are not followed properly.

Recommended sieve size for grading different category of seeds

Crop	Variety/cultivars	Screen size (mm)
Paddy	Fine grained: PKV HMT, PKV Khamang, JGL 387, Sonalika & Suvarna	1.4
	Coarse grain	1.6
Chickpea	Chaffa, Vijay, Vishal, ICCV 10 and G 12	5.0
	Bold seeded: Jaki, PKV Kabuli and G 5	5.5
Pigeon pea	C 11, ICPL 87119, AKT 8811 and BDN 2	3.6
Wheat & Barley		2.75
Sunflower hybrid KBSH 53		2.40 x 20 (S)
Maize hybrid Nithyshree		4.76 x20 (S)
Safflower		2.2
Soybean		3.6
Ragi		1.3

Awards and Publications

In reference to recognitions, scientists / cooperating centres received five awards / merit certificates for excellence in agricultural research and development activities, and published 98 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, kisan mela, kisan goshti, field day, demonstration have been conducted by several cooperating centres mentioned below. 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.

Sl. No.	Centre	No. of training	Exhibition/Kisan Mela	Research paper	Awards
1	CCSHAU, Hisar	2	2	-	-
2	OUAT, Bhubaneswar	7	-	2	-
3	GBPUAT, Pantanagar	-	1	2	-
4	CSAUA&T,Kanpur	-	-	4	-
5	PDKV, Akola	15	5	3	-
6	JNKVV, Jabalpur	3	-	14	2
7	JAU, Jamnagar	1	1	-	-
8	RAU, Durgapura	5	-	4	-
9	TNAU,Coimbatore	3	-	14	2
10	ANGRAU, Hyderabad	6	-	55	-
11	CICR,Nagpur	1	-	-	-
12	DSR, Mau	10	03	-	1
	Total	**53**	**12**	**98**	**5**

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. Project Director has also monitored the progress of BSP and conduct of the STR research activities.

Seed Production in Agricultural Crops

During the year 2013-14, total production of quality seed including all classes was 630417.84 quintals against the target of 461530.84 quintals. Production comprises 91710.94 quintals of breeder seed, 135813.82 quintals of foundation seed, 162771.07 quintals of certified seeds, 168331.77 quintals of truthfully hysic seed and 71790.24 quintals of planting material of field crops. In addition, 84.75 lakhs planting material and 4.65 lakh tissue culture plantlets of field crops were produced against the targets of 94.05 and 1.32 lakhs.

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Hkou'oj dUn ij ,Qokb,e 7-5 Vu@gDV;j $ 20%40%40 d vuikr e ,uhd feJ.k rFkk 15 fdxk@gDV;j ckjDl d bLreky l lokf/kd mit 12-49 fDo@gDV;j ik;k x;k tk vu'kflr ,uhd d i;kx dh vi{kk 13-8 ifr'kr T;knk gA ijUr vu'kflr ,uhd $,Qokb,e i;kx dju dh vi{kk 5-84 ifr'kr T;knk gA 300 fdxk@gDV;j dh nj l ftlle dk i;kx dju l 12-53 fDo@gDV;j cht mit ikIr gvk tk lekU; n'kk e 2 ifr'kr ;fj;k d ?kky dk fNMdko 30 fnu cht jki.k d ckn rFkk 60 fnu cht jki.k d i'pkr dh n'kk dh vi{kk Øe'k% 17-1 ifr'kr rFkk 11-5 ifr'kr T;knk ik;k x;kA

l;ie[kh

vkU/k in'k df'k fo'ofo|ky;] gnjkckn dUn ij ,ih,l,p 66 ldj iHkn e tc 10 fdxk@gDV;j lYQj dk mi;kx rFkk 1 fdxk@gDV;j ckjDl dk i;kx feVVh e mi;kx djr g rk cht dh mit e Øe'k% 9 ifr'kr dh of) ¼11-27 fDo@g½ rFkk 36-33 ifr'kr dh of) ¼10-65 fDo@g½ lekU; n'kk e [krh dju dh vi{kk ¼6-78 fDo@g½ ik;k x;kA feVVh e lYQj dk mi;kx 10 fdxk@gDV;j dju l vdj.k {kerk] tM dh yEckb] /kM dh yEckb] vdj.k dh yEckb rFkk chtkdj vkt lkfj.kh 1 e Øe'k% 34] 41-17] 3] 25-35 rFkk 68-53 ifr'kr dh of) ik;h xbA

;,,l] cXykj dUn ij dch,l,p 53 ldj iHkn e lLrr QfVykbtj dh ek=k ¼75 ,u % 90 QkLQkjl % 75 ikVk'k fdxk@g½ $ 10 fdxk@gDV;j ftd lYQV dk enk e i;kx $ 0-2 ifr'kr ckjku dk j ¶ykjV d fudyu ij fNMdko dju l lokf/kd mit 8-2 fDo@gDV;j ikIr gvk tk lekU; n'kk dh mit ¼7-3 fDo@gDV;j½ l 20 ifr'kr T;knk gA

eDdk

cXykj dUn ij eDdk d ldj iHkn gek ¼,u,vkb 137 x ,e,vkb 105½ e ukbVkt u % QkLQV % ikVk'k dh ek=k dk 40 ifr'kr vf/kd mi;kx ¼210 ,u % 105 QkLQkjl % 56 ikVk'k fdxk@gDV;j½ $ ftd lYQV dh ek=k 10 fdxk@gDV;j dh nj l bLreky dju ij lekU; n'kk dh vi{kk 25-5 ifr'kr T;knk cht ¼25-05 fDo@gDV;j½ ikIr gvkA Lej.k jg fd ;gk ij 40 ifr'kr ukbVkt u dk mi;kx cly Mkt d :i e fd;k x;k rFkk 30 ifr'kr ukbVkt u 8 iÙkh dh voLFkk ij $ 30 ifr'kr ukbVkt u ij i"iØe d vku dh voLFkk ij fd;k x;kA lekU; n'kk e 150 ukbVkt u % 75

QkLQkjl % 40 ikVk'k fdxk@gDV;j mi;kx djr gA

lk;kchu

jkgjh dUn ij 'kk/k l ik;k x;k fd lk;kchu dk e< ij jkikb dju] lLrr ek=k l 15 ifr'kr vf/kd mojd dh ek=k c<ku rFkk lkFk e 5 fdxk@gDV;j dh nj l fpyVM ftd dk nu l 1000 nku dk otu ¼14-47 xke½] cht mit ¼37-2 fDo@g-½] ifr ik/k Qfy;k dh l[;k rFkk cht x.koÙkk ekin.M tl vdj.k ifr'kr ¼91-0 ifr'kr½] 'k"d Hkkj ¼0-57 xke½] tM&/kM dh yEckb ¼30-10 leh½ rFkk vkt lpdkd II ¼50-98½ e mYy[kuh; c<kÙkjh ik;h x;h rFkk bldk ch%lh% vuikr ¼1%2-45½ Hkh lokf/kd ik;k x;kA

vdkyk dUn ij e< ij chtkjki.k $ lLrr Mh,ih dh ek=k $ 30 fdxk@gDV;j dh nj l enk e ftd lYQV d mi;kx l $ 0-5 ifr'kr ftd lYQV dk chtkjki.k d 52 vkj 60 fnu d ckn Li dju l ifr ik/k Qfy;k dh l[;k ¼84½] cht mit ¼29-61 fDo½] cht ikflr ¼96 ifr'kr½ rFkk vkt lpdkd ¼84-93½ e mYy[kuh; of) ik;h x;hA ble lh%ch% vuikr 1%2-7 jgk gA

t-,u-d- fo'ofo|ky;] tcyij e ,uihd $ lYQj $ ckjku $ ekyh%Mue d mi;kx l ilLdr cht mit ¼1298 fdxk@g-½] 100 cht Hkkj ¼8-04 xke½] cht ikflr ¼87 ifr'kr½] vdj.k ifr'kr ¼86 ifr'kr½ rFkk vkt lpdkd ¼2671½ e Hkh of) ik;h x;hA e< vkj dM [krh e ykxr vkj eukQk dk vuikr 1%2 ik;k x;kA

ljlks

pUn'k[kj vktkn df"k fo'ofo|ky;] dkuij e ljlk d mo'kh iHkn e ik;k x;k fd 7-5 fdxk ftd lYQV ifr gDV;j dh nj l enk e i;kx dju rFkk dkcUMkthe l cht dk 'kk/khdj.k 2 xke@fdxk cht dh nj l dju ij cht mit ¼29-17 fDo@gDV;j½ e mYy[kuh; of) ik;h x;hA ble cht ifr 98-9 ifr'kr ik;k x;kA ble ykxr ,o ykxr dk vuikr 2-15 % 1 ik;k x;kA

nxkijk dUn d 'kk/k e ik;k x;k fd lLrr ukbVktu % QkLQV % ikVk'k $ ftlle $ Qjl lYQV 25 fdxk@g- $ ftd lYQV 25 fdxk@g- dh nj l mi;kx dju ij lLrr ,uihd dh vi{kk cht mit e 35 ifr'kr vf/kd of) ik;h x;h] 1000 cht Hkkj 6-25 xke rFkk cht dk lpdkd ¼3711½ ik;k x;kA

cjlhe

jkgjh dUn d fjikV d vulkj lkekU; cht jki.k ¼15 vDVcj rd½ jkikb d 75 fnu d ckn vFkkr vfre dVkb d 10 fnu igy ikVf'k;e ukbVV dk 2 ifr'kr vkj ckjDl dk 100 ihih,e ?kkyk ituu dky d le; Li dju l lokf/kd vf/kd cht mit 1-24 fDo@g- ikIr gkrk gA

tcyij dUn d 'kk/k d vulkj nlj chtkjki.k fnol ¼15 tuojh½] vfre dVkb d 10 fnu ckn 2 ifr'kr ikVf'k;e ukbVV d ?kkyk dk Li dju l cht mit e mYy[kuh; of) ik;h x;h gA

iruxj dUn d lkekU; vkj foyEc l jkikb d le; ;g ik;k x;k fd ojnku vkj tokgj cjlhe 1 e ckjDl dk 100 ihih,e ?kky dk fNMdko i tuu dky dh voLFkk e vfre dVkb d 10 fnu igy dju l nkuk iHknk e vf/kd cht mit dh ikfIr gkrh gA mi;Dr n'kk e ckjDl d lkFk&lkFk 2 ifr'kr ikVf'k;e ukbVV d ?kky dk Hkh Li fd;k tkrk g rk cht mit e vR;f/kd of) ik;h tkrh gA

Xokj ¼DyLVj chu½

dk;EcVj dUn ij ik;k x;k fd DyLVj chu d ilk uckc gkj iHkn dk 45 x 20 leh dh njh ij iFke tykb dk jki.k fd;k x;k rk mle vi{kkdr of) d vPN ekin.M] cht mit e of) vkj mPp cht x.koÙkk oky cht ikIr gkr gA

tk/kij dUn d 'kk/k l ik;k x;k fd iHkn vkj thlh 936 e mdBk] >yl] pf.ky jkx dk vkØe.k rFkk yhQ dVj] lQn eD[kh vkj ekg dk idki 10 vkj 20 tykb dk chtkjki.k dju ij 1 tykb d chtkjki.k dh vi{kk T;knk gkrk gA

nxkijk dUn ij ik;k x;k fd iHkn vkjlh 308 e drkj l drkj dh njh e ifjoru dju l cht mit e Hkh ifjoru ik;k tkrk gA 1 tykb 2013 dk 30 x 30 leh dh njh ij chtkjki.k dju l 13-31 fDoVy@g- dh cht mit ikIr gvk gA 11 tykb 2013 dk chtkjki.k dju l 11-83 fDo-@g-

¼c½ fofHkUu ekSlekSe e[; Qlyksa dh lidj cht mRiknu gsrq LFkkukiUu {ks=ksa ds puko ij vxzkh ifj;ktuk

Qly	lidj	u;k {ks=	ykxr% ykHk	cht mit ¼fDo@g-½
pkoy	tvkj,p 5	e/;in'k dk ckyk?kkV	1¼1-86	
	dvkj,p 4	dukVd dk fljk dukVdk dk Vh- ujlhijk]	1¼1-13	11-92
	,uMhvkj,p 2	Qtkckn ,o NÙkhlx< dk lery {ks=		
	ih,lMh 3	iUr uxj] mÙkjk[k.M d ckgj dk {ks=		
vjgj	vkblhih,p 2671	e/; in'k dk lvkuh]	1¼1-4	4-2
	,dih,p,e 11303	tM,vkj,l] ;krey] egkjk"V	1¼1-56	6-43
ckt jk	vkj,pch 173 ¼vkblh,e, 93333, x vkjvkbch 192½	jkt LFkku dk Hkjrij]		
eDdk	gek	fljk] dukVdk fgjh;j rkyd] dukVd fljkxlik] dukVd	1¼1-75 1¼1-72 1¼1-70	22-50 21-70 21-25
	,pD;ih,e 1	iFkjk] djuky] vkU/k in'k	1¼1-73	
vMh	th,;lh,p 1 ,o thlh,p 4	xtjkr dk ljUnuxj fty k vkU/k in'k dk egccuxj fty e x<oky] vuUrij dk jMhiYyh {ks=] djuky fty dk ukfM;ky ,o cukxkukiYyh	1¼0-71	

cht mit ikIr gvkA foyEc dh n'kk 21 tykb 2013 dk chtkjki.k dju l 7-44 fDo@g- cht mit ikIr gvkA

l- lUpjl flfy;kfjl pkjk Qly e cht mit gr dVkb icU/ku ij v/;;u

mijkDr v/;;u e lh,tMvkjvkb 2221 ,o 2178 itkfr;k cht mRiknu ,o mul lEcfU/kr dkjdk rFkk pkjk mRiknu gr vPNh ik;h x;h gA mDr itkfr;k e lh,tMvkjvkb 2178 e lokf/kd cht mit ¼82-8 fdxk@g-½ ,o lh,tMvkjvkb 2221 e lokf/kd gjk pkjk mit ,o 'k"d inkFk dk mRiknu fjdkM fd;k x;kA ftu Qlyk e dVkb ugh dh x;h mue lokf/kd cht mit ikIr dh x;h tkfd 43 ifr'kr cht mit ,o 18 ifr'kr 'k"d inkFk mRiknu e dVkb okyh Qlyk dh ryuk e cokb d 45 fnu ij ikIr gbA lf{kIr e iÙkh dVkb }kjk cht mit e ?kVkÙkjh ik;h tkrh g blfy, lUpfjl flfy;kfjl e cht mRiknu gr dVkb dh lLrfr ugh nh tkuh pkfg,A fo'k"kdj ;fn tyok; xje ,o 'k"d gkA

n- ldj /kku e cht mit ,o mldh x.koÙkk gr ,lvkjvkb fof/k dk eY;kdu

vkpk; ;uth jxk df"k fo'ofo|ky; ,o /kku vul/kku fun'kky;] gnjkckn ij fd; x; i;kxk e ik;k x;k g fd ldj /kku Mhvkjvkj,p 3 e 18-4 ifr'kr dh mit e c<kÙkjh ,lvkjvkb fof/k }kjk ikIr dh x;h gA mijkDr c<kÙkjh vf/kd cky /kkj.k dju oky fdYyk dh l[;k] LikbDyV dh mojrk eyh; vk;ru e l/kkj d dkj.k ikIr gvk gA blh rjg l cht mit e 37-96 ifr'kr dh c<kÙkjh ldj /kku lhvkvkj,p 4 e Hkh mit ekudk e of) d dkj.k djkbdy e Hkh ikIr dh x;h gA tkjgkV dUn ij ldj /kku dh bUnk lkuk itkfr e Hkh ,lvkjvkb fof/k }kjk 6-56 fDo@gDV;j mit ikIr dh x;h g tkfd ipfyr fof/k ¼5-4 fDo@g-½ l vf/kd FkhA

;- ljf{kr n'kk e cxu ,o VekVj e ldj cht mRiknu

df"k foKku fo'ofo|ky;] /kkjokM e fd; x; i;kxk e VekVj dh ilk ldj 2 ,o cxu e ldj itkfr ih,p 9 e lMgkml voLFkk e T;knk cht mRiknu ikIr fd;k x;k ijUr ldj cxu ih,p 9 e ifrQy cht otu i{k= voLFkk e vf/kd fjdkM fd;k x;kA ldj cxu itkfr;k tl ilk ldj 5] ilk ldj 6 ,o ilk ldj 9 e uV gkml voLFkk e ykHkdkjh ykxr ykHk vuikr 1¼1-9 dh nj l vPNk cht mRiknu vPNh cht x.koÙkk d lkFk vkb,vkjvkb] ub fnYyh e fjdkM fd;k x;kA

j- ex e cht mRiknu c<kÙkjh gr cht mRiknu rduhdh dk vudfydj.k

ex itkfr ,uMh,e 1 tkfd 15 tykb l 1 vxLr d chp 30 x 10 leh dh njh ij jkbtkfc;e ,o QkLQkjl ?kkyd thok.k ,o lLrfr mojdk dh ek=k ,o ckjDl d 100 ihih,e d fNMdko d lkFk cokb dh x;h Fkh] lokf/kd cht mRiknu gr Qtkckn ,o tcyij dUnk ij mi;Dr ik;h x;h gA

y- mÙkj Hkkjrh; ifjfLFkfr;k e cgdVkrh pkjk Tokj ldj cht mRiknu dk ekudhdj.k

Tokj dh ldj itkfr lh,l,p 24 ,e,Q ,o lh,l,p 20 ,e,Q e 50 ifr'kr i"i.k e yx le; e 3 fnu d vUrj d dkj.k ifr ik/kk cht mit e lkFkd Lrj rd vUrj ik;k x;kA uj ,o eknk firRo e vf/kd vUrj gku d dkj.k lh,l,p 20 ,e,Q e cht cBu dk ifr'kr cgr de ik;k x;kA blfy, uj firRo ik/kk d le;kUrjky ij cokb djd eknk firRo d i"i.k d ledkfyu cukuk vPN cht mit d fy, vko';d gA fofHkUu frFk;k e cokb mipkj e 10 tu ,o 10 tykb dh vof/k Øe'k% lokf/kd ,o U;ure cht mit ikIr dju okyh ik;h x;h gA

o- tyok;q ifjorZu dk lUnHkZ e odfYid cokbZ le; dk ekudhdj.k

dUn ,o Qly	cokbZ le;	i{k.k@fof'k"Vrk,a
jkgjh jkxh ¼'kkUrh½	vxLr l vkx ;k 15 vDVcj l 15 fnlEcj rd	70 ifr'kr cht lfVx ,o gYeUFkkLikfj;e] yhQ LikV] bjxkV] vYVjufj;k CykbV ,o jrvk idki ¼vxLr dh cokb½
	tuojh	80 ifr'kr cht lfVx
	Qjojh ;k 1 tu l 15 tykb rd	100 ifr'kr cht lfVx] de jkx ,o dhV idki lfgr ¼tu l tykb e cokb½
	ekp l vkx	70 l 75 ifr'kr cht lfVx
	vxLr ,o Qjojh d ckn	,fQM] fFkIl] fVMM ,o ruk c/kd dk idki
cXykj ljte[kh dh ldj fdLek dch,l,p 44 ,o 53 dh ekrRo ykbu	1 ekp	lokÙke cht mit] mit ekud y{k.kk lfgr
	tykb ,o vxLr	jkxk dk lokf/kd idki
	1 eb	cht lfVx de ,o U;ure cht mit@ik/kk
	1 tu	U;ure cht lfVx
vkpk; ;uthjxk df"k fo'ofo|ky; Tokj ¼lh,l,p 14½	vDVcj	vxrh i"i.k] lokf/kd ijkx d.k mÙkjrhfork ,o 100 ifr'kr cht lfVx ,o lokf/kd cht mit
	uoEcj	vxrh i"i.k dh 'k:vkr ijUr cht lfVx de

'k- /kku dh lh/kh cokbZ gsrq ik/k itkfr;k d eY;kdu ij iFkin'kd ifj;kstuk

vkpk; ;uth jxk df"k fo'ofo|ky; ,o /kku vuq/kku fun'kky;] gnjkckn e g, i;kxk e ;g ik;k x;k g fd iMh Me lhMj }kjk cokb dju l lfØ; fdYyk voLFkk e tMk d vo;o o vUu mRiknu ij dkb lkFkd iHkko ugh iMrk gA iMh Me lhMj }kjk cokb l /kku dh jkf'k] vkfnR; ,o d".kgEk itkfr;k e vUu mit e Øe'k% 5-78] 5-67 ,o 5-58 Vu ifr gDV;j dh c<kÙkjh ik;h x;h gA

dk;EcVj e g, i;kx e /kku dh ih,pch 7] Mhvkjvkj,p 2 ,o lhvkvkj 50 e vf/kd tMk dh yEckb xhy ,o l[k {k=k e cokb }kjk ikIr dh x;h gA itkfr Mhvkjvkj,p 2] ih,pch 71 ,o vkfnR; e mPp tM vk;ru tcfd itkfr clefr e fuEu tM vk;ru vkdk x;k gA cXykj dUn ij lHkh 22 itkfr;k e cht mit ,o Qly dh n'kk dhpM voLFkk e vPNh ik;h x;h gA itkfr dvkj,p

4 e lokf/kd cht mit ,o Øe'k ,e,,l 26] d,eih 175 ,o jkf'k e fxjr g, Øe e ok;oh; voLFkk e cht mit lh/kh cokb gr vkdh x;h gA Qtkckn dUn ij fofHkUu itkfr;k e Øe'k 28-4 fDo@gDV;j ,o 45-5 fDo@gDV;j jkf'k ,o ih,pch 71 itkfr;k e cht mit ik;h x;h gA tkjgV dUn ij lHkh 15 itkfr;k e lkFkd Lrj rd cht mit ,o vU; y{k.kk e fofHkUurk ik;h x;h gA bl idkj itkfr tvkj 16 e 2852 fdxk@gDV;j cht mit ,o eukgj'kkyh e 318 fVyj ifr ehVj^2 fjdkM fd;k x;kA

II. cht nfgdh Hk.Mkj.k ,oa ijh{k.k

- cht teko dh iFke x.kuk dk i{k= mnHko d lkFk lkFkd ,o /kukRed lEcU/k ik;k x;k g ,o bl ,d fu/kkjd d :i e ldj eDdk] dikl ,o /kku e jki.k eY; d fu/kkj.k e mi;kx fd;k tk ldrk gA
- df=e cht me Roj.k mipkj ldj eDd e 96 ?kV] ldj dikl e 48 ,o 72 ?kV ,o ldj èkku e 96 ?kV d mipkj dk /kukRed lEcU/k chtk d Hk.Mkj.k {kerk l ik;k x;k g vkj bl ,d Hk.Mkjh;rk d fu/kkjd d :i e i;kx fd;k tk ldrk gA
- ikyhej cht yiu 3 feyh@fdxk cht dh nj l ¶yocy Fkk;je ½2-4 feyh@fdxk½ d l;kx vFkok foVkoDl 200 ¼Fkk;je 37-5 ifr'kr $ dkckfDly 37-5 ifr'kr½ d 2 xke@fdxk dh nj l vFkok ikyhej dk foVkoDl 200 d l;kx e i;kx dju l ldj /kku ,o ldj eDdk e ,d cokb ekle rd chtk dh x.koÙkk cuk; j[ku e lQyrk ik;h x;h gA
- ,l,lvkj ekdj ¼vkj,e 19] vkj,e 336] vkj,e 204] vkj,e 202½ dk /kku dh Mhvkjvkj,p 2] Mhvkjvkj,p 3 ,o dvkjp 4 itkfr;k e ldjh;rk ,o vkuokf'kd 'k)rk d ijh{k.k gr eY;kdu ,o iueY;kdu fd;k x;kA
- ljte[kh ldj fdLe ,ih,l,p 66 d firRo e vUrj Kkr dju gr ,l,lvkj ekdj ¼vkvkj,l 878½ dh igpku dh x;hA
- ex] /kku ,o eDdk d chtk e iYl byDVk exufVd fQYM dk 100 gVl d nj l mipkj dju l chtk dh x.koÙkk e lkFkd Lrj rd l/kkj ik;k x;kA
- cht rduhdh vul/kku dUnk ij ty ikjEHku rduhdh l lEcfU/kr dy 105 in'kuk dk fd;k x;k ftul fofHkUu Qlyk e ¼xg] /kku] jkxh] tokj] ex] vjgj ,o puk½ e 6 l 11-5 ifr'kr cht mit e of) ik;h x;hA

III. cht jkx foKku

- iUruxj df"k fo'ofo|ky; }kjk thok.k i"ixPN r'kkj jkx] vkuUn xtjkr }kjk fo"kk.k tfur chu dkeu ektd tkfd dyLVj chu ;k Xokj chu e ,o eDd e QkYl gM LeV uked u; cht tfur jkx fjikV fd; x; gA

- /kku e thok.k ifufdy CykbV gr cj[kkYMfj;k Xyeh uked thok.k mÙkjnk;h ik;k x;k g ftl }kjk cfDVfj;y xu jkV jkx Hkh mRiUu gk tkrk g rFkk chtk e de teko] de cht otu ,o detkj Qly ink gkrh gA
- mijkDr thok.kvk dk lØfer Qly }kjk fy; x; cnjxh ,o LoLFk chtk }kjk iFkd fd;k tk ldrk g tkfd i.kr;k cht tfur gA
- , ikjkb uked dod lØfer cht e yEch vof/k rd cuk jgrk g ftl cht mipkj ¼VkbdkMek gkfjft;kue ,o L;Mkekukl ¶ykjkll½ d 10 xke@fdxk cht dh nj l 1%1 vuikr e mipkfjr djd iHkkoh <x l l;kt d chtk e teko e l/kkj dj ldr g ijUr cht tfur lØe.k dk jkdu e vi{kkdr de iHkkoh gA
- l;kt d dUnk dk 35 fMxh rkieku ij 8 ?kV rd m'ek mipkj djd ifiy Cykp lØe.k dk de fd;k tk ldrk gA
- to fu;=.k dkjdk tl VkbdkMjek fojMh ,o L;Mkekukl ¶yjkll }kjk chtkipkj djd lh,e;@xke cht c<r g, Hk.Mkj.k vof/k d lkFk lkekU; rkiØe ij de fd;k tk ldrk gA
- to fu;=.k dkjd L;Mkekukl ¶yjkll d df=e bukdy'ku }kjk VekVj d ik/kk e vYVjufj;k CykbV lØe.k d ifr ifrjk/kd {kerk ink dh tk ldrh gA

IV. cht dhV foKku

1- lkekU; voLFkk e dhVuk'kh cht mipkj dk cht vdj.k ij iMu oky iHko dk v/;;u

[kk|kUu vkj nyguh chtk dk Hk.Mkj.k e {kfr igpku oky e[; dhVk d foJ u; dhVuk'kh dk eY;kdu MYVkeFkjhu dh ryuk e fd;k x;kA u; dhVuk'kh d.kk dh fofHkUu ek=kvk dk eY;kdu fuEu idkj fd;k x;k tl& bekefDVu cUtk,V 5 ,lth 2 ihih,e ¼40 feyhxke@fdxk- cht½] LikbuklM 45 ,llh 2 ihih,e ¼4-4 fexk@fdxk- cht½] bUMkDlkdkc 14-5 ,llh 2 ihih,e ¼13-8 fexk@fdxk cht½] jkbuDlhihj 20 ,llh 2 ihih,e ¼0-01 feyh yhVj@fdxk cht½] DykjQukihj 10 blh 2 ihih,e ¼0-02 feyh yhVj@fdxk cht½] ikQhukQkl ¼D;jkØku 50 blh½ 2 ihih,e ¼0-004 feyhyhVj@fdxk cht½] ukokY;jku ¼jheu 10 blh½ 5 ihih,e ¼0-05 feyh yhVj@fdxk cht½A bl i;kx dk foxr o"k :ikUrfjr djd ikQhukQkl dk ble 'kkfey fd;k x;kA

Hk.Mkj.k lofer dj xg] iyfeyV vkj eDdk dk fofHkUu df'k tyok; d gkykrk e rhu l N% eghu e iHkkfor dju oky dhVk d foJ dhVuk'kh MYVkeFkhu ¼Mlhl 2-8 blh½ d led{k gh lHkh u; dhVuk'kh d.kk [kkldj bekefDVu cUtk,V ¼ikdye 5 ,lth½ 2 ihih,e ¼40 fexk@fdxk cht½] LikbuklM ¼Vlj 45 ,llh½ 2 ihih,e ¼4-4 fexk-@fdxk cht½] jkbuDlhij ¼dkjktu 20 ,llh½ 2 ihih,e ¼0-01 feyh@fdxk cht½] ikQhukQkl ¼D;jkØku 50 blh½ 2 ihih,e ¼0-004 feyh@fdxk cht½] DykjQukihj ¼bUVihM 10 blh½ 2 ihih,e ¼0-02 feyh@fdxk cht½] b.MkDlkdkc ¼vor 14-5 ,llh½ 2

ihih,e ¼13-8 fexk@fdxk cht½ vkj ukokY;jku ¼jkbeu 10 bl h½ 5 ihih,e ¼0-5 feyh@fdxk cht½ d lehi Øekulkj iHkkoh ik;k x;kA

2- lenh rVh; {k=k e cht Hk.Mkj.k gsrq i;Dr idftx lkexh ,hyic/k;k dk eY;kdu

djkbdy vkj Hkou'oj dUn ij /kku d chtk dk ¶ycUMh,ekbM ¼Qe 480 ,l h½ 4-2 fexk@fdxk cht] bekeDVhu cUtk,V ¼ikDye 5 ,l th½ 2 ihih,e ¼40 fexk@fdxk cht½] LikbuklM ¼Vlj 45 ,l h½ 2 ihih,e ¼4-4 fexk@fdxk cht½] MYVkeFkjhu 2-8 bl h ¼0-04 feyh@fdxk cht½ d lkFk vyx&vyx feykdj rhu fofHkUu ifdx idV ¼xuh cx] lij xu cx vkj ,pMhihb cx½ e Hk.Mkfjr fd;s x;A

djkbdy e 'kk/k d mijkUr ik;k x;k fd /kku d cht tk MYVkeFkjhu d 1 ihih,e rFkk LikbuklM d 2 ihih,e l 0;ogr djd lij cx e j[kk x;k Fkk] mldk vdj.k {kerk Hkkjrh; U;ure cht iek.khdj.k ekudk d ekin.M l vf/kd ik;k x;kA lkFk gh 12 ekg rd dhVk l lØfer Hkh ugh gvkA

3- fdlku }kjk vuqf{kr cht dk dhV lØe.k lc/kh lo{k.k vkj eY;kdu

fdlkuk }kjk vujf{kr chtk dk lHkh lg;kxh dUnk l ikIr fd, x, vkj mudk dhV lØe.k lcèkh v/;;u fd;k x;kA T;knkrj ueuk e teko ifr'kr ¼76-3 ifr'kr½ Hkkjrh; U;ure cht iek.khdj.k ekudk l Åij ik;k x;kA bld foijhr yxHkx 36-9 ifr'kr d"kd inÙk cht ueuk e Hk.Mkj.k dhVk dk idki cgrk;r ik;k x;k vkj udlku g, chtk dk ifr'kr 0-1 ifr'kr l ydj 10-0 ifr'kr vkj dN ekeyk e ;g ifr'kr 32-0 ifr'kr rd igp x;kA

4- dhV ijkx.k }kjk x.koÙkk;Dr cht mRiknu

ljte[kh e cht mit dh ek=k c<ku gsrq dhV ijkx.k dk egRo e[; :i l n[kk x;k gA bld vfrfjDr vU; dkjdk tl foxj ,o ry dh ek=k e Hkh lkFkd Lrj rd dhV ijkx.k }kjk ykHk ikIr fd;k x;k gA vjgj d Qly e ijkx.k gsrq yhQ dVj e/keD[kh ,o dkjiUVj e/keD[kh dh Hkfedk vf/kd ik;h x;h gA

5- lkekU; n'kk e Hk.Mkj.k dhV d fu;=.k ,o cht dh x.koÙkk dkjdk ij dkcuMkb vkDlkbM mipkj dk iHkko

50 ifr'kr dkcuMkb vkDlkbM lkUnrk e cht Hk.Mkj.k dju l xgjs e [kijk foVy] exQyh e exQyh foVy] ex ,o puk e iYl cfpM e Hk.Mkj.k dh 6 l 9 ekg dh vof/k rd dhV lØe.k ,o cht x.koÙkk d vuj{k.k e iHkkoh fu;=.k ik;k x;kA bl idkj Hk.Mkj.k dhVk d fu;=.k e dkcuMkb vkDlkbM dk mi;kx jklk;fud mipkjk tl ¶;fexUM l d LFkkukiUu d :i e fd;k tk ldrk gA

6- cM+ Hk.Mkj cr+ukvksa esa Hk.Mkfjr chtksa esa yxus okyh dhVksa ds fu;a=.k esa dkcuMkbl vkDlkbM mipkj dh mi;ksfxrk ij iz'u

50 yhVj {kerk d Hk.Mkj cru e j[k mn d chtksa e dhV fu;a=.k gr yxk; x; dkcuMkbl vkDlkbM mipkj rfeyukM df"k fo'ofo|ky;] dk;EcVj e iHkkoh ik; x;A ftlls ;g bfxr gkrk g fd dkcuMkbl vkDlkbM dk mipkj cM+ Lrj ij chtksa e dhV fu;a=.k gr Hkh iHkkoh gA

7- lkekU; n'kk esa cht ds Hk.Mkj.k {kerk ij dhVuk'kd nokvksa ds mi;ksx vUrjkyksa dk iHkko

e[; Hk.Mkj dhVksa d lØe.k icU/ku gr ,dhdr ¼cht mipkj ,o cht Hk.Mkj rUrvksa d mipkj½ d iHkko dk v/;;u fofHkUu mipkj dk;Øeksa ftle cht mipkj ¼bekefDVu cUtk,V 5 ,lth@2 ihih,e lfØ; rRo½ ,o Qfcd mipkj ¼bekefDVu cUtk,V 5 ,lth@100 ihih,e lfØ; rRo½ d l;e fofHkUu dUnksa ij tkp x; vkj chtksa d Hk.Mkj.k vof/k ,o cht {kfr e l/kkj inf'kr djr ik;A

8- lkekU; n'kk esa dhVuk'kdksa }kjk mipkfjr u;s idftx lkexh dk cht ds Hk.Mkj.k {kerk ij iHkko

i;ksx d ifj.kkeksa d vk/kkj ij ;g fu'd"k fudkyk x;k fd dhVuk'kdksa }kjk mipkfjr idftx lkexh Hk.Mkj.k dhVksa d icU/ku e iHkkoh g ijUr bekefDVu cUtk,V 2 ihih,e dh nj l mipkfjr chtksa e Hk.Mkj.k dhVksa dk vi{kkdr vf/kd fu;a=.k ik;k x;kA

v. cht iSLdj.k

- lk;kchu dh dVkb ,o eMkb d nkjku vPN cht x.koÙkk cuk; j[ku gr dEckbu gkoLVj dh Me LihM 500 vkjih,e vkfFkd nf"Vdk.k l iHkkoh ik;h x;h gA i{k= ij de cht udlku ,o lokf/kd cht x.koÙkk gr dEckbu gkoLVj d dVj ckj dh tehu l 15 l 20 leh Åpkb vkfFkd nf"Vdk.k l lokf/kd iHkkoh ik;h x;h gA
- /kku d cht ykV l vkMhoh cht dk iHkkoh <x l fudkyu gr cht Dyhuj ,o xMj d vykok LiflfQd xfoVh liVj dk i;ksx mi;ksxh ik;k x;k gA
- fofHkUu lg;ksxh dUnksa ij yx cht fo/kk;u l;=k e vk/kfudhdj.k dh rRdky vko';drk gA yxHkx 80 ifr'kr l;=k e flfxy e'khu lykVl g vFkkr mue cht Dyhuj lg xMj gh yx g, gA T;knkrj cht fo/kk;u l;=k e vk/kkjHkr e'khujh tl ueh ehVj Hkh miyC/k ugh gA bld vfrfjDr T;knkrj l;=k e ;k rk LiflfQd xfoVh liVj miyC/k ugh g ;k i;ksx e ugh yk; tk jg gA fo/kk;u l;=k dh {kerk lrk"ktud u gku l e[; Qlyksa d chtksa e NVkb ifr'kr 20 l vf/kd gA T;knkrj cht fo/kk;u l;=k e lefpr cht Hk.Mkj.k dh lfoèkk ugh g lkFk gh cht lj{kk gr ¶;fex'ku dh lfo/kk Hkh ugh i;ksx e ykb tk jgh gA

fofHkUu Qlyk d chtk d fo/kk;u gr lLrr pyuh vkdkj

Qly	Qly izkfr	pyuh vkdkj ¼feh-½
/kku	eghu /kku % ihdoh ,p,eVh] ihdoh [kekx] t th,y 387] lkukfydk ,o louk	1.4
	ekVk /kku	1.6
puk	pkQk] fot ;] fo'kky] vkblhlhoh 10 ,o th 12	5.0
	cMk nkuk % tkdh] ihdoh dkcyh ,o th 5	5.5
vjgj	Lkh 11] vkblhih,y 87] 119] ,dVh 8811 ,o chMh,u 2	3.6
xg ,o tk		2.75
ldj ljte[kh dch,l,p 53		2.40 x 20 (S)
Lkdj eDdk fufFkJh		4.76 x20 (S)
dle		2.2
lk;kchu		3.6
jkxh		1.3

ijLdkj vkj idk'ku

fofHkUu lgHkkxh dUnk o mue dk;jr oKkfudk }kjk 5 ijLdkj@efjV lfVfQdV df"k vul/kku ,o fodkl xfrfof/k;k e mRd"B dk; gr ikIr fd; x; gA lkFk gh cht foKku ,o rduhdh l lEcfUèkr fof'k"V leh{kkRed jk"Vh; ,o vUrjk"Vh; if=dkvk e 98 'kks/k i= Hkh idkf'kr fd; gA

fofHkUu dUnk }kjk vk;kftr if'k{k.k ,o izlkj xfrfof/k;k dk fooj.k fuEu rkfydk e fn;k x;k gA

Ø-l-	dUn	if'k{k.k la[;k	in'kuh@fdlku eyk	'kks/k i=	vokMk
1-	lhlh,l,p,;] fglkj	2	2	&	&
2-	vk;,Vh] Hkou'oj	7	&	2	&
3-	thchih;,Vh] iUruxj	&	1	2	&
4-	lh,l,;,Vh] dkuij	&	&	4	&
5-	ihMhdoh] vdkyk	15	5	3	&
6-	t,udohoh] tcyij	3	&	14	2
7-	t,;] tkeuxj	1	1	&	&
8-	vkj,;] nxkijk	5	&	4	&
9-	Vh,u,;] dk;Ecrj	3	&	14	2
10-	,,uthvkj,;] gnjkckn	6	&	55	&
11-	lhvklhvkj] ukxij	1	&	&	&
12-	Mh,lvkj] eÄ	10	03	&	1
	;kx	**53**	**12**	**98**	**5**

ikl kj xfrfof/k;k

fofHkUu lgHkkxh dUnk }kjk cht mRiknu dk;Øe e yx g, lkotfud {k= d dfe;k ,o fdlkuk dk i{k= Lrj d if'k{k.k fn; tkr jg gA fofHkUu ilkj xfrfof/k;k tl& in'kuh] fdlku eyk] fdlku xk"Bh] i{k= fnol] in'ku Hkh fofHkUu dUnk }kjk le;≤ ij vk;kftr fd; x; gA ekuo llkèku fodk; dk;Øe d vUrxr cht foKku ,o ik|kfxdh ,o cht mRiknu d {k= e ekuo 'kfDr d ltu ,o dk;jr oKkfudk d dk'ky e of) dju gr rduhdh ,o oKkfud if'k{k.k dk;Øe vk;kftr fd; x;A mijkDr dk;Øek l cht dh miyC/krk ,o x.koÙkk e l/kkj gku d ifj.kkeLo:i cht cnyko nj e of) gkuk vif{kr gA

fuxjkuh % n'k d fofHkUu {k=k ¼mÙkj] ijc] if'pe] e/; ,o nf{k.k tku½ gr xfBr fuxjkuh lfefr;k }kjk vkofVr {k=k e fuxjkuh dk; lEiUu fd; x; rFkk lfefr;k }kjk fy; x; i{k.kk dk lf{kIr fooj.k ifjf'k"V&1 e fn;k x;k gA lkFk gh ifj;ktuk fun'kd }kjk Hkh Lor% lHkh itud cht mRiknu dUnk ,o cht rduhdh vul/kku dUnk d fuxjkuh dk dk; fd;k gA

4- Hkk-d-vu-i- cht ifj;ktuk

o"k 2013&14 e dy 630417-84 dUry x.koÙkk;Dr cht dk mRiknu fd;k x;k ftle 91710-94 dUry itud cht] 135813-82 dUry vk/kkjh; cht] 162771-07 dUry lR;kfir cht] 168331-77 dUry fo'oluh; cht ,o 71790-24 dUry lykfVx eVfj;y fofHkUu Qlyk d ink g,A bld vfrfjDr 84-75 yk[k lykfVx eVfj;y ,o 4-65 yk[k fVl dYpj lykVyV Hkh ink fd; x;A

3 Research Programmes and Achievements

3.1 Directorate of Seed Research, Mau

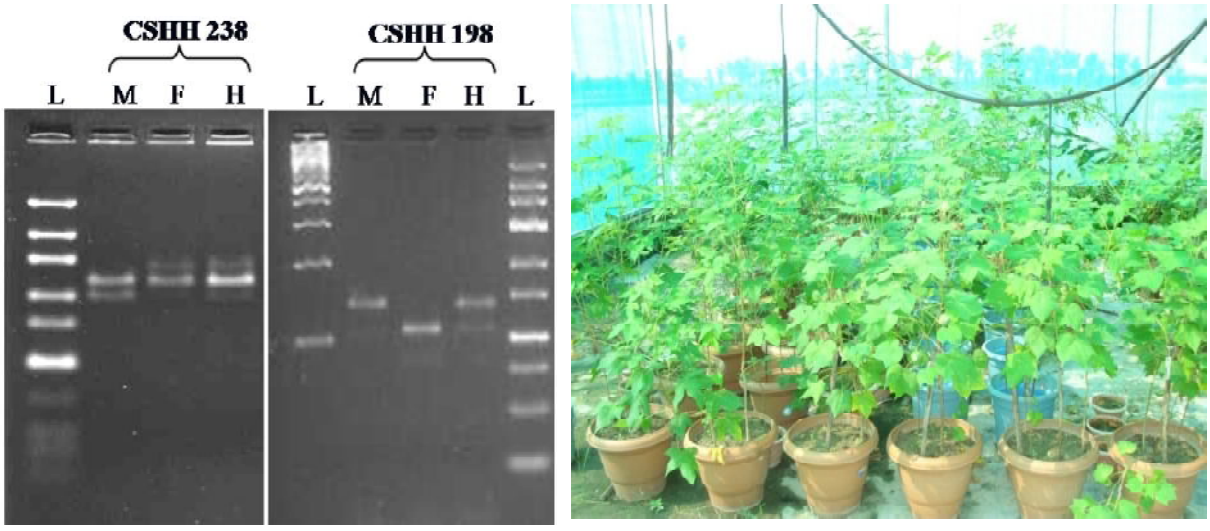
Directorate of Seed Research established in 2004 by upgrading the AICRP–NSP (Crops), had been set up in the campus developed for erstwhile National Institute of Sugarcane and Sugar Technology (NISST) located at village Kushmaur, Distt. Mau, Uttar Pradesh. At present the Directorate has developed a good infrastructure of laboratories, office rooms, library, residential quarters, research/ seed production farm, ARIS Cell and hostel for SRF/ JRF personnel. Number of sophisticated laboratory equipment viz., PCR, binocular microscope, seed analyzer, seed coating machine, BOD incubators, spectrophotometer, digestion system, touch sensitive screen, walk in germinators, laminar flow, autoclaves, cold centrifuges, deep freezer, gel electrophoresis equipment, transilluminator, Micro-array facility etc have been procured and installed along with requisite farm implements including tractors, seed drills, ploughs, mounted sprayer and cultivators.

Activities with regard to multiplication of breeder seeds of important crops, farmers' participatory seed production, operation of seed village scheme, field evaluation of rice hybrids and wheat varities, standardization of hybrid rice seed production technology, seed enhancement in high volume seed lots through seed priming coating and pelleting, seed agronomy for rice and wheat, QTL mapping for seed vigour in rice, testing of genetic purity through molecular markers, studies on seed borne diseases using biopriming and management of storage insect pest were taken up during the year. Theme wise salient achievements are as under.

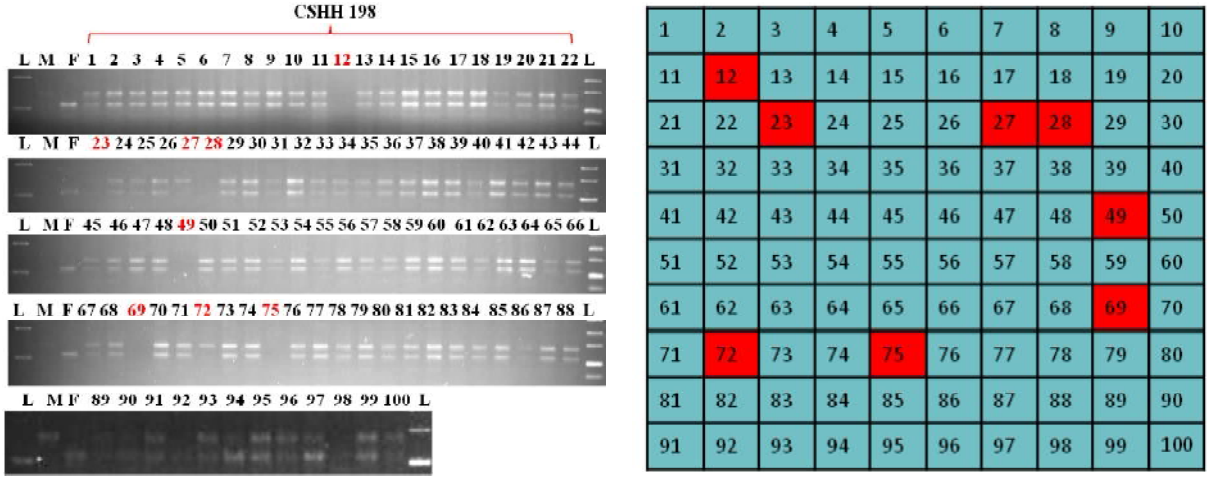
3.1.1 Seed Molecular Biology

3.1.1.1. Molecular Characterization of CSHH 198 Cotton Hybrid Using Microsatellite Markers

- Assessment of genetic purity is one of the most important quality control components in cotton hybrid 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. Here we report the use of molecular marker (Simple sequence repeat (SSR) microsatellite markers) for rapid testing of genetic purity of cotton hybrid (CSHH 198) and its parental line.
- Molecular characterization of CSHH 198 cotton hybrids along with their parents was done using breeder seed to assess the genetic purity by using microsatellite SSR marker at genomic level. Out of sixty cotton SSR markers analyzed, 15 markers were found to produce polymorphism ranging 20-33%, amplifying a total of 29 alleles, with an average of ±1.9 allelic variants per SSR locus. Most of the bands are found to be monomorphic across the genotypes tested, indicating substantial homogeneity in respect to the cotton genome.



Molecular characterisation of CSHH 198 cotton hybrids using SSR marker



Genetic purity testing of CSHH 198 cotton hybrid using SSR marker

- Three SSR markers showed amplification of an allele, which was very specific and unique to a particular parental line and not amplified in any other cotton 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 and indicate true blend of both the parents.
- Thus, these cotton SSR markers are found to be the effective and alternative tool against the conventional Grow Out Test (GOT) and prospects immensely to reduce the cost and time required for estimation of genetic purity in cotton hybrids. Using cotton specific and trait specific SSR molecular markers we estimated the hybrid purity and genetic purity in the commercial seed lots of CSHH 238 cotton hybrid. It is also mentionable that there is ample scope to identify more cotton hybrids through use of cotton specific SSR markers.

3.1.1.2. 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.)", germination test of 155 rice germplasm lines were conducted at different interval (3 months, 6 months and 9 months old seeds) during 2013-14. Screening and multiplications of 155 rice germplasm lines were carried out during *Kharif 2013*, at DSR Mau. The present investigation has revealed that, variance due to genotype was significant for vigour traits. Out of 155 germplasm only two germplasm lines viz., Acc. No: 3118 (GP-100) and Acc. No: 2693 (GP-74) were identified for low to medium variance for vigour traits. These lines will be used for revalidation and crossing programme.

Fig.1. Low vigour rice germplasm lines

  Further, the data analysis and compilation of recorded eleven quantitative traits (days to 50 % flowering, days to maturity, plant Height, uppermost 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) is in progress.

- For validation of marker-trait association, primers were designed for markers linked with seed vigour trait QTLs (earlier identified) which includes minor and major QTLs of seed vigour traits.

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

- Under the in-house project entitled **"**Effect of different bioactive chemicals on traits favouring out-crossing and their molecular characterization in hybrid Rice (*Oryza sativa* L.), seven hybrid parental lines (A, B and R) of rice has been screened and multiplied during Kharif-2012-13 at DSR Mau. Floral and floral contributing traits for out-crossing has been recorded viz., panicle exsertion percent, stigma exsertion percent, spikelet opening angle, flag leaf angle, number of spikelet per panicle and high seed setting potential. The present investigation has revealed that, four hybrid showed better performance namely PRH10, KRH2, NDRH2 and CORH3 as compared to DRRH2, DRRH3 and PSD1. Hence present studies need further revalidation of identified hybrid parental lines in the prevailing environment condition.

- In-vitro pollen viability test has been standardised which will be followed in further investigation.

3.1.2 Seed Physiology and Storage

3.1.2.1 Seed enhancement in pegion pea

A research project entitled "**Studies on seed priming induced hysic-chemical and isozyme changes and its effect on crop performance in pegion pea (*Cajanus cajan* L)"** was started in July 2010-11. Under this project, the experiment was conducted as per the approved technical programme in the fourth year 2013-14 on the recommendation of 8th RAC conducted during 25.11.2012 with two pegion pea varieties namely Malviya 13 and Bahar. The Observations were recorded under lab and field condition on germination, shoot and root length, seedling dry weight and vigour indices indicated 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 (Table 1a to f) 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 á-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 (Table 2a&b). Nitrate assimilatory enzymes including nitrate and nitrite reductases 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 (Table 3d&e). The similar trend was observed in chlorophyll a and b contents (Table 3a&b). Proline accumulation in the leafs of pegion 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 compare to priming with tap water and GA_3 (Table 3c). The anti oxidant enzymes including catalase, peroxidase and super oxide dismutase were assayed using

Table 1a. Germination %

Treatments	Germination %		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	72.00	85.00	**78.50**	
Tap water priming	73.66	88.00	**80.83**	**2.97**
Priming with KNO_3 in 0.2% conc.	79.00	92.66	**85.83**	**9.34**
Priming with GA_3 in 100 ppm conc.	85.33	95.00	**90.17**	**14.67**
Varietal Mean	**77.49**	**90.16**		
	SE±	**CD**		
Variety (V)	0.16	0.34**		
Treatment (T)	0.23	0.49**		
V× T	0.32	0.69**		
CV	**0.50%**			

T_0: Control (Unprimed) T_1: Seed priming with Tap water;
T_2: Seed priming with 0.2% KNO_3; T_3: Seed priming with100 ppm GA_3

Table 1b. Root length (cm)

Treatments	Root length (cm)		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	23.2	23.27	**23.23**	
Tap water priming	25.08	22.98	**24.03**	**3.43**
Priming with KNO_3 in 0.2% conc.	25.07	23.45	**24.26**	**4.42**
Priming with GA_3 in 100 ppm conc.	27.07	26.04	**26.55**	**14.27**
Varietal Mean	**20.88**	**24.69**		
	SE±	**CD**		
Variety (V)	0.57	1.23		
Treatment (T)	0.81	1.74**		
V× T	1.14	2.46		
CV	5.59%			

Table 1c. Shoot length (cm)

Treatments	Shoot length (cm)		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	21.11	26.86	**23.98**	
Tap water priming	22.08	26.05	**24.06**	**0.34**
Priming with KNO_3 in 0.2% conc.	22.93	26.57	**24.75**	**3.19**
Priming with GA_3 in 100 ppm conc.	24.88	25.53	**25.20**	**5.09**
Varietal Mean	**22.25**	**26.00**		
	SE±	**CD**		
Variety (V)	0.88	1.89		
Treatment (T)	1.25	2.67		
V× T	1.76	3.78		
CV	**9.04%**			

Table 1d. Seedling dry weight (mg)

Treatments	Seedling dry weight (mg)		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	349.00	345.00	**347.00**	
Tap water priming	379.00	408.00	**394.00**	**13.55**
Priming with KNO_3 in 0.2% conc.	406.00	413.00	**410.00**	**18.16**
Priming with GA_3 in 100 ppm conc.	417.00	433.00	**425.00**	**22.48**
Varietal Mean	**388.00**	**400.00**		
	SE±	**CD**		
Variety (V)	0.14	0.29		
Treatment (T)	0.19	0.42**		
V× T	0.27	0.59		
CV	**8.88%**			

Table 1e. Vigour index I

Treatments	Vigour index I		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	3260	3772	**3516**	
Tap water priming	3473	3965	**3719**	**5.79**
Priming with KNO_3 in 0.2% conc.	3792	4299	**4045**	**15.06**
Priming with GA_3 in 100 ppm conc.	4432	4838	**4635**	**31.83**
Varietal Mean	**3739**	**3985**		

Table 1f. Vigour index II

Treatments	Vigour index II		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	25167	29320	**27240**	
Tap water priming	27890	35870	**31880**	**17.04**
Priming with KNO_3 in 0.2% conc.	32020	38260	**35140**	**29.01**
Priming with GA_3 in 100 ppm conc.	35520	41120	**38320**	**40.68**
Varietal Mean	**30150**	**36140**		

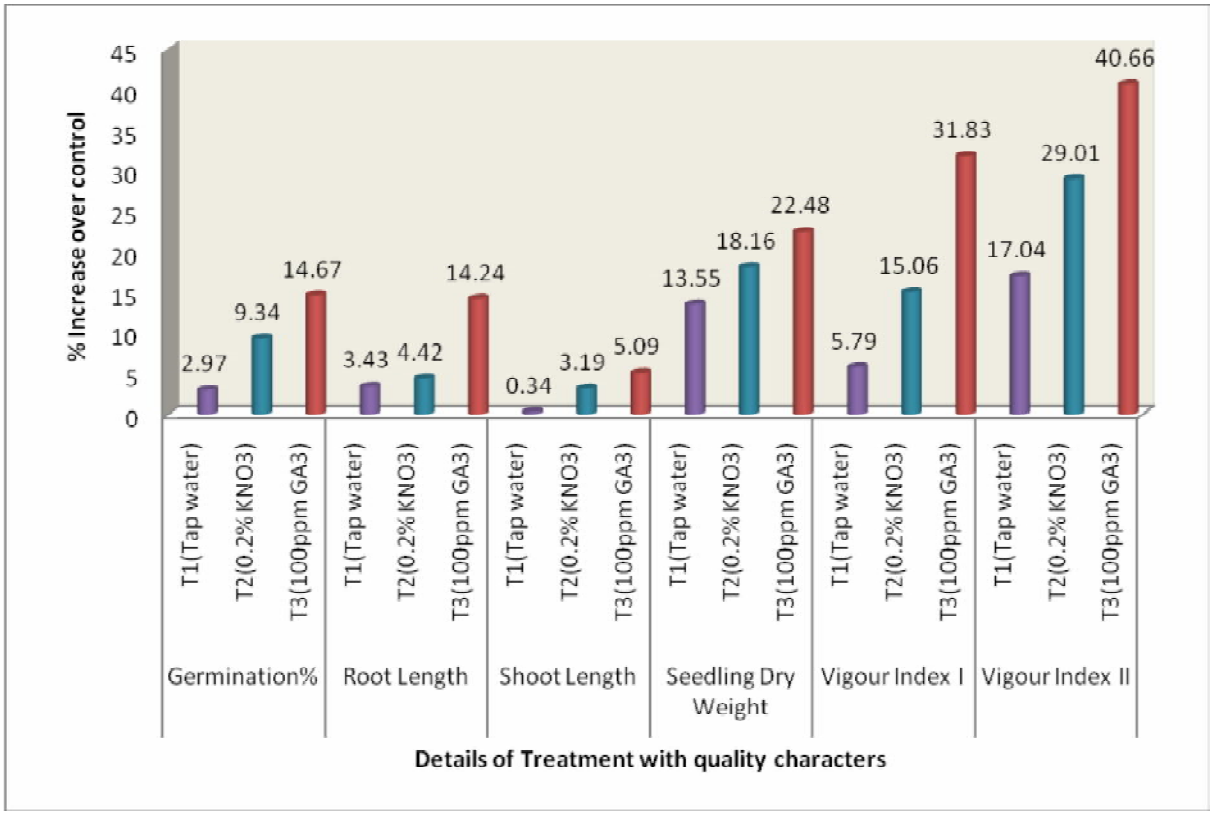


Fig. 2: Influence of seed priming with tap water, KNO_3, GA_3 over untreated control

Table 1g. Plant height (cm)

Treatments	Plant height (cm)		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	196.66	203.33	**199.99**	
Tap water priming	205.33	218.66	**211.99**	**6.01**
Priming with KNO_3 in 0.2% conc.	222.33	234.33	**228.33**	**14.18**
Priming with GA_3 in 100 ppm conc.	239.33	245.66	**242.49**	**21.25**
Varietal Mean	**215.92**	**225.49**		
	SE±		**CD**	
Variety (V)	3.23		6.93	
Treatment (T)	4.57		9.80	
V× T	6.46		13.86	
CV	**3.77%**			

Table 1h. No. of branches/plant

Treatments	No. of branches/plant		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	24.66	27.66	**26.16**	
Tap water priming	27.67	30.33	**29.00**	**10.85**
Priming with KNO_3 in 0.2% conc.	31.00	35.66	**33.34**	**27.44**
Priming with GA_3 in 100 ppm conc.	37.66	43.00	**40.34**	**54.20**
Varietal Mean	**30.25**	**34.16**		
	SE±		**CD**	
Variety (V)	0.83		1.79	
Treatment (T)	1.18		2.53	
V× T	1.67		3.58	
CV	**5.55%**			

Table 1i. No. of pods/plant

Treatments	No. of pod/plant		Treatment Mean
	Malviya 13	Bahar	
Control	484.33	488.33	486.33
Tap water priming	496.66	537.66	517.16
Priming with KNO_3 in 0.2% conc.	528.00	604.66	566.33
Priming with GA_3 in 100 ppm conc.	599.66	707.66	653.66
Varietal Mean	527.16	584.58	
	SE±		**CD**
Variety (V)	5.21		11.18
Treatment (T)	7.37		15.81
V× T	10.42		22.36
CV	**2.43%**		

Table 2a. α-amylase activity

Treatments	α-amylase activity IU/mg fresh weight		Treatment Mean
	Malviya 13	Bahar	
Control	0.176	0.184	**0.180**
Tap water priming	0.185	0.195	**0.190**
Priming with KNO_3 in 0.2% conc.	0.202	0.208	**0.202**
Priming with GA_3 in 100 ppm conc.	0.224	0.296	**0.260**
Varietal Mean	**0.197**	**0.221**	
	SE±	CD	
Variety (V)	0.002	0.004**	
Treatment (T)	0.002	0.005**	
V× T	0.003	0.007**	
CV	**2.10%**		

Table 2b. Protease activity

Treatments	Protease activity µmol tyrosine reduced/ml		Treatment Mean
	Malviya 13	Bahar	
Control	0.326	0.39	**0.36**
Tap water priming	0.367	0.39	**0.38**
Priming with KNO_3 in 0.2% conc.	0.501	0.62	**0.50**
Priming with GA_3 in 100 ppm conc.	0.406	0.72	**0.56**
Varietal Mean	**0.40**	**0.53**	
	SE±	CD	
Variety (V)	0.003	0.007**	
Treatment (T)	0.005	0.010**	
V× T	0.007	0.015**	
CV	**1.81%**		

Table 3a. Chlorophyll ‘a’ content (mg/l.)

Treatments	Chlorophyll ‘a’ content (mg/l.)		Treatment Mean
	Malviya 13	Bahar	
Control	171.59	175.70	**173.64**
Tap water priming	193.50	244.76	**219.13**
Priming with KNO_3 in 0.2% conc.	197.17	339.47	**268.32**
Priming with GA_3 in 100 ppm conc.	307.10	347.07	**327.08**
Varietal Mean	**217.34**	**276.75**	
	SE±	CD	
Variety (V)	2.26	4.86**	
Treatment (T)	3.20	6.87**	
V× T	4.53	9.71**	
CV	**2.16%**		

Table 3b. Chlorophyll 'b' content (mg/l.)

Treatments	Chlorophyll 'b' content (mg/l.)		Treatment Mean
	Malviya 13	Bahar	
Control	114.74	138.50	**126.62**
Tap water priming	127.34	151.83	**127.34**
Priming with KNO_3 in 0.2% conc.	124.60	151.21	**137.90**
Priming with GA_3 in 100 ppm conc.	136.90	175.27	**156.08**
Varietal Mean	**125.89**	**154.20**	
	SE±	CD	
Variety (V)	0.47	1.01	
Treatment (T)	0.67	1.43	
V× T	0.94	2.03	
CV	**0.86%**		

Table 3c. Proline content (µg/g f.w.)

Treatments	Proline content (µg/g f.w.)		Treatment Mean
	Malviya 13	Bahar	
Control	344.67	492.23	**418.45**
Tap water priming	229.03	384.03	**306.53**
Priming with KNO_3 in 0.2% conc.	224.26	357.43	**290.84**
Priming with GA_3 in 100 ppm conc.	288.34	484.00	**288.34**
Varietal Mean	**271.57**	**429.42**	
	SE±	CD	
Variety (V)	0.18	0.38	
Treatment (T)	0.25	0.54	
V× T	0.36	0.77	
CV	0.12%		

Table 3d. Nitrate reductase activity (nmole/h/g/f.w.)

Treatments	Nitrate reductase activity (nmole/h/g/f.w.)		Treatment Mean
	Malviya 13	Bahar	
Control	472.74	514.07	**493.40**
Tap water priming	520.27	582.16	**551.21**
Priming with KNO_3 in 0.2% conc.	598.03	665.56	**631.79**
Priming with GA_3 in 100 ppm conc.	569.17	588.10	**578.63**
Varietal Mean	**540.06**	**587.48**	
	SE±	CD	
Variety (V)	0.87	1.88	
Treatment (T)	1.24	2.65	
V× T	1.75	3.75	
CV	0.38%		

Table 3e. Nitrite reductase activity (nmole/h/g/f.w.)

Treatments	Nitrite reductase activity (nmole/h/g/f.w.)		Treatment Mean
	Malviya 13	Bahar	
Control	962.00	1014.00	**0988.00**
Tap water priming	994.00	1014.30	**1004.15**
Priming with KNO_3 in 0.2% conc.	1113.46	1150.66	**1113.46**
Priming with GA_3 in 100 ppm conc.	1024.66	1085.33	**1054.99**
Varietal Mean	**1023.53**	**1066.07**	
	SE±	CD	
Variety (V)	1.85	3.98**	
Treatment (T)	2.62	5.62**	
V× T	3.71	7.95**	
CV	0.41%		

Table 4[a]. Catalase µmol H_2O_2 reduced/g. Leaf

Treatments	Catalase µmol H_2O_2 reduced/g. Leaf		Treatment Mean
	Malviya 13	Bahar	
Control	2.24	2.32	**2.28**
Tap water priming	3.25	3.33	**3.29**
Priming with KNO_3 in 0.2% conc.	4.07	4.27	**4.07**
Priming with GA_3 in 100 ppm conc.	3.30	3.65	**3.47**
Varietal Mean	**3.22**	**3.39**	
	SE±	CD	
Variety (V)	0.02	0.05**	
Treatment (T)	0.03	0.07**	
V× T	0.04	0.09**	
CV	1.59%		

Table 4b. Peroxidase µmol tetra-guaiacol formed/min/g. f.w.

Treatments	Peroxidase µmol tetra-guaiacol formed/min/g. f.w		Treatment Mean
	Malviya 13	Bahar	
Control	55.51	56.16	**55.83**
Tap water priming	55.99	55.95	**55.97**
Priming with KNO_3 in 0.2% conc.	59.91	63.95	**61.93**
Priming with GA_3 in 100 ppm conc.	57.23	57.90	**57.56**
Varietal Mean	**57.16**	**58.49**	
	SE±	CD	
Variety (V)	0.17	0.37	
Treatment (T)	0.24	0.52	
V× T	0.34	0.74	
CV	0.61%		

Table 4c. Super Oxide Dismutase (enzyme activity/g. leaf)

Treatments	Super Oxide Dismutase (enzyme activity/g. leaf)		Treatment Mean
	Malviya 13	Bahar	
Control	37.25	38.02	**37.63**
Tap water priming	40.22	41.58	**40.90**
Priming with KNO_3 in 0.2% conc.	55.85	57.01	**56.43**
Priming with GA_3 in 100 ppm conc.	49.21	51.23	**50.22**
Varietal Mean	**45.63**	**46.96**	
	SE±	CD	
Variety (V)	0.10	0.21	
Treatment (T)	0.14	0.30	
V× T	0.19	0.43	
CV	0.46%		

Table 5a. Test weight (g.)

Treatments	Test weight (g.)		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	69.86	76.25	73.06	
Tap water priming	76.27	83.66	79.97	9.46
Priming with KNO_3 in 0.2% conc.	81.04	97.17	89.11	21.97
Priming with GA_3 in 100 ppm conc.	95.76	111.04	103.40	41.53
Varietal Mean	**80.73**	**92.03**		
	SE±	**CD**		
Variety (V)	2.18	4.68**		
Treatment (T)	3.09	6.62**		
V× T	4.36	NS		
CV %		6.07		

Table 5b. Biological yield (kg)

Treatments	Biological yield (kg)/plot		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	9.44	11.73	10.59	
Tap water priming	10.99	11.97	11.48	8.40
Priming with KNO_3 in 0.2% conc.	12.26	12.59	12.42	17.28
Priming with GA_3 in 100 ppm conc.	12.99	14.28	13.63	28.70
Varietal Mean	**11.42**	**12.64**		
	SE±	**CD**		
Variety (V)	0.10	0.21**		
Treatment (T)	0.14	0.29**		
V× T	0.19	0.42**		
CV%		1.95		

Table 5c. Grain yield (kg)

Treatments	Grain yield (kg)/plot		Treatment Mean	% Increase over control
	Malviya 13	Bahar		
Control	1.46	1.87	1.67	
Tap water priming	1.60	1.97	1.78	7.03
Priming with KNO_3 in 0.2% conc.	1.82	2.13	1.98	18.73
Priming with GA_3 in 100 ppm conc.	2.01	2.49	2.25	35.18
Varietal Mean	**1.72**	**2.11**		
	SE±	**CD**		
Variety (V)	0.02	0.05**		
Treatment (T)	0.03	0.07**		
V× T	0.05	0.10		
CV%		3.32		

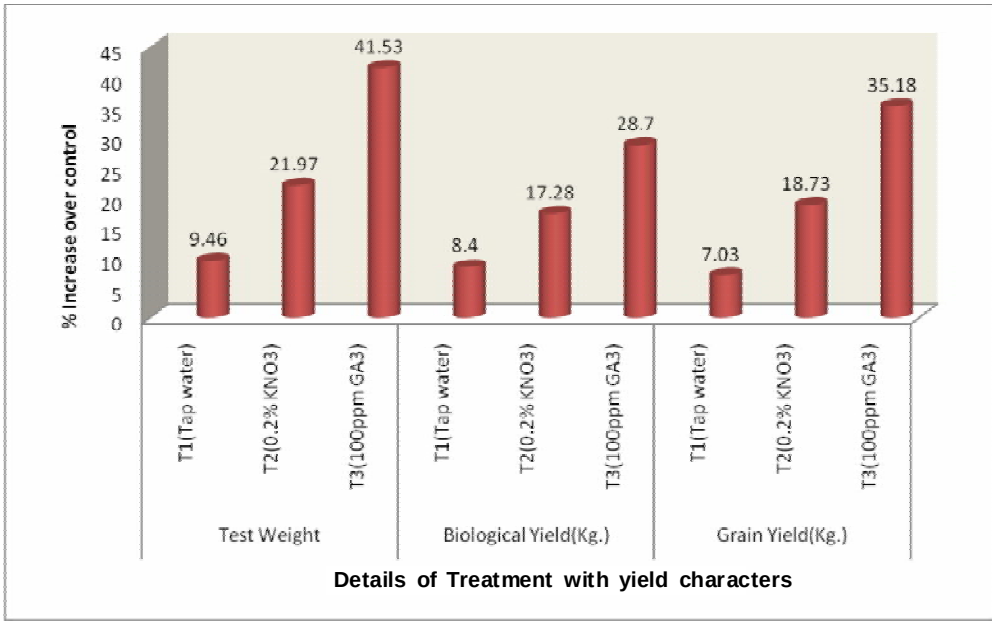


Fig. 3: Influence of seed priming with tap water, KNO_3, GA_3 over untreated control

the respective standard methods in growing seedlings. The observations recorded during the year indicates that among the priming agents used, KNO_3 enhanced relatively more activity of catalase, peroxidase and super oxide dismutase over unprimed control (Table 4 a,b&c). The treatments of priming with inorganic salts and plant growth regulator showed the improvement in plant height and yield attributes including test weight, biological yield and finally grain yield in both the varieties evaluated (Table 5a-c). In Varieties, Bahar displayed higher values in all the parameters studied.

3.1.2.2 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. The observations on germination, vigour, growth parameters yield attributes have been recorded. On the basis of third year 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 in 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 (Table-6a-h). The influence of GA_3 @ 100 ppm was more as compare 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

Table 6a: Observations prior treatment application

Variety	Germination %	Speed of germination	Seedling length	Vigour index I	Vigour index II
V_1-HI 1563	96.33	16.14	38.42	3702	1567
V_2-Raj 3765	96.20	15.23	36.28	3488	1503
Mean	**96.27**	**15.69**	**37.35**	**3595**	**1535**
SE±	1.271	0.449	2.150		
CD at 5%	5.472	1.933	9.251		
CV %	1.62	3.51	7.05		

Table 6b: Plant height (cm)

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	84.27	83.06	**83.67**	80.67	78.52	**79.29**
T_2 Spraying of GA_3@50 ppm	85.07	84.52	**84.79**	82.50	81.55	**82.03**
T_3 Spraying of GA_3@100 ppm	86.69	85.29	**85.99**	86.84	84.56	**85.7**
Mean	**85.35**	**84.29**		**83.14**	**81.55**	
	SE±			CD		
Treatment (T)	1.78			4.95		
Variety (V)	0.32			1.39		
V× T	1.79			4.97		
Irrigation (I)	1.62			3.53		
T x I	2.81			6.12		
V x I	2.29			4.99		
T x V x I	3.97			8.65		

Table 6c: No. of tillers

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	5.3	4.8	**5.05**	4.67	4.07	**4.37**
T_2 Spraying of GA_3@50 ppm	5.9	5.4	**5.65**	5.37	5.17	**5.27**
T_3 Spraying of GA_3@100 ppm	6.24	6.14	**6.19**	5.90	5.60	**5.75**
Mean	**5.82**	**5.45**		**5.32**	**4.95**	
	SE±			CD		
Treatment (T)	0.64			1.79		
Variety (V)	0.47			2.03		
V× T	0.48			1.33		
Irrigation (I)	0.39			0.85		
T x I	0.67			1.47		
V x I	0.55			1.20		
T x V x I	0.95			2.08		

Table 6d: Spike length (cm)

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	9.31	9.25	**9.28**	8.59	8.26	**8.42**
T_2 Spraying of GA_3@50 ppm	9.62	9.47	**9.54**	9.29	9.07	**9.18**
T_3 Spraying of GA_3@100 ppm	10.8	10.35	**10.57**	9.8	9.45	**9.62**
Mean	**9.91**	**9.69**		**9.22**	**8.92**	
	SE±			CD		
Treatment (T)	0.50			1.39		
Variety (V)	0.16			0.71		
V× T	0.31			0.86		
Irrigation (I)	0.19			0.43		
T x I	0.34			0.74		
V x I	0.28			0.60		
T x V x I	0.48			1.05		

Table 6e: No. of seeds/spike

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	37.46	37.2	37.33	36.9	35.9	36.4
T_2 Spraying of GA_3@50 ppm	39.63	38.08	38.83	37.3	37.1	37.2
T_3 Spraying of GA_3@100 ppm	40.5	40.0	40.25	39.8	37.7	38.75
Mean	39.19	38.41		39.0	36.9	
	SE±			CD		
Treatment (T)	0.74			2.06		
Variety (V)	2.04			8.79		
V× T	2.19			6.11		
Irrigation (I)	1.42			3.10		
T x I	2.46			5.36		
V x I	2.01			4.38		
T x V x I	3.48			7.58		

Table 6f: 1000 Seed weight (g)

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	35.84	34.81	**35.32**	33.38	31.12	**32.25**
T_2 Spraying of GA_3@50 ppm	37.14	36.61	**36.87**	36.93	36.5	**36.71**
T_3 Spraying of GA_3@100 ppm	43.05	37.92	**40.48**	40.82	37.85	**39.34**
Mean	**38.68**	**36.44**		**37.04**	**35.15**	
	SE±			CD		
Treatment (T)	0.95			2.64		
Variety (V)	0.76			3.29		
V× T	0.89			2.48		
Irrigation (I)	0.94			2.06		
T x I	1.63			3.56		
V x I	1.33			2.91		
T x V x I	2.31			5.04		

Table 6g: Biological Yield (kg/plot)

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	16.06	15.6	**15.83**	14.86	14.13	**14.49**
T_2 Spraying of GA_3@50 ppm	16.96	16.83	**16.89**	16.66	15.03	**15.84**
T_3 Spraying of GA_3@100 ppm	18.63	17.7	**18.16**	18.6	16.93	**17.76**
Mean	**17.21**	**16.71**		**16.70**	**15.80**	
	SE±			CD		
Treatment (T)	1.49			4.15		
Variety (V)	0.71			3.05		
V× T	1.25			3.48		
Irrigation (I)	0.77			1.68		
T x I	1.33			2.91		
V x I	1.09			2.38		
T x V x I	1.89			4.11		

Table 6h: Grain Yield (kg/plot)

Treatment/variety	Moisture level					
	I_1			I_2		
	V_1	V_2	Mean	V_1	V_2	Mean
T_1 Control	5.01	4.7	4.85	4.98	4.38	4.68
T_2 Spraying of GA_3@50 ppm	5.83	5.58	5.70	5.28	5.03	5.49
T_3 Spraying of GA_3@100 ppm	6.88	6.13	6.50	6.62	5.75	6.18
Mean	5.91	5.47		5.63	5.05	
	SE±			CD		
Treatment (T)	0.76			2.11		
Variety (V)	0.29			1.28		
V× T	0.31			0.86		
Irrigation (I)	0.41			0.90		
T x I	0.72			1.56		
V x I	0.58			1.27		
T x V x I	1.01			2.21		

3.1.3 Seed production & certification

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

Effect of seed treatment with growth regulators on initial seed vigour & tillering capacity (Laboratory experiment)

A research project entitled "Devising agro-techniques for reducing the seed rate of wheat" was started in 2011-12. The experiment was initiated in the lab to find out the suitable plant growth regulator along with optimum dose for enhancing the tillering capacity in wheat using low seed rate. The experiment was laid out in randomized block design (RBD) with three replications. The one year old three varieties of wheat viz., HD 2733, PBW 550 and PBW 502 were selected and surface sterilized with 0.1% of $HgCl_2$ for five minutes. After surface sterilization, sand priming has been performed as per treatments v/w in 100 ppm solutions of GA_3, IAA, Kinetin, 2,4-D amine salt, 2,4-D sodium salt and hydroprimimg separately in plastic container for the period of twelve hour. After priming the seeds were taken out from the container and allowed for shade drying. One set of unprimed control was also maintained simultaneously. Laboratory experiments for seed quality parameters such as speed of germination, germination percentage, seedling length, seedling dry weight and vigour index-I & II recorded and the results are mentioned below in brief.

Data on speed of germination is presented in Table 7 & Fig.4. Results showed that the speed of germination was significantly higher with growth regulator (GA_3). However, difference among two growth regulator (IAA and 2,4-D amine salt) was not significant. The highest value (32.3) was obtained

Table 7: Effect of growth regulators and varieties on speed of germination, germination, seedling length, seedling dry weight and vigour index I & II of wheat

Treatments	Speed of germination	Germination (%)	Seedling length (cm)	Seedling dry weight (g)	Vigour index I	Vigour index II
Growth Regulators						
Control	26.9	91.5	34.9	0.135	3209	12.3
GA_3	32.3	100.0	42.2	0.193	4217	19.3
IAA	31.3	98.4	40.2	0.192	3959	18.9
Kinetin	30.1	97.3	40.2	0.170	3910	16.5
2,4-D amine salt	31.3	97.8	39.2	0.159	3830	15.6
2,4-D sodium salt	30.1	95.4	39.2	0.150	3741	14.3
Hydropriming	29.3	94.9	38.0	0.139	3609	13.2
SEm±	0.59	0.26	0.26	0.004	25.10	0.36
LSD (0.05%)	1.68	0.74	0.73	0.010	71.44	1.01
Genotypes						
HD2733	27.8	95.1	36.7	0.147	3498	14.0
PBW550	30.7	97.0	39.1	0.156	3808	15.2
PBW502	32.1	97.3	41.6	0.185	4040	18.0
SEm±	0.39	0.17	0.17	0.002	16.43	0.23
LSD (0.05%)	1.10	0.49	0.48	0.007	46.77	0.66

with the use of GA_3 during the experimentation. The speed of germination was increased significantly with application of GA_3 as compared to control and hydropriming. The maximum speed of germination was recorded with GA_3 (32.3) followed by IAA (31.3), 2,4-D amine salt (31.3) and Kinetin (30.1). Among the varieties PBW 502 recorded significantly higher values of speed of germination (32.1) as compared to PBW 550 (30.7) and HD 2733 (27.8). However, PBW 550 also produced higher seed quality parameters as compared to HD 2733.

A positive increase in germination (%), seedling length (cm), seedling dry weight (g) and vigour index I&II was pointed out superiority with GA_3 treatments (Table 7). The seed treatment with GA_3, IAA, Kinetin, 2,4-D amine Salt, 2,4-D sodium salt and hydropriming increased the germination (%), seedling length (cm), seedling dry weight (g) and vigour index I & II, however difference among Kinetin and 2,4-D amine salt was not significant. The highest value of germination (100%), seedling length (42.0 cm), seedling dry weight (0.193g) and vigour index I&II (4217 & 19.3) in seed were recorded with GA_3 and lowest values of all the parameters were recorded with control followed by hydropriming.

Among the varieties PBW 502 recorded significantly higher values of all the quality parameters viz. germination (97.3 %), seedling length (41.6 cm), seedling dry weight (0.185 g) and vigour index I&II (4040 & 18.0) as compared to PBW 550 and HD 2733.

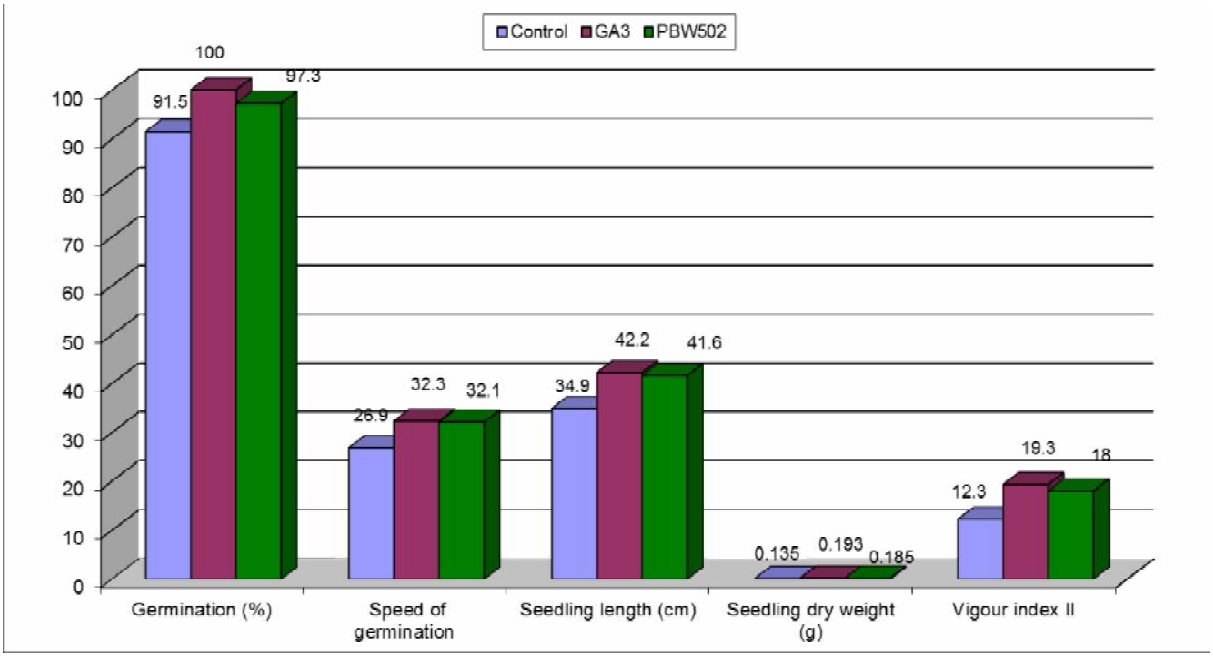


Fig. 4: Effect of growth regulator on seed quality parameter of wheat

Effect of seed treatment with growth regulators on initial seed vigour & tillering capacity (Pot Experiment).

The study was carried out at Directorate of Seed Research, Mau, U.P. during the *Rabi* season of 2012-13. The soil of the experimental pot was clay loam in texture, alkaline (pH 7.40), low in organic carbon (0.29 %) and available N (245 kg/ha), medium in available P (13.50 kg/ha) and available K

(164.0 kg/ha). Twentyone treatment combinations comprising of one year old seeds of 3 wheat varieties, viz., HD2733, PBW 550 and PBW 502 were surface sterilized with 0.1% of $HgCl_2$ for five minutes.100 ppm each of gibberellic acid, indole acetic acid, kinetin, 2,4-D amine salt, 2,4-D sodium salt and hydropriming were used for soaking the seeds separately. There were actually two controls, distilled water treatment and the untreated seeds which were not presoaked before sowing. The seeds were soaked in the various concentrations of the growth regulators and the distilled water for a period of an hour, after which they were drained using cotton wool and allowed to dry on filter papers for 24 hours before sowing. The weight of each treated seed variety was taken after drying using a weighing balance. Distilled water was also used for soaking and to also serve as control so that the effect of seed pre-treatment on plant growth should not be affected by the differences in seed development along with untreated seeds for comparing the effect of various pre-treatments. The experiment was arranged in RBD with three replications. The wheat seed was shown on 15 December, 2012 with seed rate of 100 kg/ha. Ten plants were chosen randomly from the centre of each pot to determine the growth, yield attributes, seed yield, biological yield and harvest index and seed quality parameters. The germination percentage (GP) was calculated according to the International Seed Testing Association (ISTA) method.

The periodical data on plant height are presented in Table 8 & Fig.5. Results indicated that growth regulators bring significant improvement in plant height and number of tillers / plant at harvesting as compared to control and hydropriming. Maximum plant height (81.43 cm) and number of tillers / plant (5.03) was reported with the application of GA_3 during the harvesting. However, no significant difference was noticed between GA_3, IAA, Kinetin, 2,4-D amine salt & 2,4-D sodium salt on growth (plant height and number of tillers / plant) during experimentation. Among the varieties PBW 502 recorded

Table 8: Effect of growth regulators and varieties of wheat on plant height, number of tillers / plant, Spike length, Spike weight, number of seed/spike and seed weight/spike.

Treatments	Plant height (cm)	No. of tillers / plant	Spike length (cm)	Spike weight (g)	No of seed / spike	Seed weight / spike
Growth Regulators						
Control	71.00	3.79	8.72	1.99	39.6	1.51
GA_3	81.43	5.03	9.36	2.24	44.3	1.67
IAA	81.00	4.98	9.31	2.22	44.0	1.63
Kinetin	80.17	4.89	9.27	2.21	44.0	1.58
2,4-D amine salt	79.64	4.72	9.12	2.14	43.4	1.63
2,4-D sodium salt	78.04	4.68	9.20	2.12	42.9	1.63
Hydropriming	75.20	4.44	8.94	2.09	40.0	1.54
SEm±	1.60	0.23	0.11	0.05	1.20	0.05
LSD (0.05%)	4.55	0.66	0.32	0.14	3.41	NS
Genotypes						
HD2733	74.09	4.36	8.81	2.10	39.6	1.58
PBW550	76.95	4.69	8.99	2.12	42.8	1.61
PBW502	83.17	4.88	9.59	2.22	45.4	1.61
SEm±	1.05	0.15	0.07	0.03	0.78	0.03
LSD (0.05%)	2.98	NS	0.21	0.09	2.23	NS

significantly higher values of plant height (83.17cm) and on par in number of tillers / plant (4.88) as compared to PBW 550 (76.95 cm & 4.69) and HD 2733 (74.09cm & 4.36).

Besides number of tillers, the spike length also plays an important role in improving total seed yield of wheat. Results on spike length, spike weight and number of seed/ spike of wheat by growth regulators and varieties have been presented in Table 8. The data showed that GA_3, IAA, Kinetin have favourable effect on spike length, spike weight and number of seed/ spike of wheat seed. Growth regulators (GA_3, IAA, Kinetin) increased the spike length, spike weight and number of seed/ spike over control. However, no significant variation in increase the spike length, spike weight and number of seed/ spike were observed between individual seed treatment of GA_3, IAA and Kinetin.

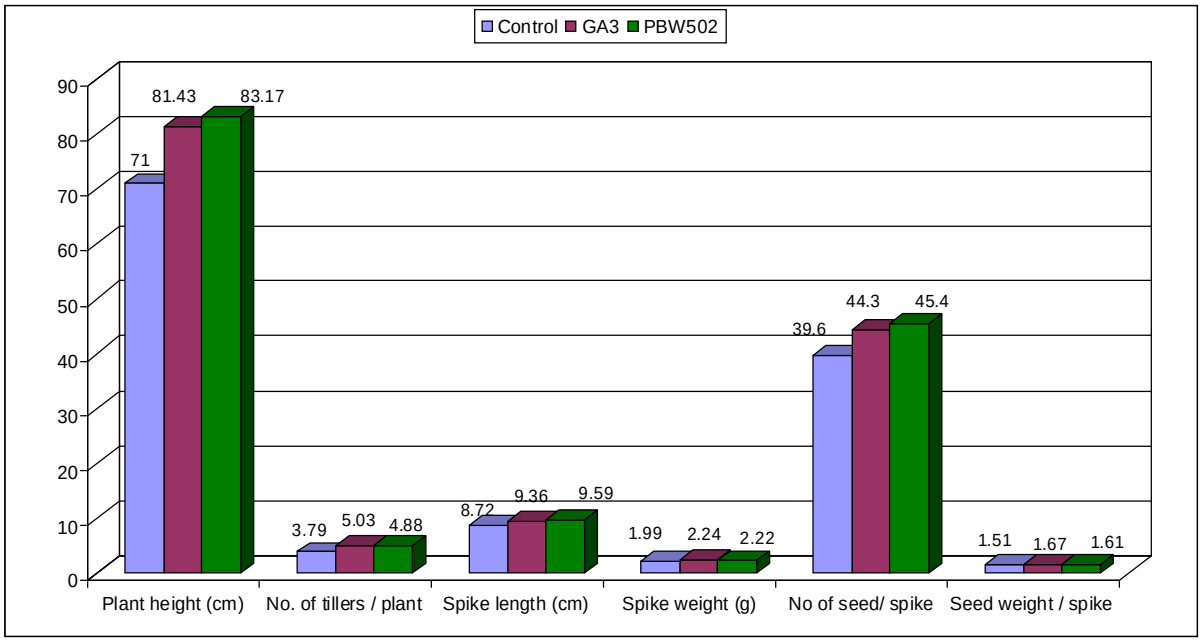


Fig. 5: Effect of growth regulators on growth and yield attributing character of wheat

Among growth regulators, GA_3 recorded maximum spike length (9.36cm), spike weight (2.24 g) and number of seed / spike (44.3). Among the varieties PBW 502 recorded significantly higher values of spike length (9.59 cm), spike weight (2.22 g) and number of seed/ spike (45.4) as compared to PBW 550 and HD 2733.

The results on seed weight/ spike of wheat have been presented in Table 9 & Fig.6. Data pointed out that inoculation of wheat seed with growth regulators hosted the seed weight / spike. However, difference between GA_3, IAA, Kinetin, 2,4-D amine salt and 2,4-D sodium salt individually was not significant. Data pertaining to test weight (1000 seed weight) of wheat are presented in Table 2 and results showed that test weight was found to be higher with GA_3, IAA and 2,4-D sodium salt treated seed as compared to rest of treatment. Among all treatments, highest test weight (35.5) was recorded with GA_3, followed by IAA, 2,4-D sodium salt (35.3), hydropriming (35.0), 2,4-D amine salt (34.8) and Kinetin (34.7).

Table 9: Effect of growth regulators and varieties of wheat on test weight, seed yield, biological yield (g/pot) and harvest index

Treatments	Seed yield (g/pot)	Biological yield (g/pot)	Test weight (g)	Harvest Index (%)
Growth Regulators				
Control	55.7	156.3	34.4	36.15
GA_3	84.2	210.3	35.5	40.87
IAA	80.7	203.5	35.3	40.00
Kinetin	74.5	185.9	34.7	40.64
2,4-D amine salt	70.4	177.3	34.8	39.59
2,4-D sodium salt	73.4	181.5	35.3	40.41
Hydropriming	62.6	165.1	35.0	37.68
SEm±	4.99	12.64	0.69	1.50
LSD (0.05%)	14.21	35.98	35.0	NS
Genotypes				
HD2733	60.2	142.2	38.0	41.756
PBW550	70.0	190.9	32.6	36.833
PBW502	84.7	215.5	34.5	39.414
SEm±	3.27	8.27	0.45	0.981
LSD (0.05%)	9.30	23.55	1.29	2.794

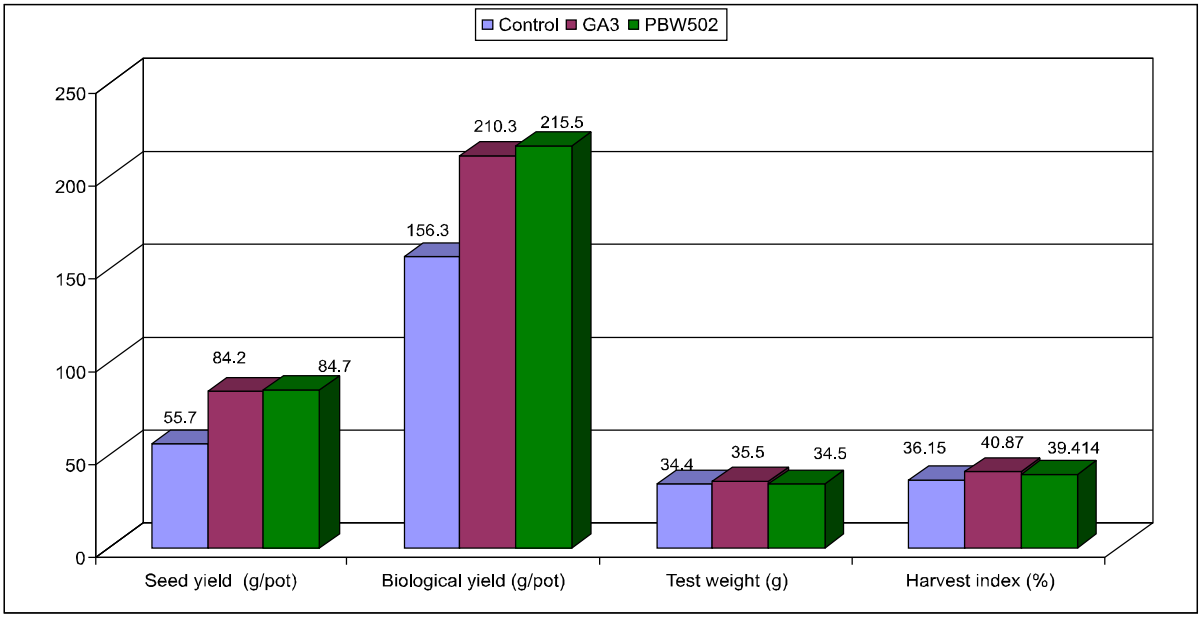


Fig 6: Effect of growth regulators on yield and yield attributing characters of wheat

Among all the treatments, application of GA_3 resulted in highest value of seed yield (84.2 g/pot), followed by IAA (80.7 g/pot) and Kinetin (74.5 g/pot), 2,4-D sodium salt (74.3 g/pot),2,4-D amine salt (70.4 g/pot), hydro priming (62.6 g/pot) and lowest in control. This may be due to the phyto hormones shown beneficial effect on growth & yield by increasing nutrient reserves through increased physiological activities & root proliferation (Darra *et al.*, 1973).The seed treatment with GA_3 significantly increased the biological yield over all other treatments. However, no significant difference were obtained with Kinetin (185.9 g/pot), 2,4-D sodium salt (181.5 g/pot) and 2,4-D amine salt (177.3 g/pot) except hydropriming & control. Kabar, 1987 & Datta *et al.*, 1998 also reported that increased seed yield due to mitigate the harmful effects of salinity & optimize physical metabolic conditions for germination. The highest biological yield (210.3 g/pot) was obtained from the GA_3 treated plots. The ratio of seed to biological yield in percent indicates the seed yield production efficiency of plants. The seed treatment with growth regulators increased the harvest index and highest harvest index was associated with GA_3 (40.87) application. Among the varieties PBW 502 recorded significantly higher values of test weight (34.5 g), seed yield (84.7 g/pot), biological yield (215.5 g/pot) and harvest index (39.414 %) as compared to PBW 550 and HD 2733.

Significant improvement in the seed quality parameters viz. germination (96.7 %), seedling length (32.9 cm), seedling dry weight (0.191 g) and vigour index I & II (3179.7 & 18.5) were recorded with

Table 10: Effect of growth regulators and varieties on germination, seedling length, seedling dry weight and vigor index (I&II) of wheat.

Treatments	Germination (%)	Seedling length (cm)	Seedling dry weight (g)	Vigour index I	Vigour index II
Growth Regulators					
Control	92.6	29.5	0.160	2733.6	14.8
GA_3	96.7	32.9	0.191	3179.7	18.5
IAA	96.2	32.0	0.190	3076.3	18.3
Kinetin	95.0	30.3	0.189	2873.1	17.9
2,4-D amine salt	96.0	31.7	0.189	3044.1	18.2
2,4-D sodium salt	95.4	30.7	0.182	2922.9	17.4
Hydropriming	93.4	30.2	0.174	2820.2	16.2
SEm±	0.78	0.59	0.004	54.26	0.36
LSD (0.05%)	2.23	1.68	0.01	154.47	1.02
Genotypes					
HD2733	93.2	30.0	0.168	2799.9	15.7
PBW550	95.6	31.0	0.181	2958.3	17.3
PBW502	96.3	32.1	0.197	3091.8	19.0
SEm±	0.51	0.39	0.002	35.52	0.23
LSD (0.05%)	1.46	1.10	0.007	101.13	0.67

the application of GA_3 hydropriming & control (Table 10). The similar finding was observed by Salisbury and Ross (1997) and stated that hormones generally decrease viscosity of cytoplasm and increase diffusion of water into the cell therefore, increase seed quality parameters. However, all the treatment were significantly high over control and IAA, Kinetin, 2,4-D were on par with each other and recorded significantly higher seed quality parameter as compared to control & hydropriming. Seed qualities of the three wheat varieties (HD 2733, PBW 550 & PBW 502) showed variable growth pattern at different stages of their development (germination, shoot & root growth). The findings of Singh and Sharma (1996) and Gulnaz *et al.* (1999) on the quantitative and qualitative responses of plants to different growth regulators may differ considerably at different plant growth stage. The variety, PBW 502 had the highest germination, seedling length, seedling dry weight among all tested varieties.

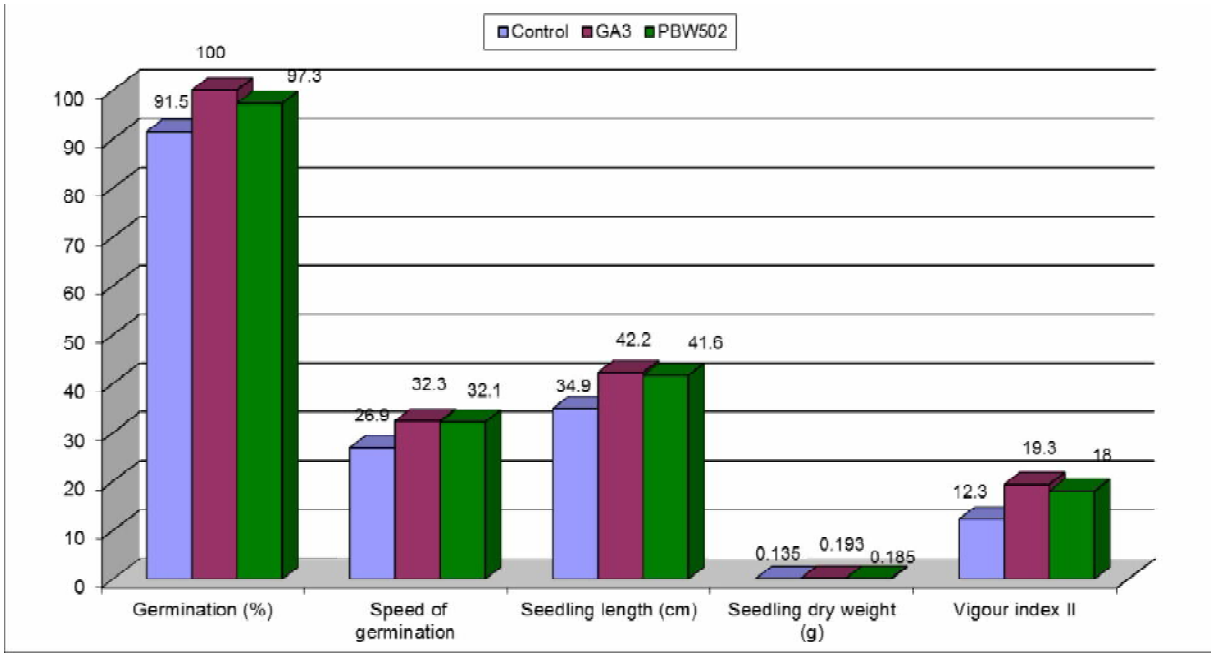


Fig 7: Effect of growth regulators on seed quality parameter in wheat

Among the varieties PBW 502 recorded significantly higher values of seed quality parameters (germination 96.3%, seedling length 32.1cm), seedling dry weight (0.197g) and vigour index I & II (3091.8 & 19.0) as compared to PBW 550 (95.6%, 31.0 cm, 0.181 g and 2958.3 & 17.3) and HD 2733. Darra *et al.* (1973) suggested that plant hormones increase the rate of absorption of water and available nutrients thereby better growth. The hormones might also have substantially enhanced cell enlargement and rapid increase in cell division as suggested by Magome, 2004**.** The increasing seed quality parameters due to application of growth regulators enhanced oxygen uptake, increased α–amylase activity, the higher efficiency of mobilizing nutrients from the cotyledons to the embryonic axis (Datta *et al.*, 1998, Sastry & Shekhawat, 2001).

Conclusion

- Pre-sowing seed treatment with growth regulators (GA_3, IAA, Kinetin, 2,4-D amine salt, 2,4-D sodium salt and hydropriming) in 100 ppm concentration considerably enhances the seed quality parameters and tillering capacity in wheat seeds. However, application of GA_3 was significantly superior in respect of above parameters over rest of the treatments including control.
- Among the varieties PBW 502 recorded significantly higher values of all the quality parameters viz. germination, seedling length, seedling dry weight and vigour index I & II as compared to PBW 550 and HD 2733.

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

A research project entitled "Impact of genotypes and conservation tillage on seed quality and productivity of wheat in the eastern-UP." was started in 2012-13. The 18 treatment combinations comprising of 3 tillage systems viz., Zero tillage (ZT), Conventional tillage (CT) and Furrow Irrigated Raised Beds (FIRB) and 6 wheat varieties viz., KRL 213, HD 2733, PBW 550, HD 2967, KRL 210 and DBW 39 were arranged in split plot design (SPD) with three replications and the results obtained from the experiment were mentioned below in brief.

In present research findings results showed (Table 11) that ZT treatment recorded significantly higher growth and yield attributes (DMA, tillers m^{-2}) as compared to CT and FIRB because under ZT condition more favourable micro climate for plant growth. However, plant height was more under CT. The yield attributes like spike length and grains/spike were more under FIRB system because each and every rows showed border effect resulting more yield attributes are recorded. 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 shown in Table 12 and revealed that ZT practise effect significantly on yield (biological, seed and straw yield) as well as harvest index as compared to CT and FIRB. The magnitude to increased seed yield over CT and FIRB were 3 and 35%, respectively. The wheat genotypes i.e. HD 2967 recorded significantly higher biological, seed and straw yield.

The maximum cost of cultivation was recorded under CT followed by FIRB and 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.

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.

Table 11. Effect of tillage and genotypes on yield attributes.

Treatments	Plant ht (cm)	DMA (g m^{-2})	Tillers (m^{-2})	Spike length (cm)	Grains/ spike	Test weight (g)
Tillage						
ZT	88.9	107.2	369.2	9.13	63.1	35.7
CT	93.9	96.7	345.9	9.17	62.0	35.8
FIRB	89.3	82.8	312.2	9.33	65.2	34.8
SEm±	1.04	4.29	8.49	0.01	0.54	0.59
LSD (P=0.05)	4.1	16.8	33.4	0.02	2.1	NS
Genotypes						
KRL 213	87.0	104.8	347.8	9.36	69.2	30.7
HD 2733	84.6	83.2	325.4	9.04	55.8	38.3
PBW 550	86.4	86.9	330.2	9.36	60.0	39.6
HD 2967	95.1	110.8	381.7	9.73	70.3	33.8
KRL 210	97.1	96.4	329.2	8.60	59.9	36.6
DBW 39	94.1	91.2	340.2	9.15	65.4	33.5
SEm±	1.18	4.12	8.03	0.06	1.47	0.91
LSD (P=0.05)	3.4	11.9	23.2	0.17	4.3	2.6

Table 12. Effect of tillage and genotypes on yield and economics

Treatments	Biological yield (q ha^{-1})	Seed yield (q ha^{-1})	Straw Yield (q ha^{-1})	Harvest Index	Cost of cultivation (x10^3 `/ha)	Gross return (x10^3 `/ha)	Net return (x10^3 `/ha)	B:C ratio
Tillage								
ZT	103.9	48.4	55.5	46.8	30.8	120.4	89.6	2.90
CT	102.9	47.0	55.9	45.9	38.0	117.4	79.4	2.08
FIRB	73.1	31.5	41.6	43.4	32.8	79.6	46.9	1.42
SEm±	3.26	1.43	1.88	0.47	---	---	---	0.08
LSD (P=0.05)	12.8	5.6	7.4	1.8	---	---	---	0.33
Genotypes								
KRL 213	89.3	44.6	44.8	49.7	34.2	109.2	75.0	2.21
HD 2733	97.4	42.5	54.9	43.5	33.9	107.2	73.3	2.17
PBW 550	86.0	39.3	46.7	46.5	33.4	98.1	64.7	1.96
HD 2967	102.1	46.2	55.8	45.7	34.5	115.6	81.2	2.38
KRL 210	93.8	38.6	55.2	40.6	33.3	98.6	65.3	1.97
DBW 39	91.1	42.7	48.4	46.4	33.9	105.9	72.1	2.13
SEm±	3.02	1.43	2.62	1.62	---	---	---	0.08
LSD (P=0.05)	8.7	4.1	7.6	4.7	---	---	---	0.22

* Price of seed & straw were ` 2200 and 250/q, respectively.

Conclusion

The increasing cost of cultivation and emerging shortages of labour and water for agriculture necessitates a change in the way farmers presently grow wheat crop. The zero tillage system is seen as alternative to conventional system and in area of water shortage FIRB system are feasible for sustain quality seed production of wheat. However, this study showed that wheat did not perform well in FIRB system in respect of seed yield but gave better quality parameters. Therefore, more efforts will be needed to improve ZT and FIRB technology a location/site specific basis for wheat seed production. In addition, long term changes, inputs use efficiency should be monitored to achieve this shift in farmers' practices.

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

The different floral morphological traits were recorded and bio-chemical tests on floral biology conducted in different lines of mustard and the results of the present experiment are summarized in Table 13. The flowering in plants treated with 3, 5 and 8% detergent was delayed by 3, 4, and 6 days, respectively, compared to control plants where floral bud initiation occurred 35 days after sowing (Table 13). The size of flowers in plants treated with surf-excel was slightly reduced. The anthers in the flowers of treated plants were smaller and indehiscent in nature (Closed type). The reduction in anther size was directly proportional to the concentration of detergent. There was a reduction in the number of pollen grains per flower and maximum reduction was recorded in plants sprayed with 8% detergent (13,990 pollen grains/ flower). All the treatments with detergent were found to be quite effective in inducing pollen sterility (Table 13). The results of pollen fertility tested at regular intervals indicate that plants sprayed with 8% detergent exhibited complete pollen sterility even 25 days after treatment.

Table 13. Comparative floral morphology of treated and untreated plants

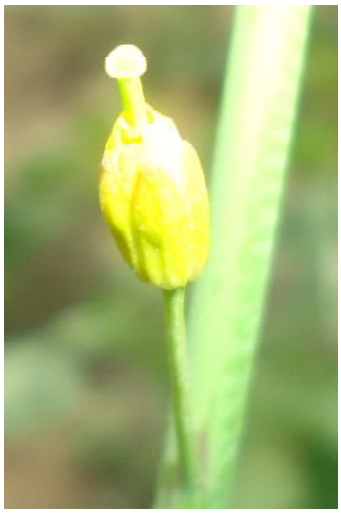
Character	Control plant	Detergent treated plants		
		3%	5%	8%
Floral bud initiation	35	38	49	41
Anther length	2.1	1.9	1.8	1.6
No. pollen grains / bagged flower	31453	28588	16648	13990
Pollen fertility				
1st day after flowering	90.3	0.00	0.00	0.00
10th	-	0.00	0.00	0.00
15th	-	4.6	0.00	0.00
20th	-	15.3	6.2	0.00
25th	-	18	8.4	0.00
Stylar length (mm)	2.07	2.23	2.62	3.10
Time stigma receptivity	8.00am-10.00am	7.30am-10.00am		
No. ovules/ flower	18.00	17.00	14.00	12.00
Pollen – ovule ratio	1747:1	1682:1	1189:1	1166:1
Seed set (%)	90.53	92.96	91.95	89.52
Total yield/ plant (g)	27.70	22.67	17.35	5.47

However, 3% detergent-treated plants after 15, 20 and 25 days exhibited a slight reduction in their pollen sterility (95.4, 84.7 and 82%, respectively). On the other hand, plants sprayed with 4% detergent exhibited 93.8 and 91.6% pollen sterility after 20 and 25 days, respectively. The detergent-treated bagged flowers failed to produce any seeds. However, the expression male sterility was not uniform in the all the plants.

It was interesting to note that stylar length in the buds of treated plants increased with the increase in concentration of detergent. In the buds of plants sprayed with 8% detergent, the elongation of style was maximum (3.1 mm). Due to the increase in the size of the style, the stigma protruded out of all the buds of an inflorescence (Figure 8c). The stigma of such floral buds was receptive between 8.00 am to 10.00 am whereas untreated stigma showed receptive between 7.30 to 10.00 am. Thus, the complete pollen sterility (in detergent treated plants), elongated style with raised receptive stigma in the buds of plants sprayed compared to control plants contributed to increase in the seed-set percentage in treated

a) Field view of floral bud initiation in detergent sprayed plants (3-6 day delay)

b) Scorching effect after detergent spray



c) Elongation of style/exertion of stigma in detergent treated plants

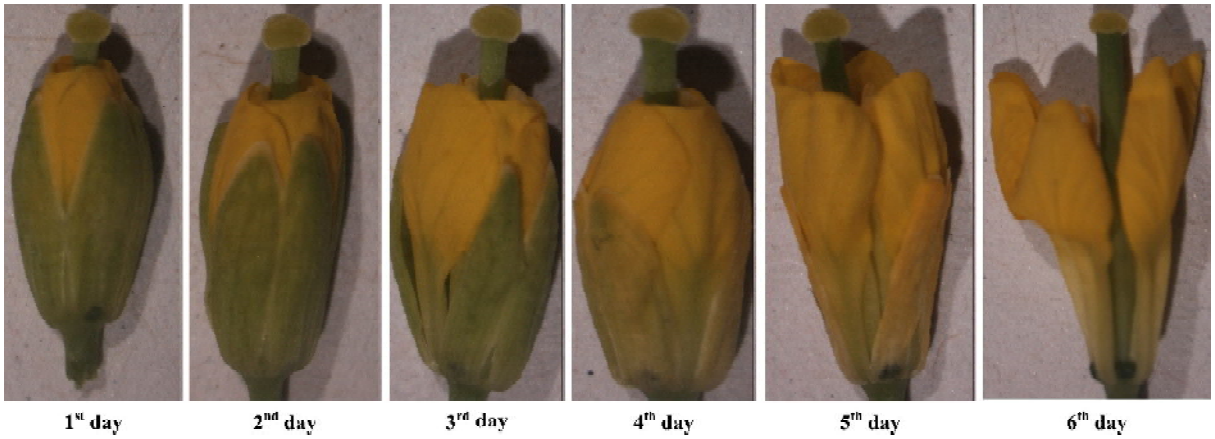


Figure 8. Floral opening and stigma exertion in protogynous (Pg) lines at different stages

plants which may be attributed to the fertilization of all the ovules due to cross-pollination brought about by honey bees. On the other hand, treatments with different concentrations of detergent caused a slight reduction in total yield/plant (22.67 g/plant) sprayed with 2% detergent. The reduction in total yield/ plant treated with 8% detergent is largely because of the reduction in the seed size, seed weight and delay in recovery of plant growth after scorching effect (Figure 2b).

In case of Protogynous lines (Pg) the stigma exertion is prominent (17 to 18.5 mm) than induced male sterile flowers (14.25 – 16.5 mm). Further, results indicated that the protogynous interval extended up to 8-10 days and stigma remained receptive up to 3-4 days from its protusion (Figure 8). However, partial male sterility (25-50%) and closed type flowers (indehiscent in nature) noticed in Pg lines.

3.1.3.4. Advance Varietals Trial

Summary report of yield data of Advance Varietals Trial (Late sown and Irrigated) conducted at DSR, Mau under All India Coordinated Wheat Improvement Programme, during *Rabi 2013-14* are presented in Table 14. The variety NE-LS-3 key no. 12 (42.46 q/ha) was recorded as the highest yielding genotype followed by the variety NE-LS-6 key no. 2 (40.03 q/ha) and variety NE-LS-3 key no. 3 (39.22 q/ha). All the above three varieties were found numerically superior than the check variety NE-LS-12 key no. 8.

Table 14: Summary report of yield data of Advance Varietals Trial

S. No.	Variety	Key No.	Days to heading	Days to maturity	Height (cm)	Leaf blight score (in double digit scale)	1000 grain weight (gm)	Yield in q/ha (based on total yield of 4 replications
1	NE-LS-1	4	67	99	95	35	30.0	32.51
2	NE-LS-2	13	67	100	100	45	29.0	30.24
3	NE-LS-3	3	67	101	97	34	34.0	39.22 IIIrd
4	NE-LS-4	5	73	100	101	56	29.0	27.67
5	NE-LS-5	1	66	99	105	45	26.0	28.32
6	NE-LS-6	2	67	105	106	35	33.0	40.03 IInd
7	NE-LS-7	6	70	102	87	35	29.0	34.83
8	NE-LS-8	9	72	103	96	34	29.0	24.89
9	NE-LS-9	12	67	100	99	35	36.0	42.46 Ist
10	NE-LS-10	7	70	105	106	45	29.0	31.40
11	NE-LS-11	10	73	102	90	34	27.0	33.32
12	NE-LS-12	8	68	100	83	35	40.0	38.96 (Control)
13	NE-LS-13	11	67	104	96	35	26.0	31.49

Production of breeder seed : Production of breeder seed during 2013-14 at DSR farm is presented in table 15.

Table 15 : Production of Breeder seed during 2013-14 at DSR, Mau

S.N.	Crop	Variety	Produced quantity (in quintals)
1.	Wheat	HD 2733	16.0
2.	Rice	IR 36	5.0
		IR 64	5.0
		BPT 5204	5.0
		MTU 7029	5.0

3.1.4 Seed protection

3.1.4.1. Resistance to commonly used insecticides in important storage insect pest and their management

Adhatoda vasica, Argemone maxicana, Calotropis procera, Citrus-limon,Datura stramonium, Hibiscus rosa sinensis, Mentha arvensis, Melia azadirach (leaf), *Melia azadirach* (pod), *Ocimum tenuiflorum, Parthenium hysterophorus, Phyllanthus emblica* extracted in acetone, ethanol, methanol, petroleum ether and chloroform against three storage insect pests *viz.*, *Tribolium castaneum, Sitophilus oryzae* and *Rhizopertha dominica* to test the repellency and insecticidal property.

1. Repellent activity of plant extracts

a. Against *Sitophilus oryzae.*

Repellent activity of different plant viz, *Adhatoda vasica, Argemone maxicana, Calotropis procera, Citrus-limon, Datura stramonium, Hibiscus rosa sinensis, Mentha arvensis, Melia azadirach* (leaf), *Melia azadirach* (pod), *Ocimum tenuiflorum, Parthenium hysterophorus, Phyllanthus emblica* extracted in various solvents were tested at 10% concentration against *S. oryzae.*

When extracted in acetone all test plants showed repellency at different intervals. *Adhatoda vasica* and *Mentha arvensis* proved to be best repellent by showing the percent repellency 43.33 and 22.22, respectively. However, *A. maxicana, C. procera* and *O. tenuiflorum* also showed the low to medium repellency. All the plants showed varied degree of repellency at different intervals when extracted in ethanol. *A. maxicana* , *Melia azaderach*, *Parthenium* and *P. emblica* showed the maximum (53.33%) repellency, Methanolic extract of *Adhatoda vasica* showed maximum repellency 45.55% which is close to its repellency percentage (43.33) in acetonic extract.

When plants were extracted in petroleum ether, *Calotropis procera* and *Adhatoda vasica* showed maximum repellency among the all tested plants , *Datura, Argemone, Citrus* and *Melia* (leaf) also produced more then 30% repellency to *Sitophilus oryzae* .In the comparison with methenolic, ethenolic and acetonic extract, plants extracted in petroleum ether showed lower repellency in range of 0.0 to 41.11% .How ever all the test plant showed little to moderate repellency % age except *Parthenium hysterophorus*.

b. Against *Rhizopertha dominica*

In case of acetonic extract *phyllanthus emblica* possessed highest average repellent activity (31.11%) among all the tested plants followed by *Melia* (pod) with 27.77 % repellency against *R.*

dominica. The repellency of plant extracts increased with the increase in period of exposure. The level of repellent activity of *M. arvensis* has increased form 26.66% at 4 hrs exposure to 46.66% at 24 hrs exposure period. When extracted with ethanol *Calotropis procera* showed maximum repellency (38.88%). *Citrus-limon* and *Melia azadirach* (leaf), came up with 22.22% and 21.11 % repellency against *R. dominica*.

Among methanolic extract only four test plants viz.,*Adhatoda vasica, Mentha arvensis, Ocimum tenuiflorum* and *Datura stramonium* showed repellency against *R.dominica* after 24 hours. After comparing the mean *Adhatoda vasica* and *Mentha arvensis*, proved to be best repellents by showing the total percent repellency 28.8 and 27.77 respectively. *Datura stramonium* and *phyllanthus emblica* showed maximum repellency among the all tested plant extracted in petroleum ether. *Hibiscus rosa sinensis* and *Argemone maxicana* produced moderate to little repellency to *Rhizopertha dominica*. In the comparison with methenolic ethenolic and acetonic extract, plant extracted in petroleum ether showd lower repellency in range of 0 to 33.33%.

c. Against *Tribolium castaneum*

All acetonic extract of the test plants showed repellency in range of 5.5 to 64.44 %. *Mentha arvensis* proved to be best treatment with 64.44 % repellency. While *O. tenuiflorum* , *Melia (*pod), *A.vasica and Mentha* showed the maximum (41.11%, 33.33, 31.11 and 26.66, respectively) repellency when test plants were extracted in ethanol. In case of methanol maximum repellency was exhibited by *Ocimum tenuiflorum* which showed 44.44% repellency. Among plants extracted in petrolium *Calotropis procera*, proved to be best repellent by showing the 44.44 percent (mean of various intervals) repellency. However, *A.maxicana, C.procera* and *O.tenuiflorum* also showed the moderate repellency. When extracted in chloroform all tested plant extracts possessed low to medium repellent activity against *T. castaneum*. Among all the plant tested *Ocimum tenuiflorum* possess highest average repellent activity with 54.44% followed by *Adhatoda vasica* with 48.88 % repellency.

2. Insecticidal activity of various plants extracted in 5 solvents

To observe the insecticidal actively possess by various plants, average of all the solvents used for extraction has been calculated. *M. arvensis* has been proved best treatment after 7, 21 and 28 days after treatment causing 42.74 , 53.55 and 61.77 % mortality respectively

On considering the mean value the effective tested plants in descending order is as follows.

M.arvensis > *A.maxicana* > *M.azadirach* (pod) > *P.hysterophorus* > *C.procera* > *A.vasica* > *P.emblica* > *M.azadirach*(leaf) > *O.tenuiflorum* > *H.R.Sinensis* > *C.limon* > *A.indica* > *D.stramonium*.

3. Solvent wise average insecticidal activity of various plants.

The find out the efficient solvent to extract plant for insecticidal activity, average of all the five solvents has been calculated.

Ethanol proved to be best solvent after 7, 15, 21 and 28 days after treatment by causing the mortality percentage of 45.18, 49.68, 51.11 and 52.40%, respectively. A gradual increase in mortality

percentage with time has been observed in all extract.

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

1. Survey was conducted in major seed storage godowns (NSC) situated in South India to study the insecticide use pattern, type of insecticides used and spraying interval and also collected the insect samples for further assessment of level of resistance under laboratory condition.
2. 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* (>90%) recorded more resistance.

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

- Fifty six bacterial isolates have been isolated using serial dilution technique from healthy rice and chickpea rhizosphere of DSR's field, Mau (U.P.) for evaluation of seed borne disease management and seed quality enhancement of rice and chickpea.
- Evaluated the antagonistic effect of 56 isolated bacterial cultures against *Macrophomina phaseolina* causing root rot of chickpea (Fig.9), *Fusarium oxysporum* f.sp. *ciceri* causing wilt of chickpea, *Sclerotinia sclerotiorum* causing stem rot of chickpea, *Pyricularia oryzae* causing blast of rice, *Rhizoctonia solani* causing sheath blight of rice and *Ustilaginoidea virens* causing false smut of rice using dual culture technique. Bacterial 14 isolates were found effective having antagonistic effect of fungal pathogens of rice and chickpea.
- Among these 14 antifungal bacterial isolates, 12 bacterial isolates did not shown any antifungal activities against *Trichoderma* sp. that means they are compatible with fungal biocontrol agent.
- Screened the phosphate solubilization traits of 56 isolated bacterial cultures and two isolates was found to have the phosphate solubilization activities (Fig.10). One isolates (RRB 3) have shown both phosphate solubilization activities and antifungal activities.
- Evaluated the IAA production traits of 56 isolated bacterial cultures for seed quality enhancement of rice and chickpea and found that all 15 isolates having medium IAA production potential.
- Qualitative cellulose degradation activity test was also conducted and found that 7 bacterial isolates having cellulose degradation activity, which may be used for recycling soil organic matter or decomposing the agricultural waste (Fig 11).
- After ascertaining beneficial traits of 15 isolated bacterial cultures (Table 16), multiprong techniques (combining the morphological, biochemical and molecular techniques) was done for identification of 15 bacterial isolates. Morphological characters like shape, color, margin and texture of the colony on culture plate, and shape of bacterial cell were recorded, and 13 biochemical tests were conducted. 16S rRNA gene was amplified, purified, sequenced. By analyzing the morphological,

biochemical and 16S rRNA gene sequence, 9 bacterial isolates were identified as *Bacillus methylotropicus* strain RRB-4, RRB-6, RRB-10, RRB-34; *Brevibacterium halotolerans* strain RRB-31, RRB-38, CRB-B; *Prolinoborus fasciculus* strain RRB-7 and *Bacillus aerophilus* strain RRB-3.

- Gram –negative, rod shaped *Prolinoborus fasciculus* strain RRB-7 is the novel strain having antifungal activities which is first time reported while *Bacillus aerophilus* strain RRB-3 having both P solubization activities and antagonistic effect.

Table 16: Beneficial traits of 15 potential bacterial isoates isolated from rice and chickpea rhizosphere of DSR' field, Mau (U.P.) and their molecular identification.

Isolated culture	16S rRNA identification (Closest relative)	16S rRNA Sequence similarity (%)	Antagonistic effect against fungal pathogens						P solubili-zation	IAA production	Cellulase activity	Compatibilty with *Trichderma* sp.
			MP	SS	RS	FoC	PO	UV				
RRB-3	***Bacillus aerophilus***	100	+++	++	+++	+	+++	++	+	+++	+	+
RRB-4	*B. methylotropicus*	100	+++	+++	+++	-	++	+++	-	++	-	+
RRB-6	*B. methylotropicus*	100	+++	++	+++	++	+++	++	-	++	-	+
RRB-7	***Prolinoborus fasciculus***	99.88	+++	++	++	++	+++	+	-	+++	+++	+
RRB-8	-		++	+	+++	++	++	++	-	+++	+++	+
RRB-10	***B. methylotropicus***	99.82	+++	++	+++	++	++	++	-	+++	+++	+
RRB-26	-		+	+	+++	-	++	++	-	+++	-	+
RRB-31	***Brevibacterium halotolerans***	99.68	+++	++	+++	++	+++	+++	-	++	-	+
RRB-33	-		+++	++	++	++	++	++	-	+++	-	-
RRB-34	*B. methylotropicus*	100	+++	++	+++	+	++	+	-	+	++	-
RRB-36	-		++	+	++	-	++	++	-	+++	-	+
RRB-38	*B. halotolerans*	99.52	+++	++	+++	-	++	++	-	+++	-	+
RRB-BS-4	-		++	++	++	-	++	++	-	+	+++	+
CRB-B	*B. haotolerans*	100	++	++	++	-	++	++	-	+++	++	+
CRB-H	-		-	-	-	-	-	-	+++	+++	-	+

Note:

MP: Macrophomina phaseolina, *SS:* Sclerotinia sclerotiorum, *RS:* Rhizoctonia solani, *FoC:* Fusarium oxysporum *f. sp*. ciceri, *PO:* Pyricularia oryzae, *UV:* Ustilaginoidea virens.

Antagonistic effect against fungal pathogens: +++ = Inhibition zone (in mm) + % growth inhibition >50, ++ = Inhibition zone (in mm) + % growth inhibition 50 to 30, and + = Inhibition zone (in mm) + % growth inhibition < 30.

P solubilization: +++ = 10 mm halo zone, + = 3 mm halo zone around bacterial colony.

IAA production: +++ = >5 µg/ml, ++ = 3-5 µg/ml, + = < 3 µg/ml.

Cellulase activity: +++ = >8 mm pink zone, ++ = < 8 mm pink zone, + = 0 mm pink zone around bacterial colony.

Compatibility test with Trichderma *sp.: + = compatible, - = icompatible.*

$$I = \frac{C - T}{C} \times 100$$

I = Percent growth inhibition

C = Colony diameter of pathogen in control

T = Colony diameter/radial growth of pathogen in treatment

IZ = Inhibition zone

BC = Bacterial colony

A loop full bacterial culture was inoculated on centre of Petri plate containing Pikovskaya's agar media and incubated at 28°C for 6 days and halo zone around the bacterial colony was recorded as P solubilization activity.

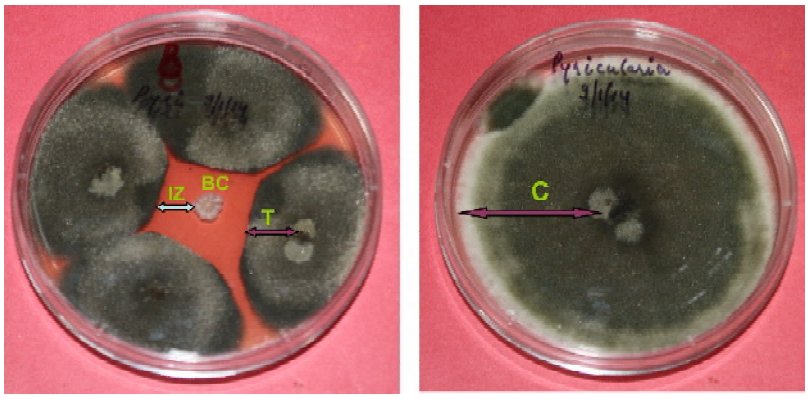


Fig. 9: Calculation of percent growth inhibition of *Brevibacterium halotolerans* strain CRB-B against *Pyricularia oryzae* causing rice blast disease

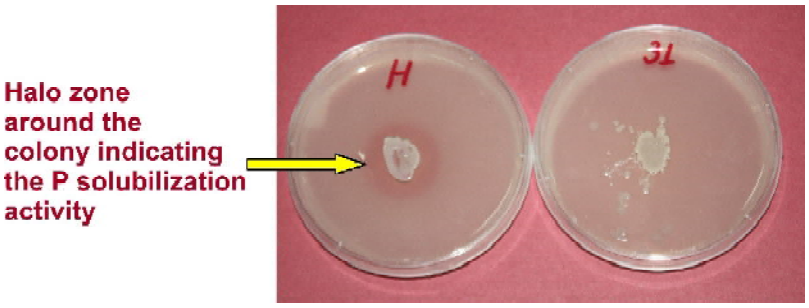


Fig. 10: Phosphate solubilization test

Cellulose degradation activity test

This is performed to determine the ability of bacteria to degrade cellulose by the cellulase enzyme. Test is confirmed by appearance of light pink zone around the bacterial growth.

3.1.5 Seed economics & policy research

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

Questionnaire has been prepared for collection of data and information under the project 'Impact Assessment of Quality Seed Production'. The list of certified seed growers of wheat in Ghazipur district have been obtained from Uttar Pradesh State Seed Certification Agency, Regional Office, Mau for the year 2012-13. From the list four certified seed producing villages of wheat has

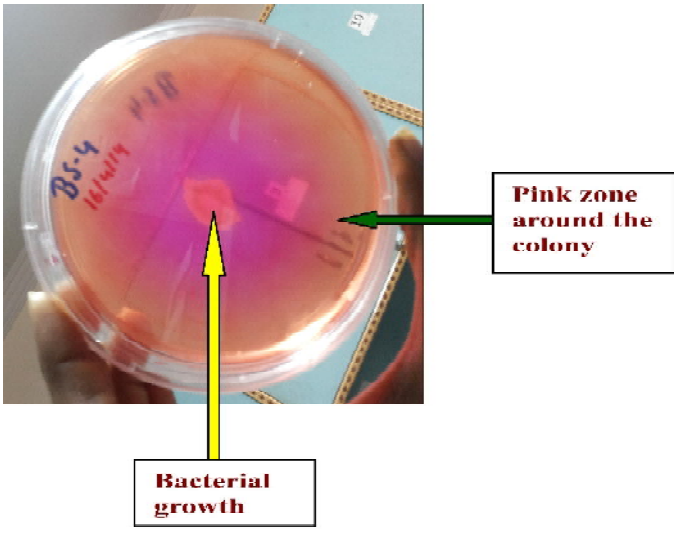


Fig. 11: Plate showing the cellulose degradation activity

been selected randomly and from each selected village ten certified seed producers of wheat have been selected randomly. For comparison study with grain production of wheat, against ten grain producers of wheat selected randomly from the selected villages. Primary data were collected by personnel interview with the respondents using a well-structured and pre-tested interview schedule. Data on various inputs used in the grain and seed production of wheat and their costs and returns were collected for the agricultural year 2012-13.

Economics of wheat seed production

The cost and return of certified seed production of wheat have been provided in Table 17. Human labour was the major component of cost inputs applied for seed production of wheat. Its share in total costs was about 30 per cent. It was followed by machine labour accounting for about 27 per cent of the total cost of wheat seed production. Cost of manures and fertilizers used for crop accounted for about 14 per cent. The share of irrigation in total cost was around 11 per cent. The share of seed cost to total input was about 9 per cent. The share of plant protection chemicals and seed certification charges were less than five per cent of total cost of cultivation. Hence, the total cost of all inputs used in certified seed production of wheat was ` 31900 per hectare. The average yield of wheat seed and undersize seed was 36 quintal and 4 quintal respectively. The gross return and net return was ` 65000 and ` 33100 per hectare, respectively.

Table 17. Cost and return in certified seed production of wheat (`/ha)

Sl.	Particulars	Amount (`)	Per cent
1	Human labour	9500	29.78
2	Machine labour	8500	26.65
3	Seed	3000	9.40
4	Manures & Fertilizers	4500	14.11
5	Irrigation	3500	10.97
6	Plant protection chemicals	1400	4.39
7	Seed certification charges	1000	3.13
8	Others	500	1.57
9	Total cost	31900	100.00
10	Total yield		
a	Wheat seed (q)	36.0	
b	Undersize seed (q)	4.0	
11	Gross return (`)	65000	
12	Net return (`)	33100	
13	BC ratio	2.03	

Comparison in wheat grain and seed production

The gross return was about 34 per cent higher in seed production of wheat (` 65000 /ha) than grain production (` 48600/ha). Consequently, net return from seed production of wheat was 37 per cent (` 33100/ha) than grain production (` 24100/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 that the grain in the marketing of produce. Graphical presentation of cost and return in wheat grain and seed production has been made in Fig. 12.

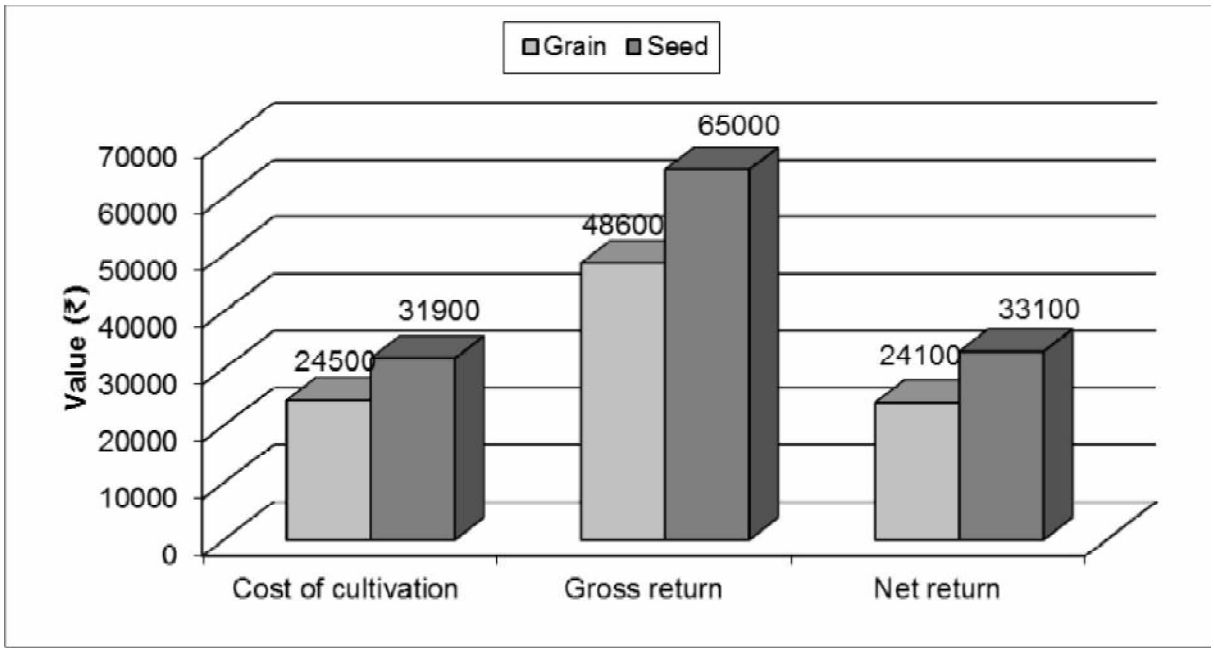


Fig.12. Cost and return in wheat grain and seed production

Reasons for adoption of seed production

Farmers were asked to rank the reasons for adoption of wheat seed production and the same were analysed using Garrett's ranking technique. The results are presented in Table 18. It was revealed that higher yield and profitability were the top most reason for adopting wheat seed production, followed by increased return to labour. Availability of high quality seed and easy marketability of produce were ranked third and fourth important reasons, respectively, for adoption of wheat seed production.

Table 18. Reasons for adoption of seed production

Particulars	Garrett score	Rank
Higher yield and profitability	73.0	I
Increased return to labour	56.0	II
Availability of high quality seed	38.3	III
Easy marketability of produce	32.7	IV

Reasons for non-adoption of seed production

Reasons for non-adoption of seed production are presented in Table 19. It was revealed that high cost of cultivation was the top most reason for non-adopting wheat seed production followed by lack of awareness. Lack of experience, maintenance of isolation distance, non-availability of seed in time and lack of skilled labour were ranked third, fourth, fifth and sixth important reasons, respectively, for non-adoption of wheat seed production.

Table 19. Reasons for non-adoption of seed production

Particulars	Garrett score	Rank
High cost of cultivation	71.8	I
Lack of awareness	52.0	II
Lack of experience	51.5	III
Maintenance of isolation distance	36.0	IV
Non-availability of seed in time	34.0	V
Lack of skilled labour	24.0	VI

3.1.6 Seed Village Scheme

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

- 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), Ministry of Agriculture, Government of India, New Delhi from *Kharif* 2013 and Rabi 2013-14.

No. of districts covered	:	Mau, Ballia, Ghazipur, Varanasi and Chandauli
No. of villages covered	:	750 Villages
Area covered	:	14691 acres
Seeds distributed	:	4141.71 quintals
No. of farmers benefited	:	14691 farmers
Crops	:	**Pigeon pea** (Narendra Arhar-1 & 2)

Paddy (MTU 7029, MTU 1010, Sarju-52, PR-113, PR-118, CSR-36, IR-36, Kalanamak, BPT-5204, IPB-1, Pusa Sugandh-3, Pusa Sugandh-5 and Malviya Sugandha-105)

Mustard (Pusa Tarak, Ashirwad, Rohini, NDR 8501 & Varuna)

Lentil (DPL 62, IPL 406, IPL 81, HUL 57)

Chick pea (Pusa 362, Avarodhi, KPG 59 & DCP-92-3)

Wheat (HD 2733, DBW 39, PBW 621, HD 2967, KRL 213, PBW 343, PBW 502, PBW 550, WH 711, PBW 373, PBW 154, HD 2643, HD 2687, WR 544, NW 2036, UP 2338, Raj 3765, Raj 3777 and Unnat Halna)

Seed distribution under Seed Village Scheme by Hon'ble Joint Secretary Seed Dr. Atanu Purkayastha, DoAC, Govt. of India

Seed distribution under Seed Village Scheme by Hon'ble Joint Secretary Seed Dr. Atanu Purkayastha, DoAC, Govt. of India

3.1.7 Tribal Sub Plan

3.1.7.1 DSR Main Scheme Achievements under Tribal Sub Plan

- A total amount of Rs. 49.79 lakhs has been released to 8 SAUs, 01 central University and 2 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 2012-13.
- A total amount of Rs. 49.00 lakhs has been released to 8 SAUs, 01 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 2013-14.
- More than 1500 tribal farmers have been benefited through distribution of quality seed of paddy, wheat, groundnut, urd, moong, maize, chickpea, fieldpea, jute, rapeseed, linseed etc. of 16 districts of 7 states.
- A total number of 17 training programmes have been conducted for tribal farmers of seven 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 200 seed storage structure, 5 sprinkler irrigation system and 7 pump set have been distributed to tribal famers.

Photographs related to Tribal Sub Plan (DSR Main Scheme)

Demonstrating seed treatment with Rhizobium and PSM at Junagarh, Gujarat

Demonstration of storing Groundnut Seed with CaCl2 pellets at Junagarh, Gujarat

Training to tribal farmers at Durg, Chhattisgarh

Distribution of seed storage structure at Gariyabandh, Chhattisgarh

Distribution of quality seed storage at CAU, Imphal, Manipur

Awareness cum Training on quality seed production by CAU, Imphal, Manipur

3.1.7.2 Achievements of AICRP-NSP (Crops) under Tribal Sub Plan

With the objective of improving the livelihood of tribal farmers and, as per the direction received from 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 2013-14.

(Rs. in lakhs)

Sl. No.	Centre	AICRP –NSP (Crops) Tribal Sub Plan 2013-14	
		(I installment)	(II installment)
1	SKUA& T, Srinagar	2.00	3.00
2	HPKVV, Palampur	2.00	2.00
3	MPUA&T, Udaipur	6.00	0.00
4	AAU, Anand	5.00	2.00
5	MPKV, Rahuri	6.00	3.00
6	PDKV, Akola	6.00	2.00
7	UAS, Bangalore	5.00	1.00
8	TNAU, Coimbatore	2.00	2.00
9	CRIJAF, Barrackpore	3.00	0.00
10	CAZRI, Jodhpur	4.00	0.00
11	CRRI, Cuttack	3.00	0.00
12	DRR, Hyderabad	2.00	0.00
13	DSR, Hyderabad	2.00	0.00
14	CICR, Nagpur	2.00	0.00
	Total	**50.00**	**15.00**

Various activities of the implementation of TSP programme 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.

PDKV, Akola

During the financial year 2013-14, the funds of Rs. 4 lakh were allotted 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 programme for tribal farmers with the aim of increasing seed production in agricultural crops as per the below mentioned sub-head:

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

In this regards, 13 "One day farmers training" on "Seed production, processing and safe storage"

were organized at following tribal areas:

Sl. No.	Village	Date	No. of participants
1.	Pimparkhed (Vari) Ta. Telhara Dist Akola	16/10/2013	103
2.	Shahapur Ta. Akot Dist. Akola	26/10/2013	101
3.	Jitapur Ta. Akot Dist. Akola	27/10/2013	106
4.	Chipi (Gayran) Ta. Telhara Dist. Akola	30/10/2013	110
5.	Bhilli Ta. Telhara Dist. Akola	31/10/2013	113
6.	Khatkadi Ta. Chikhaldara Dist. Amravati	13/11/2013	107
7.	Aahad Ta. Chikhaldara Dist. Amravati	14/11/2013	95
8.	Menghat Ta Chikhaldara Dist. Amravati	15/11/2013	111
9.	Zingapur Ta. Chikhaldara Dist. Amravati	16/11/2013	117
10.	Rudali Ta. Chikhaldara Dist. Amravati	17/11/2013	98
11.	Popatkhed Ta. Akot Dist. Akola	22/02/2014	145
12.	Malkapur (Gound) Ta. Akot Dist. Akola	23/02/2014	118
13.	Shahanur Ta. Akot Dist. Akola	27/02/2014	120

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 were demonstrated successfully on farmer's field.

During each training, five tribal farmers were selected from each village and the useful firm input like Knapsack sprayers were distributed to the selected tribal farmers. Total 65 Knapsack sprayers were distributed to 65 tribal farmers.

The tribal areas will be monitored by Seed Technology Research Unit during Kharif 2014 for the feedback of above programme. More such programme for tribal community will be helpful for adopting the new technologies in future also.

Input distribution among tribal farmers

CAZRI, Jodhpur

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

Operational area: Village- Patia Dungra, Gram Panchyat - Madalda, Teh- Garhi, Distt: Banswara is situated in the southern - most part of Rajasthan and village is having more than 90% ST residents. It has an area of 5037 km^2 and lies between 23.11° N to 23.56° N latitudes and 73.58° E to 74.49° E. longitudes. Normal annual rainfall is about 825.9 mm. Maize, Wheat, Cotton, Gram are main crops. Forest land consists of 20% of the total area.

Number of beneficiaries: 110 (approx.)

Major crops grown in the village:

Rabi : Wheat is the major crop grown during winters. Gram, barley, winter maize and fodder crops are also grown in some pockets

Zaid : Mung bean

Kharif : Rice, soybean and maize are the major crops

Requirements of the farmers related to crop cultivation: Improved varieties seeds, fertilizers, farm implements, sprayers, storage bins, knowledge of improved cultivation practices, etc.

Activities carried out:

1. Providing agricultural inputs
2. Providing farm implements, storage bins, etc.
3. Seed production techniques

Inputs provided:

1. Seeds of improved varieties of crops: For rabi-wheat, gram and barley
2. Fertilisers- DAP, UREA, etc.
3. Farm implements
4. Sprayers, storage bins etc.

Workers associated:

1. Dr M.P. Rajora, PS, Plant Breeding
2. Dr Sunil S. Mahajan, Sr. Scientist, Seed Technology
3. Dr M. Patidar, PS, Agronomy
4. Dr R.K. Bhatt, PS & Head, Div-III, CAZRI, Jodhpur

Centre: CAZRI, Jodhpur

Village: Patia Dungra, Teh: Garhi, Distt: Banswara

Total no. of farmers selected: 138

Progress report: The programme entitled "Livelihood improvement of Scheduled Tribe Farmers through improved agricultural interventions" was implemented in Village: Patia Dungra, Teh: Garhi, Distt: Banswara under "AICRP NSP (Crops)-TSP". 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 villagers and state agriculture department officials, improved seeds of *rabi* crops, fertilisers and implements were provided. Total 4600 kg seeds (50 kg of Barley var. RD 2052, 4400 kg of wheat var. Raj. 4037 and 150 kg of Gram var. PratapChana 1), 2750 kg Urea and 2750 kg DAP, 13 Sprayers and 9 ploughs were given to 138 farmers of the village. Lectures on improved crop cultivation practices were also delivered by the project workers to harness the benefit of inputs.

Table 20: Inputs provided

Sl. No.	Input	Quantity
1.	Barley seed var. RD 2052	50 kg
2.	Wheat seed var. Raj 4037	4400 kg
3.	Gram var. Pratap Chana 1	150 kg
4.	Sprayers	13 nos.
5.	Plough	9 nos.
6.	Urea	2750 kg
7.	DAP	2750 kg

Input distribution at Village: Patia Dungra, Teh: Garhi, Distt: Banswara Programme conducted by CAZRI, Jodhpur

Directorate of Sorghum Research, Hyderabad

Directorate of Sorghum Research received TSP grants (Total 4.0 lakhs) from DSR, Mau, in 2012-13. The first grant (2.0 lakhs) was received in April 2013 and second grant was Rs 2.0 lakhs in the financial year 2013-14.

During 2013-14 three clusters of tribal groups were identified where interventions in term of providing quality seeds and establishing the tribal community seed supply in Karnataka, Maharashtra and Andhra Pradesh were targeted.

Keeping in view the plan the varietal seed multiplication plan was drawn and seed is being multiplied in rabi 2013-14.

The programme *per se* encompassing seed distribution, training and other interventions will start from kharif 2014 and entire money is being used for seed production, distribution and other related interventions.

JNKVV, Jabalpur

Name of the Project : NSP-TSP

Allotment during 2013-14 : 831301

Activity Undertaken:

1. Farmers participatory quality seed productionof high yielding varieties of wheat and pea were undertaken. The quality seed of wheat and pea varieties were provided to the farmers at the project cost by JNKVV,Jabalpur. The training on quality seed production of wheat, and pea crops were also provided to the selected farmers. The programme was organized under the supervision of Krishi Vigyan Kendra, Dindori. The detailed report is as under-

Activity-1(A): Farmers participatory quality seed production in tribal district Dindori, M.P.

Name of the Block	:	Amarpur, Samnapur and DindoriDist: Dindori (M.P.)
Crops	:	Wheat, Name of the varieties: JW 3211, JW 3173, GW-273, HD 2932, HD 2864 and JW-3269 Pea: IPF 9925
No. of farmers participated	:	44+9 = 53
Season	:	Rabi, 2013-14

Seed production plots

Wheat Variety JW 3211

Wheat Variety JW 3211

Wheat Variety HD 2864

Wheat Variety HD 2932

Wheat Variety JW 3173

Pea Variety IPF 9925

Activity-II: Training programme on seed production technology

Farmers Training programme organized (Rabi 2013-14)

Sl. No.	Title of Training	No. of Farmers		Total
		Male	Female	
1.	Production Technology of Wheat	22	02	24
2.	Training on seed treatment	20	02	22
3.	Management of Termite in Wheat	24	00	24
4.	Production Technology of Pea	22	03	25
5.	Management of wilt in Pea	24	03	27

Training proposed in the month of March 2014

Sl. No.	Name of Training	No. of Farmers to be Participated	Date of training	Village	Block
1	Seed Production technology of Rabi crops	50	03.03.14	Jhanki	Bajag
2	Seed Production technology of Rabi crops	50	04.03.14	Suniyamar	Bajag
3	Seed Production technology of Rabi crops	50	05.03.14	Mohda	Samnapur
4	Seed Production technology of Rabi crops	50	06.03.14	Kohka	Dindori

Training Programme on Seed Treatments

Sowing of Wheat crop by Nari System

Publication: Extension folders (5)

1. Seed Production Technology of wheat
2. Seed Production Technology of gram
3. Seed Production Technology of Mung
4. Seed Production Technology of Rice
5. Seed Production Technology of Pea

UAS, Bangalore

Sl. No.	Name of the Scheme	:	Tribal Sub Plan
1.	Name of the Scientist involved	:	All NSP Staff
2.	Funds allotted during 2013-14	:	Rs. 5.00 lakh during 2013-14 (in August, 2013) Rs. 1.00 lakh during 2013-14 (in December, 2013)
3.	Funds utilized	:	Rs. 6.00 lakh
4.	Place of implementation of programme	:	BR Hills, MM Hills & Chamarajanagar of Chamarajanagar District and H.D. Kote, Mysore district.
5.	Types of ST population / No. of ST families covered under the programme	:	1475 Tribal farmers
6.	Agricultural scenario like crops, cropping systems and allied agricultural activities practiced in the selected area.	:	Local varieties of Ragi, Maize, Red gram, Field Bean, Bhendi, Beans, Chilly, Bengal gram, and Black gram cultivated in small holding.
7.	Benchmark information on socio economic background of the selected tribes	:	Based on the preliminary survey to identify the tribals and their needs
8.	Activities / programmes / technical interventions planned/implemented (with details on name of the programme, no. of beneficiaries / participants etc.	:	Conducted group meetings to identify the requirements and distributed the seeds of improved cultivars of Ragi, Maize, Red gram, Field Bean, Bhendi, Beans, Chilly, Bengalgram, and Blackgram. While distributing the seeds training on cultivation practices were also conducted in all the Thandas (Tribal village).The total number of beneficiaries were 1475tribalsfrom MM hills (868) and BR hills(307) of Chamarajanagar District and H.D. Kote (300) of Mysore District
9.	Relevance of the programmes to achieve the mandate of the scheme / university activities	:	The programs were undertaken as per the guidelines and directions of Directorate of Seed Research, Mau.
10.	Particulars on Publications / literature / press clippings & other documentation	:	Leaf lets' in local language pertaining to crop production on of Ragi, Maize, Red gram, Field Bean, Bhendi, Beans, Chilly, Bengal gram, and Black gram were distributed among the tribal farmers. (Relevant photos indicating activities are appended)

Sl. No.	Name of the Scheme	:	Tribal Sub Plan
11.	Impact of the programmes on the adoption of technology and socio economic empowerment of the tribals	:	The tribals of these areas have been revisited and the feedback indicated that the tribals were very happy about the new improved varieties of ragi, red gram, field bean & vegetable seeds and they also requested to conduct more such programmes in future. They could able to grow more and utilize the same for further sowings, consumption and to sell left over produce in local market.
12.	Constraints in implementing the programme	:	It was very difficult to reach the tribals inside the forest areas because of Government restrictions, wild animals and vulnerable roads.
13.	Suggestions for effective implementation of the TSP Programme	:	The programme shall be organized in collaboration with nearby KVKs and NGO's for effective implementation.
14.	Other remarks (if any)		

A survey was conducted during September, 2014 and identified tribals in the area of H.D. Kote of Mysore district where rabi crops are in practice. The tribals of these areas were supplied with seeds of Bengal gram, Black gram and Field bean and trained on seed production techniques.

Training and distribution of seeds to the Tribal farmers at MM Hills, HD Kote, Mysore

Training and distribution of seeds to the Tribal farmers at Kollegala, Chamarajnagra

3.2. All India Coordinated Research Project - NSP (Crops)

3.2.1 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 from a meager 3914 quintals in 1981-82 to 95011.59 q quintals in 2012-13 (*Rabi*/ Summer 2012-13 and *Kharif*, 2013) (Figure 14). The breeder seed availability has improved the quality of seeds in subsequent generations in the seed multiplication chain which results in increasing seed replacement of different crops.

*1995-96 onwards, data includes breeder seed produced against state indent also

- Progress of breeder seed production during 2012-13 was touching a production level of 95011.59 q. However slight shortfall in few crops was observed due to climate vagaries in refered year.

Table 21: Centre-wise (total) breeder seed production for the year 2012-13 (*Rabi*/Summer 2012-13 and *Kharif* 2013)

(Figures in quintals)

Sl. No	Centre	GOI		State		Total	
		Indent	Production	Indent	Production	Indent	Production
	State Agricultural Universities						
1	SKUA &T, Srinagar	61.45	105.80	6.30	7.00	67.75	112.80
2	CSHHPKV, Palampur	58.24	58.24	177.05	673.88	235.29	732.12
3	PAU, Ludhiana	3334.96	3569.40	238.29	327.11	3573.25	3896.51
4	CCSHAU, Hisar	1062.43	854.42	1264.00	1308.40	2326.43	2162.82
5	GBPUAT, Pantnagar	1886.05	1667.60	3776.10	3814.46	5662.15	5482.06
6	NDUA&T, Faizabad	556.10	573.30	1279.70	1687.42	1835.80	2260.72
7	CSAUA&T, Kanpur	1716.35	1619.00	1812.49	2311.19	3528.84	3930.19
8	BHU, Varanasi	171.45	265.80	87.50	238.00	258.95	503.80
9	AAU, Jorhat	129.50	145.30	17.00	309.59	146.50	454.89
10	BAU, Ranchi	146.76	34.89	68.00	68.84	214.76	103.73
11	RAU, Dholi	87.90	68.00	850.70	878.28	938.60	946.28
12	OUA&T, Bhubaneswar	1284.80	791.15	770.10	515.50	2054.90	1306.65
13	MAF,AU, Kota	2331.30	3304.06	0.00	0.00	2331.30	3304.06
14	RAU, Bikaner	3883.45	3497.03	0.00	0.00	3883.45	3497.03
15	SDAU, S.K.Nagar	1220.34	1001.79	794.20	1198.43	2014.54	2200.22
16	IGKV, Raipur	1420.94	1429.33	214.00	398.20	1634.94	1827.53

Sl. No	Centre	GOI		State		Total	
		Indent	Production	Indent	Production	Indent	Production
17	JNKVV, Jabalpur	24070.70	7174.22	4813.90	7667.04	28884.60	14841.26
18	MPKV, Rahuri	1956.99	2044.88	401.12	459.57	2358.11	2504.45
19	PDKV, Akola	1484.46	1560.94	234.85	251.09	1719.31	1812.03
20	MAU, Parbhani	1294.70	2082.02	217.44	1691.66	1512.14	3773.68
21	UAS, Bangalore	652.20	919.40	143.20	381.80	795.40	1301.20
22	UAS, Dharwad	10460.55	12697.00	3248.00	4793.72	13708.55	17490.72
23	ANGRAU, Hyderabad	7665.92	8002.80	4544.59	5254.25	12210.51	13257.05
24	TNAU, Coimbatore	191.97	100.80	705.11	450.70	897.08	551.50
25	KAU, Pattambi	37.50	49.46	9.99	46.62	47.49	96.08
26	PAJANCOA&RI, Karaikal	0.00	0.00	7.85	23.98	7.85	23.98
27	KKV, Dapoli	24.45	85.46	18.78	96.20	43.23	181.66
	Total SAUs	**67191.46**	**53702.09**	**25700.26**	**34852.93**	**92891.72**	**88555.02**
	ICAR, Institute						
28	VPKAS, Almora	213.35	215.40	0.00	0.00	213.35	215.40
29	IIPR, Kanpur	314.15	416.26	0.00	0.00	314.15	416.26
30	IGFRI, Jhansi	141.65	157.35	0.00	0.00	141.65	157.35
31	CRIJAF, Barrackpore	17.40	18.54	0.00	0.00	17.40	18.54
32	CAZRI, Jodhpur	4.00	6.47	0.00	0.00	4.00	6.47
33	CRRI, Cuttack	496.80	433.60	0.00	0.00	496.80	433.60
34	DRR, Hyderabad	100.50	190.00	0.00	0.00	100.50	190.00
35	DSR, Hyderabad	18.13	56.98	0.00	0.00	18.13	56.98
36	CICR, Nagpur	0.94	0.94	0.00	0.00	0.94	0.94
37	IARI, Karnal	1267.79	1225.05	0.00	0.00	1267.79	1225.05
38	IARI, New Delhi	3332.15	3735.98	0.00	0.00	3332.15	3735.98
	Total ICAR Institute	**5906.86**	**6456.57**	**0.00**	**0.00**	**5906.86**	**6456.57**
	Total (SAU + ICAR)	**73098.32**	**60158.66**	**25700.26**	**34852.93**	**98798.58**	**95011.59**

Table 22: Crop- Wise (total) breeder seed production for the year 2012-13 (*Rabi*/Summer 2012-13 and *Kharif* 2013)

(Figures in quintals)

Crop	GOI		State		Total	
	Indent	Production	Indent	Production	Indent	Production
CEREAL CROPS						
Rice	5290.00	6459.80	8880.53	11883.59	14170.53	18343.39
Wheat	20066.05	20809.03	9255.90	11851.29	29321.95	32660.32
Maize	32.55	41.75	96.19	173.83	128.74	215.58
Pearlmillet	1.32	7.31	2.87	7.57	4.19	14.88
Sorghum	62.61	327.99	24.22	262.02	86.83	590.01
Barley	923.60	605.46	77.00	143.91	1000.60	749.37
Finger Millet	32.41	68.56	27.87	53.19	60.28	121.75
Foxtel Millet /Navane	0.00	0.00	4.50	8.55	4.50	8.55
Barnyard millet	0.00	0.00	0.04	0.24	0.04	0.24
Kodo	4.20	5.00	10.25	12.02	14.45	17.02
Littile Millet	20.00	3.69	2.28	6.42	22.28	10.11
Total Cereal Crops	**26432.74**	**28328.59**	**18381.65**	**24402.63**	**44814.39**	**52731.22**

Crop	GOI		State		Total	
	Indent	Production	Indent	Production	Indent	Production
PULSE CROPS						
Chickpea	6469.00	6261.01	806.55	1294.89	7275.55	7555.90
Pigeonpea	289.23	589.23	306.48	439.02	595.71	1028.25
Field Pea	611.50	472.59	178.80	210.25	790.30	682.84
Mung	665.66	643.15	190.99	204.85	856.65	848.00
Urd	413.34	342.37	311.69	344.31	725.03	686.68
Lentil	382.80	319.06	210.60	251.84	593.40	570.90
Rajmash	13.20	20.40	0.32	10.75	13.52	31.15
Horse Gram	0.00	0.00	3.63	8.21	3.63	8.21
Beans	0.00	0.00	2.30	11.40	2.30	11.40
Cowpea	22.00	11.80	17.06	50.48	39.06	62.28
Lathyrus	0.00	0.00	15.00	36.40	15.00	36.40
Moth Bean	119.00	70.07	0.00	0.00	119.00	70.07
Guar/ Cluster bean	166.36	53.06	3.50	15.82	169.86	68.88
Kolthi	0.00	0.00	1.00	1.40	1.00	1.40
Total Pulse Crops	**9152.09**	**8782.74**	**2047.92**	**2879.62**	**11200.01**	**11662.36**
OILSEED CROPS						
Soybean	25947.20	10775.30	1759.40	2824.76	27706.60	13600.06
Sunflower	2.56	15.70	0.30	0.00	2.86	15.70
Groundnut	10594.45	10846.01	3041.60	3898.58	13636.05	14744.59
Linseed	73.88	97.36	27.65	54.91	101.53	152.27
Safflower	17.65	157.92	69.50	159.56	87.15	317.48
Sesamum	9.43	9.49	40.20	40.73	49.63	50.22
Niger	20.25	14.70	20.00	21.92	40.25	36.62
Castor	5.78	10.21	47.91	62.53	53.69	72.74
Rapseed Mustard						
Mustard	77.24	84.58	45.09	48.04	122.33	132.62
Toria	9.36	10.73	59.50	84.48	68.86	95.21
Ghobi Sarson	0.22	1.80	0.30	2.10	0.52	3.90
Yellow Sarson	0.00	0.00	0.25	0.31	0.25	0.31
Brown Sarson	1.00	4.00	0.00	0.72	1.00	4.72
Raya	0.18	6.30	0.10	0.94	0.28	7.24
Rai	8.09	9.59	12.60	14.88	20.69	24.47
Karan Rai	0.00	0.00	0.00	0.30	0.00	0.30
Til	0.00	0.00	0.75	0.75	0.75	0.75
Taramira	1.20	1.84	0.10	0.15	1.30	1.99
Total Oilseed Crops	**36768.49**	**22045.53**	**5125.25**	**7215.66**	**41893.74**	**29261.19**
FIBRE CROPS						
Cotton	14.22	29.57	7.90	23.85	22.12	53.42
Jute	17.40	18.54	2.00	2.00	19.40	20.54
Mesta	0.00	0.00	20.00	20.00	20.00	20.00
Total Fibre Crops	**31.62**	**48.11**	**29.90**	**45.85**	**61.52**	**93.96**

Crop	GOI		State		Total	
	Indent	Production	Indent	Production	Indent	Production
FORAGE CROPS						
Oats	274.10	354.85	72.00	184.75	346.10	539.60
Maize	69.18	110.68	0.00	70.92	69.18	181.60
Sorghum	31.10	24.17	5.20	5.58	36.30	29.75
Pearl Millet	4.05	5.75	0.00	0.00	4.05	5.75
Lucerne	1.50	1.04	0.00	0.00	1.50	1.04
Cowpea	26.90	2.50	0.80	1.20	27.70	3.70
Grain Cowpea	20.00	17.00	10.00	10.77	30.00	27.77
Berseem	79.95	65.50	6.20	11.75	86.15	77.25
Rice bean	0.00	0.00	0.30	0.35	0.30	0.35
Guar	206.60	372.20	0.00	0.00	206.60	372.20
Metha	0.00	0.00	0.50	0.80	0.50	0.80
Guinea Grass	0.00	0.00	0.04	0.15	0.04	0.15
Daincha	0.00	0.00	20.00	22.00	20.00	22.00
Rey Grass	0.00	0.00	0.50	0.90	0.50	0.90
Total Forage Crops	**713.38**	**953.69**	**115.54**	**309.17**	**828.92**	**1262.86**
Grand Total	**73098.32**	**60158.66**	**25700.26**	**34852.93**	**98798.58**	**95011.59**

3.2.2 Seed Technological Research

3.2.2.1. Seed Production and Certification

a. Integrated approach for maximization of seed yield

Rice

In case of JRH 5 hybrid rice seed production, the alternate method of planting pollen parent with application of recommended dose of NPK along with micronutrients Boron + Sulphur + Zinc was the best treatment combination in increasing the seed yield with highest C:B ratio of 1:1.60.

The hybrid seed yield of CORH 4 was significantly highest (10.32 q/ha) in case of mixed planting of male parent (CB 174R) and applications of micronutrient Boron @ 0.02% spray at panicle initiation stage.

In case of KRH-4 hybrid seed production, application of 125:75:75 kg NPK/ha and foliar application of Boron @0.5% at the time of panicle exertion has significantly increased (8%) the seed yield at TNAU, Coimbatore.

At KAU, Pattambi, irrespective of hybrids (DRRH 2 and DRRH 3) alternate/ mixed planting of staggered pollen parent maximized seed set in hybrids.

Wheat

At Kanpur, plain sowing along with application of 1.25 × RDF (recommended dose of fertilizer) and 5 kg Zn / ha exhibited maximum seed yield (69.76 q/ha), quality, seed recovery percentage and benefit cost ratio of 2.88. In case of PBW 502 (Faizabad), Ridge planting with 150: 75: 50 NPK/ ha

and 10Kg/ha zinc sulphate as basal enhanced seed yield and C:B ratio to 1:1.68. At Hisar, in cv WH-102, the ridge sowing method increased seed yield by 3.49 % over conventional sowing method. Mn and Zn enhanced yield by 3.19 to 5.32 percent and 8.39 to 9.09 per cent respectively. At Dharwad, in GW-322, ridge method of sowing and application of 1.50 x RDF showed significantly higher plant growth parameters and seed yield (47.2q/ha).

Groundnut

At ANGRAU, Hyderabad, var. Kadiri 9, application of FYM @ 7.5 t/ha + RDNPK + gypsum @ 500 kg/ha at pegging recorded higher sound mature kernels (74.90%), pod yield (45.53 q/ha) and germination (92%). At OUAT, Bhubaneswar, in TAG 24, application of FYM 7.5 t/ha + RDNPK of 20:40:40 + Borax @ 15 kg/ha recorded the highest seed yield (12.49 q/ha) with 13.8 and 5.84% increase over RDNPK and FYM + RDNPK application respectively with increased Shelling %. Gypsum application @ 300 kg/ha the highest seed yield of 12.53 q/ha which was 17.1, 11.5 and 11.1% higher than control, 2% urea spray at 30 DAS and 2% urea spray at 30 and 60 DAS, respectively.

Sunflower

At ANGRAU, Hyderabad, in APSH 66, soil application of sulphur @ 10 kg/ha and soil application of borax @ 1 kg/ha increased yield by 39% (11.27 q ha-1) and 36.33% (10.65 q ha-1) over control (6.78 qha-1). Soil application of sulphur @ 10 kg/ha increased germination, root length, shoot length, seedling length and seedling vigour index I by 34, 41.17, 3, 25.34, 68.53% respectively against control. At UAS, Bangalore, in KBSH-53, highest seed yield (8.2 q/ha) was recorded by application of 20% >RDF (75:90:75 NPK kg/ha) + zinc sulphate @ 10 kg/ha (soil application) + boron @ 0.2% (Foliar spray at ray floret initiation stage) over control (7.3 q/ha) with recommended RDF without micronutrient application.

Maize

In maize hybrid Hema (NAI-137 x MAI-105) at Bangalore, application of 40% >RDF (210: 105:56 NPK kg/ha) + ZnSO4 @10 kg/ha in the form of 40% N basal + 30% N at 8 leaf stage + 30% N at tasseling increased seed yield (25.05 q/ha) by 25.50% over the recommended NPK kg/ha (150:75:40 NPK kg/ha) + ZnSo4 @10kg/ha in the form of 40% N basal + 60% N at tasseling.

Soybean

At Rahuri, 1000 seed weight (144.7 g), seed yield (37.20 q/ha), number of pods per plant (73) and seed quality parameters viz., germination (91.00%) and dry matter content (0.57 g), root shoot length (30.10 cm) and vigour index II (50.98) were significantly superior in the ridge sowing with application of 150% dose than recommended fertilizer dose and application of 5 kg chelated Zn/ha over the other treatment combinations with highest B:C ratio (2.45).

Ridge sowing + recommended DAP + soil application of $ZnSo_4$ @ 30 kg/ha + foliar spray @ 0.5% at 52 and 60 DAS was found significantly superior for number of pods/plants (84), seed yield/ha (29.61 q), seed recovery (96%) and vigour index (84.93) with a C:B ratio of 1:2.7 over other treatment combinations at Akola centre.

In UAS, Raichur, 40:80:25 NPK kg/ha + S-40kg + Zn -5kg increased seed yield (1636 kg/ha) by 20% over control (1359kg/ha). Ridges furrow method increased germination (77%), seedling length (20.8 cm), seedling vigour index (1568) over flat bed method.

At JNKVV, Jabalpur, the treatment 150% NPK resulted in higher processed seed yield (1196kg/ha), 100 seed weight (7.88), seed recovery (85%), germination (84%) and vigour index (2550). Application of NPK+ S + Zn+ B+ Mo increased processed seed yield (1298kg/ha), 100 seed weight (8.04g), seed recovery (87%), germination per cent (86%) and vigour index (2671). Ridge and furrow cultivation had highest C:B ratio of 1:2.

Mustard

At Kanpur, in cv Urvashi, Application of 7.5 kg Zn ha-1 and Seed treatment with Carbendazim @ 2 g/kg of seed showed significantly highest seed yield (29.17 q ha-1) with 98.9% of seed recovery and Benefit: Cost of 2.15:1.

In Durgapura, application of RDNPK + Gypsum + Fe ($FeSO_4$ @ 25 kg/ha) + Zn ($ZnSO_4$ @ 25 kg/ha) recorded highest Seed yield (35% more), 1000-seed weight (6.25 g) and seedling vigour index (3711) compared to the RDNPK application.

Berseem

Normal sowing (15th october), Cutting at 10 days before normal last cut (75 DAS) and nutritional spray (KNO3 @ 2% and Borax @ 100 ppm) at the reproductive stage resulted in higher seed yield of 1.24 q/ha at Rahuri centre.

In Jabalpur, second date of sowing (15th January), cutting at 10 days after normal last cut and spray of KNO3 @ 2 % was found to be significantly superior for increase in seed yield.

At Pantnagar, under both normal and late sown conditions, Borax spray @ 100 ppm at reproductive stage is equally effective for obtaining more yields in both genotypes (Wardan and Jawahar Berseem 1). The borax application @ 100 ppm at reproductive stage just 10 days before last cut as well as 10 days after last cut is found very effective for getting more seed yield followed by spray of KNO_3 @ 2% at reproductive stage just 10 days before last cut.

Cluster bean

At Coimbatore, in Pusa Navbhar, 45 x 20 cm spacing and sowing on July 1st resulted in better growth parameters, seed yield and seed quality characters. At Jodhpur, in cv. RGC 936, incidence of diseases like, wilt, blight and powdery mildew and insect pests, leaf cutter, white fly and aphids were observed more in 10th and 20th July sowing compared to sowing done on 1st July. At Durgapura, in RC 1038, Plant height and seedling length were affected by sub effects i.e. different row spacings. Higher seed yield (13.31 q/ha) was observed in crop geometry 30 x 30 cm sown on 01.07.2013. Seed yield in 1 July (12.79 q/ha) and 11 July (11.83 q/ha) sowing were at par being significantly superior to the late sowing on 21.07.2013 (7.44 q/ha).

b. Pilot project on alternative area for hybrid seed production of major crop in different seasons

Crop	Hybrid	New Areas	Cost: Benefit	Seed Yield (q/ha)
Rice	JRH 5	Balaghat, Madhya Pradesh	1:1.86	
	KRH 4	Sira , Karnataka T. Narasipura , Karnataka	1:1.13 1:1.12	11.92 10.58
	NDRH 2	Faizabad, Chhattisgarh plains		
	PSD 3	Areas outside of Pantnagar, Uttarakhand		
Pigeonpea	ICPH 2671	Seoni, Madhya Pradesh	1:1.4	4.2
	AKPHM-11303	ZARS, Yaotmal, Maharashtra	1:1.56	6.43
Pearl millet	RHB-173 (ICMA 93333A x RIB 192)	Bharatpur, Rajasthan		
Maize	Hema	Sira, Karnataka Hiriyur taluk, Karnataka Siraguppa, Karnataka	1:1.75 1:1.72 1:1.70	22.50 21.70 21.25
	HQPM 1	Pathera village, Karnal dist, Andhra Pradesh	1:1.73	
Castor	GAUCH-1 and GCH-4	Surendranagar dist, Gujarat Gadwal in Mahboobnagar district, Reddipalli area of Ananthapur, Nandyal and Banaganapally, Kurnool dist, Andhra Pradesh	1: 0.71	

c. Studies on cutting management for seed yield and its quality in *Cenchrus ciliaris*

The genotypes CAZRI 2221 and CAZRI 2178 are the better genotypes for seed production and its related traits, and also for fodder production. Among the genotypes, CAZRI 2178 recorded maximum pure seed yield (82.8 kg/ha) whereas, CAZRI 2221 recorded maximum green fodder yield (12603 kg/ha) and dry matter production (4025 kg/ha). Uncut crop had maximum pure seed yield (102.4 kg/ha) i.e. 43% higher seed yield and 18% more dry matter than foliage cutting at 45 days. Overall foliage cutting reduced the seed yield, hence not advisable for seed production in *C. ciliaris* under hot arid climate.

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

In case of DRRH 3 hybrid, SRI method resulted in yield improvement of 18.04% over the conventional method at ANGRAU, Hyderabad and DRR, Hyderabad due to increase in ear bearing tillers per hill, spikelet fertility and root volume. At PAJANCOA&RI, Karaikal, CORH 4 performed better and produced 37.96% higher seed yield than DRRH 2 with the improvement in yield contributing components viz., number of effective tillers/hill, number of filled grains/panicle, percentage spikelet fertility and single plant seed yield. Irrespective of the hybrids studied, 28% higher seed yield was recorded with SRI method. At Jorhat, seed yield of Hybrid Indira Sona was found superior in SRI method (6.56 q/ha) over conventional method (5.40 q/ha).

e. Hybrid seed production in Brinjal and Tomato under protected conditions

At UAS, Dharwad, in case of tomato- Pusa hybrid 2, higher seed yield of 187.1kg/ha was recorded under shade house condition with higher seed quality parameters at spacing of 60 x 60 cm

compared to open field conditions. In brinjal hybrid PH9 at number of fruits per plant (3.58) and fruit set (19.90%) were higher under shade house condition whereas seed weight per fruit was maximum under open field condition. 60 cm x 75 cm spacing recorded maximum seed yield under both conditions with better seed quality recorded under shade house condition.

Seed production of Brinjal Hybrids namely, Pusa Hybrid 5, Pusa Hybrid 6 and Pusa Hybrid 9, under net house condition resulted in profitable Cost benefit ratio of 1:1.9 with better seed quality at IARI, New Delhi.

f. Optimization of seed production technology in mungbean for maximizing seed yield

In mungbean, var. NDM 1, sown between 15th July and 1st August, spacing of 30 x 10 cm and treatment of seed with Rhizobium and Phosphate Solubilizing Bacteria + RDF as basal dose + Borax spray (100 ppm) was found optimum for maximizing seed yield at Faizabad and Jabalpur.

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

At Pantnagar, Hybrid H 2 (CSH 24MF) produced significantly higher yield/plant and higher seed quality than Hybrid H 1 (CSH 20MF) because of less difference (3 days) in time taken for 5% flowering in male and female parent of H 2 hybrid as compared to H 1 hybrid parents (18 days). Because of greater difference in male and female parent flowering in H 1seed set per cent was very poor. It is, therefore, suggested that staggered planting of male parent be also included in the experiment in order to achieve nicking and synchronization in flowering between male and female parent for better seed set and seed quality. Among different dates of planting treatments, 10th June and 10th July planted crop recorded highest and lowest seed yield/plant, respectively, with no significant influence on seed quality parameters.

h. Standardization of alternative planting windows vis-s-vis climate change

Centre and crop	Planting window	Observation/Highlights
Rahuri Pearlmillet (Shanti)	August onwards or 15th October to 15th December	70%- Seed setting and disease viz., *Helmenthosporium* leaf spot, Ergot, *Alternaria* blight and Rust incidence (August sowing)
	January	80%- Seed setting
	February or 1st June to 15th July	100%- Seed setting with low disease and insect pest incidence (June –July sowing)
	March onwards	70-50%- Seed setting
	August and after February	Aphids, Thrips, hoppers and stem borer infestation
Bangalore Sunflower Parental lines of hybrid KBSH-44, KBSH-53	1st March	Superior seed yield and yield attributing characters
	July and August	Higher incidence of diseases
	1st May	Lower seed yield per plant and seed setting
	1st June	Lowest seed setting
ANGRAU Sorghum (CSH14)	October	Early flowering, high pollen viability, cent per cent seed setting and highest seed yield
	November	Early flower initiation, lower seed setting

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

At ANRAU, Hyderabad and DRR, Hyderabad sowing with drum seeder had no significant impact on root characters at active tillering stage and grain yield. Among the varieties Rasi, Aditya and Krishnahamsa performed better with drum seeder and resulted in grain yield of 5.78 t/ha, 5.67 t/ha and 5.58 t/ha, respectively.

At Coimbatore, cultivars PHB 7, DRRH 2 and CO(R) 50 registered higher root length in wet as well as in dry seeding. Root volume was higher in DRRH 2, PHB 71 and Aditya in both whereas vasumathi registered low volume in wet seeding. At Bangalore, seed yield and crop performance was better in puddled condition in all the 22 cultivars. Hybrid KRH-4 recorded the highest seed yield followed by cultivars MAS-26, KMP-175 and Rasi under aerobic condition and is more suited for the direct seeding. At Faizabad, the grain yield ranged from 28.4 q/ha (Rasi) to 45.5 q/ha (PHB 71). At Jorhat, all fifteen tested varieties differed significantly for all the characters with highest seed yield of 2852 kg/ha recorded by variety JR 16 and Manoharsali with highest (318) tillers/m2.

3.2.2.2 Seed Physiology, storage and testing

- First count of germination showed significant positive correlation with field emergence and may be used as an index to assess the planting value of hybrid maize, cotton and paddy.
- Accelerated ageing for 96 hrs (hybrid maize), 48 & 72 hrs (hybrid cotton) and 96 hrs (hybrid paddy) showed high significant correlation with storage potential and may be used as an index of storability.
- Polymer coating @ 3ml/kg seed in combination with flowable thiram (2.4 ml/kg) or vitavex 200* @ 2g/kg seed (Thiram 37.5 % + Carboxil 37.5 %) or polymer in combination with vitavex 200* were found at par in maintaining the seed quality of hybrid paddy and hybrid maize for one planting season.
- SSR markers (RM 19, RM 336, RM 204, RM 202) have been validated and revalidated for hybridity and genetic purity testing of paddy hybrid DRRH-2, DRRH-3 and KRH-4.
- SSR marker (ORS-878) has been identified to distinguish the parents of sunflower hybrid APSH-66 amplifying female parent at 220 bp and male at 235 bp.
- Exposure of seeds to Pulsed Electromagnetic Field (PEMF) @ 100 Hz significantly improves the seed quality as well as seed yield of mungbean, paddy and maize.
- A total of 105 demonstrations of hydro-priming technology were organized at farmer's field across the centres.
- Hydro-priming technology improves seed yields by 6-11.5% in different crops (Wheat, paddy, pearlmillet, sorghum, mungbean, pigeonpea & chickpea).

3.2.2.3 Seed Pathology

- Bacterial Panicle Blight disease of rice (*Burkholderia glumae*) by GBPUA&T, Pantnagar, Uttarakhand; Viral disease caused by *Bean Common Mosaic* on cluster bean/ guar (*Cyamopsis tetragonoloba*) and false head smut (*Ustilaginoidea virens)* of maize from Anand (Gujarat) are reported as new emerging seed-borne diseases.
- *Burkholderia glumae* is found responsible for Bacterial Panicle Blight (BPB) disease in rice and also causes bacterial grain rot. The most susceptible period for floret infections is during panicle emergence and flowering. The infected seeds are poor in germination, give reduced grain weight and poor plant stand.
- The bacterium is isolated both from discoloured and even from healthy looking seed, collected from infected crop. The pathogen is readily seed-borne and is successfully isolated on King's B medium from infected seeds when incubated at 28^{0}C for 48 h. The bacterium survives in seed from year to year.
- The fungus *A. porri* survives in infected seed, collected from infected umbels for >20 months under dry and cold conditions. However, the longevity of *A. porri*, in infected seeds, under ambient conditions is noticed only up to a period of 12 months.
- The seed treatment with both the bioagents (*T. harzianum and Ps. fluorescens*) @ 10g/kg of seed (1:1) are found effective in improving germination but did not manage the seed borne infection of *A. porri* in Onion crop.
- Heat treatment of onion bulbs at 35°C for 8 hours before planting helps in reducing the purple blotch infection.
- The seeds when treated with different concentration of biocontrol agents, *Trichodema viride* and *Ps. flurorescens*, the CFU/g seed decreased with the increase in storage period at ambient room temperature.
- Biocontrol agent *Ps. fluroscence*, on artificial inoculation in tomato seedlings induce resistance against Alternaria blight infection.

3.2.2.4 Seed Entomology

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

Newer insecticide molecules viz. emamectin benzoate 5 SG@ 2 ppm (40.0 mg/kg seed), spinosad 45 SC @ 2 ppm (4.4 mg/kg seed), indoxacarb 14.5 SC @ 2 ppm (13.8 mg/kg seed), rynaxypyr 20 SC @2ppm (0.01 ml/kg seed), chlorfenapyr 10 EC@2ppm (0.02 ml/kg seed), profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed), novaluron (Rimon 10 EC) @ 5ppm (0.05 ml/kg seed) were evaluated along with standard chemical (deltamethrin) against major storage insect-pests damaging cereals and pulse seeds. This experiment was modified last year and Profenofos was included.

All newer insecticides especially emamectin benzoate (Proclaim 5SG) @ 2 ppm (40.0 mg/kg

seed), followed by spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed), rynaxypyr (Coragen 20 SC) @2ppm (0.01ml/kg seed), profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed), chlorfenapyr (Intrepid 10 EC) @2ppm (0.02ml/kg seed), indoxacarb (avaunt 14.5 SC) @ 2 ppm (13.8 mg/kg seed) and novaluron (Rimon 10 EC) @ 5ppm (0.05ml/kg seed) were found at par with deltamethrin (Decis 2.8 EC) @1.0 ppm and provided control of storage insects infesting wheat, pearl millet, and maize under different agro-climatic conditions up to three to six months.

2. Evaluation of packaging material and methodology to store seed in Coastal region

Paddy seeds treated with flubendiamide (Fame 480 SC) (4.2 mg/ kg seed), emamectin benzoate (Proclaim 5SG) @ 2 ppm (40.0 mg/kg seed), spinosad (Tracer 45 SC) @ 2 ppm (4.4 mg/kg seed), deltamethrin 2.8 EC (0.04ml /kg seed) were stored in three different types of packaging materials (Gunny bag, Super grain bags and HDPE bags) at Karaikal and Bhubaneswar centre.

Paddy seed treated with deltamethrin @ 1.0 ppm and spinosad @ 2 ppm and stored in moisture impervious bags like super grain bags maintained seed germination above IMSCS with appreciable control of insect infestation up to 12 months period at Karaikal.

3. 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 with special reference to insect infestation. Most of samples (76.3%) were having germination above IMSCS. In contrast, large proportion (about 36.9%) of farmers' seed samples were infested with storage pests and intensity of damaged seed usually varied from 0.1to10% while in some cases it had gone up to 32%.

4. Quality seed production through insect pollination

Bee pollination plays a major role in improving the quantity of seed produced in case of sunflower. Apart from seed yield, parameter like vigour and oil content improved substantially due to bee pollination. In case of pigeon pea other pollinators like leaf cutter bee, carpenter bee play major role in pollination.

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

Seed storage at 50% CO_2 treatment can provide complete protection against khapra beetle in wheat, groundnut beetle in groundnut and pulse bruchid in green gram and chick pea without affecting seed quality up to 6-9 months storage. Thus, CO_2 can be a good alternative to use of chemical treatments including fumigants for preventing storage pests in wheat, groundnut, chickpea and green gram.

6. 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 50L capacity containers for treating black gram seed has been successfully demonstrated at TNAU, Coimbatore. This clearly indicated that large scale would be equally effective in controlling storage pests.

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

This experiment was conducted to evaluate integration effect of seed treatment as well as fabric treatments against infestation of major storage insect-pests damaging seeds.

Treatment schedules i.e. combination of seed treatment (emamectin benzoate 5SG @2ppm a.i.) and fabric treatment (emamectin benzoate 5SG@100ppm a.i.) at various centres have been developed for management of storage insects of seeds having better storage life (good storer) but prone to insect damage.

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

Different types of insecticide impregnated bags like treated bag, no lamination, no liner; Treated bag, non treated lamination, non treated liner and treated bag, treated lamination, treated liner were tested along with untreated bag (same fabric i.e. PP Bag) and gunny bag (control).

Preliminary results showed that different types of insecticide impregnated bags are quite effective for management of storage pests. But storage of treated seed (seed treatment with emamectin benzoate @ 2ppm) in insecticide impregnated bags has shown better insect pest management.

3.2.2.5 Seed Processing

- The use of combine harvester at 500 rpm of drum speed is found most economical and effective for maintaining seed quality during harvesting and threshing of soybean. Similarly for minimum field losses and maximum seed quality use of combine harvester at 15 to 20 cm height of cutter bar from ground level was found effective and economical.
- The ODV seeds in paddy seed lot can be effectively removed to the acceptable limit by using specific gravity separator in addition to seed cleaner and grader.

Crop	Variety/cultivars	Screen size (mm)
Paddy	Fine grained: PKV HMT, PKV Khamang, JGL 387, Sonalika & Suvarna	1.4
	Coarse grain	1.6
Chickpea	Chaffa, Vijay, Vishal, ICCV 10 and G 12	5.0
	Bold seeded: Jaki, PKV Kabuli and G 5	5.5
	C 11, ICPL 87119, AKT 8811 and BDN 2	3.6
Pigeon pea	C 11, ICPL 87119, AKT 8811 and BDN 2	3.6
Wheat & Barley		2.75
Sunflower hybrid KBSH 53		2.40 x 20 (S)
Maize hybrid Nithyshree		4.76 x20 (S)
Safflower		2.2
Soybean		3.6
Ragi		1.3

- There is urgent need to modernize the seed processing plants in most of the places. The condition of the many seed processing plant is not encouraging. Nearly 80 % of the plants are single machined plants i.e. having seed cleaner cum grader only. Most of the plants do not have basic machinery like moisture meter, etc. In most of the plants specific gravity separator is not either available or not in use. The efficiency of the machines is not satisfactory and the percentage of the rejection is more than 20 % in major crops. In most of the plants there is no proper seed storage facilities and in most of the places the seed protection measures like fumigation are not followed properly.
- For the grading of different varieties of field crops including cereals, pulses and oilseed the recommended screen size is as under.

3.3. Seed Production in Agricultural Crops

Seed is prime input having the capacity to ensure food security i.e. seed security can play a vital role in ensuring food security. Realizing the importance of quality seed, ICAR took its first initiative by launching a milestone project AICRP-NSP Crops in 1979-80 with the goal to produce adequate quantity of breeder seed production as per country's requirement and conduct seed technological research to support quality seed production. However, there is a gap between the requirement and production of quality seeds and majority of farmers are using their farm saved seeds particularly in high volume and low value crops. Keeping this in view there is need to raise the seed replacement rate (SRR) and to make quality seed available to the farmers, ICAR launched a project ''ICAR seed project - seed production in agricultural crops and fisheries'' in plan X for the years 2005-06 and 2006-07 and was continued in XI plan period with field crop component alone. Having a modest start during last two years of X plan period, this project made an everlasting impact on the face of Indian seed sector during XI plan period.The project was operated in 56 centres for field crop component including 34 SAU's, 21 ICAR Institute and one non ICAR institute with major objectives- to build/ strengthen the capacity for improved seed production of various institutes, to enhance the seed production of agricultural crops both in terms of quantity and quality, to undertake the rapid multiplication of planting material through tissue culture/ micro propagation, to improve the quality of farm saved seed and on-farm demonstration of production technology, to undertake the human resource development through training of seed producers and various stakeholders.

During the year 2013-14, total production of quality seed including all classes was 630417.84 quintals against the target of 461530.84 quintals. Production comprises 91710.94 quintals of breeder seed, 135813.82 quintals of foundation seed, 162771.07 quintals of certified seeds, 168331.77 quintals of truthfully labelled seed and 71790.24 quintals of planting material of field crops. In addition, 84.75 lakhs planting material and 4.65 lakh tissue culture plantlets of field crops were produced against the targets of 94.05 and 1.32 lakhs.

Summary of seed production during 2013-14 under ICAR seed project- "Seed Production in Agricultural Crops"

(in quintals)

S. No.	Particulars	In University/Institute		Participatory Seed Production		Total	
		Target	Production	Target	Production	Target	Production
1	Breeder seed	85816.84	90910.94	825.00	800.00	**86641.84**	**91710.94**
2	Foundation seed	54748.90	69786.61	10066.62	66027.21	**64815.52**	**135813.82**
3	Certified seed	36027.30	49471.44	143714.50	113299.63	**179741.80**	**162771.07**
4	TFL seed	45966.68	64433.63	31922.00	103898.14	**77888.68**	**168331.77**
5	Planting material	52443.00	71790.24			**52443.00**	**71790.24**
	Total	**275002.72**	**346392.86**	**186528.12**	**284024.98**	**461530.84**	**630417.84**
							(in lakh)
S. No.	**Particulars**	**Target**	**Production**	**Target**	**Production**	**Target**	**Production**
1	Planting material	94.05	84.75			94.05	84.75
2	Tissue culture plants	1.32	4.65			1.32	4.65
	Total	**95.37**	**89.40**			**95.37**	**89.40**

With respect to infrastructure development, state of art machinery, modern processing plants, fully equipped seed testing labs, precision application irrigation facilities, tissue culture labs, protected cultivation structures etc. were established in all the co-operating centres making it one of its kind project in terms of infrastructure establishment. This project also has helped in human resource development, technology dissemination (Farmers' participatory seed production and seed village programme), employment generation and ultimately socio-economic up-liftment of its clientele (farmers). In a nutshell, this project mediated in quantitative and qualitative enhancement in the availability of quality seed there by paving the way for seed replacement as well as varietal replacement, which were the twin means for ensuring food security by assurance of quality seed security.

With the mandate to disseminate technology, various modules of trainings have been prepared to cater the need of seed producing personnel including farmers, trainers and employees (field staff) of university/ State Seed Certification Agency/ State Seed Corporation/ Seed Producer Companies and NGOs. Training mainly focused on seed production, processing, storage and packaging, quality enhancement, quality control and seed health management. According to crop season, need and type of beneficiary, trainings were imparted on regular basis under Human Resource Development (HRD) component. Special training programmes on quality seed production for farmers of tribal areas were also started across the country. The project has made a significant dent on establishing the linkage with other crop Project Directorates, ICAR institutes, SAU's, PPV & FRA, DoAC, State seed corporations, NSC, SFCI, NGO's, Self help groups, public / private seed companies involving in popularizing new varieties/ hybrids, application of new technologies, marketing of the seed and boosting the HRD components in the field of Seed Science and Technology.

Total fund release during 2013-14 to different cooperating centers under ICAR Seed project

(Rs. in lakh)

TA	HRD	ORC	**Total**	TSP	**Recurring + TSP Total**
64.75	98.00	270.50	**433.25**	56.00	**489.25**

Photographs showing quality seed production in Field Crops

Field view of quality seed production of varied crops under ICAR Seed Project

Capacity building and TOT under ICAR Seed Project during 2013-14

4 Participation in Meetings / Trainings / Seminars / Workshops

Programmes organized by DSR, Mau

Sl. No.	Name of programme organized	Date	Place	Coordinator
International Trainings				
1.	International training on "Organizing and implementing an effective national seed quality control system"	27.01.2014 – 08.02.2014	Seed production centre of DSR, Mau at Bangalore	Dr. S. Rajendra Prasad Dr. Uday Bhaskar K. Sh. Umesh Kamble Dr. Bhojraja Naik

Interactive session with Dr. S. Ayyappan, Hon'ble Secretary, DARE & DG, ICAR on 06. Feb. 2014 at Bengaluru

Sl. No.	Name of programme organized	Date	Place	Coordinator
National Trainings				
1.	Training on "Identification of Storage Pests"	18.06.13 - 22.06.13	UAS, Bangalore	Dr Arvind N. Singh
2.	National training programme on "Varietal purity testing through conventional and biotechnological tools"	15-19.10.2013	DSR, Mau in collaboration with NSRTC, DAC, GOI, Varanasi	Dr. Dhandapani R.
3.	Advanced training on Fodder Seed Production Technology	21-25.10.2013	DSR, Mau collaborated with NDDB	Dr. S. Natarajan
4.	Training on requisites of seed production, testing and quality assurance at Tripura	27- 28.11.2013	DSR, Mau and Department of Agriculture, Tripura	Dr. S. Rajendra Prasad Dr. S. Natarajan Dr. Uday Bhaskar
5.	6 days Researchers' training-XI: Data analysis using SAS" under consortia-based project "Strengthening Statistical Computing for NARS"	03.03.2014 – 08.03.2014	DSR, Mau	Dr. Chandu Singh
Brain Storming Session				
1.	Brain Storming for finalization of seed platform project	08.04.2013	DSST, IARI, New Delhi	Dr. S. Rajendra Prasad
Meetings				
1.	XXVIII Annual Group Meeting of AICRP – NSP (Crops)	27-29.04.2013	PAU, Ludhiana	Dr. S. Rajendra Prasad
2.	Institute Research Committee (IRC) meetings	08.07.2013	DSR, Mau	Dr. T.N. Tiwari
3.	Attended the EFC meeting with Dr. R.K.Chowdhury, Member, RAC, DSR, Mau and revision of EFC of DSR, Mau including sub-schemes as per his suggestions.	26.07.2013	DSR, Mau	Dr. T.N. Tiwari Dr. S. Natarajan Dr. Udaya Bhaskar K. Dr. Asit K. Mandal Sh. Umesh Kamble

Sl. No.	Name of programme organized	Date	Place	Coordinator
4.	VIII Annual Review Meeting of ICAR Seed Project – Seed Production in Agricultural Crops	26-27.08.2013	NBPGR Auditorium, New Delhi	Dr. S. Rajendra Prasad
5.	Research Advisory Committee (RAC) meeting in the Chairmanship of Dr. R.R. Hanchinal, Chair-person, PPV&FR authority, Govt. of India, NASC Complex, New Delhi	18.09.2013	DSR, Mau	Dr. T.N. Tiwari

RAC meeting at DSR, Mau

6.	Principal Investigator (P.I) meeting of All India Coordinated Research Programme –National Seed Project (Crops)	17.01.2014	NASC, New Delhi	Dr. Dhandapani R.
Farmer Trainings				
1.	Farmers training on 'Quality seed production of *Kharif* crops'.	09.07.2013	Kureji, Rasadha, Ballia	Dr. Rajiv K. Singh
2.	Farmers training on "Improved Cultivation of Paddy"	01.08.2013	DSR, Mau	Dr Arvind N. Singh
3.	Farmers training under Seed Village Scheme	14.08.2013	KVK Ghazipur,	Dr. T.N. Tiwari
4.	Farmers training under Hindi Chetna Maas, the topic was "Role of quality seed in food security"	10.10.2013	DSR, Mau	Dr. T.N. Tiwari
5.	Farmers training on the theme area Utilization of modern techniques in seed production of rabi crops.	16.01.2014	DSR, Mau	Dr. A.K. Sinha
6.	Farmers training programme under Seed Village Scheme in collaboration with Mahila Samakhya, Mau.	21.01.2014	DSR, Mau	Dr. Rajiv K. Singh & Dr. T.N. Tiwari
7.	Farmers training under Seed Village Scheme	30.01.2014	Matehu, Ghazipur	Dr. T.N. Tiwari

Sl. No.	Name of programme organized	Date	Place	Coordinator
8.	Farmers training programme under SVS	12.03. 2014	DSR, Mau	Dr. Rajiv K. Singh
9.	Farmers training programme under SVS	20.03.2014	DSR, Mau	Dr. Rajiv K. Singh
10.	Farmers training programme under ICAR Seed Project	22.03.2014	DSR, Mau	Dr. Rajiv K. Singh
11.	Farmers training programme under SVS	24.03.2014	DSR, Mau	Dr. Rajiv K. Singh
12.	Farmers training programme under ICAR Seed Project	25.03.2014	DSR, Mau	Dr. Rajiv K. Singh
13.	Farmers training programme under SVS	29.03.2014	DSR, Mau	Dr. Rajiv K. Singh

Farmers training at DSR, Mau under Seed Village Scheme

Visits				
1.	Visit of DG, Uttar Pradesh Council of Agriculture Research visited the DSR, Mau and interacted with DSR scientists regarding their ongoing research activities.	05.02.2014	DSR, Mau	Dr. T.N. Tiwari
2.	Visit of delegation from Nepal comprising Mr. Uttam Kumar Bhattarai, Joint Secretary, Ministry of Agriculture Development and Chairman, National Seed Company Limited and Mr. Nanu Jha, Managing Director, National Seed Company Limited under the Bill & Melinda Gates Foundation funded project "Stress Tolerant Rice for Africa and South Asia (STRASA)" visited the DSR, Mau on 6th February, 2014 and interacted with Project Director incharge and scientists to gain knowledge of Indian experiences on seed research activities in general and role of DSR in particular.	06.02.2014	DSR, Mau	Dr. T.N. Tiwari

Visit of delegation from Nepal comprising Mr. Uttam Kumar Bhattarai, and Mr. Nanu Jha at DSR, Mau

Sl. No.	Name of programme organized	Date	Place	Coordinator
Other programmes				
1.	Field day on 'Improved techniques of quality seed production in Rabi crops'	20.02.2014	Badaraon, Mau.	Dr. Govind Pal
2.	National Science Day	28.02.2014	DSR, Mau	Dr Arvind N. Singh

National Science Day organized at DSR, Mau

3.	*Parthenium* Awareness Week (16-22, August, 2013).	20.08.2013	DSR, Mau	Dr Arvind N. Singh

Uprooting of Parthenium during Awareness Week (16-22, August, 2013)

Programmes/ Meeting/Training attended by DSR Scientists and Staff

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
International				
1.	International Conference on Impact of Technological tools on Food Security under Global Warming Scenario organized by Hi-Tech Horticultural Society	11-12.05.2013	Meerut, U.P	Dr. A.N. Singh
2.	International Conference on Agriculture, Veterinary & Life Sciences.	24-25.01.2014	Vijaywada, Andhra Pradesh	Dr. A.N. Singh Dr. Govind Pal
3.	International Attachment Training Course on "Organizing and implementing an effective National Seed and quality Control System"	27.01.2014 - 08.02.2014	New Delhi and DSR, Mau	Dr. T.N. Tiwari Dr. Rajiv K. Singh Dr. Arvind N. Singh Dr. Asit K. Mandal Dr. Udaya Bhaskar K. Dr. Dhandapani R. Sh. Umesh Kamble
4.	International Conference on Emerging Trends in Science & Technology: Impact on Environment & Society for Inclusive Growth organized by AISECT University	14-15.02.2014	AISECT University, Bhopal	Dr. T.N. Tiwari & Dr. A.N. Singh
National				
1.	National Seminar 2013 on Social Dimensions of Extension Education in Holistic Development of Rural Livelihood.	26-27.04. 2013	Lucknow	Dr. Govind Pal
2.	XIII ISST National Seed Seminar on Innovations in Seed Research and development jointly organized by ISST, new Delhi and GKVK, UAS, Bangalore	8-10.06.2013.	UAS, Bangalore	Dr. S. Rajendra Prasad Dr. Dhandapani R. Dr. Govind Pal Dr. Rajiv K. Singh
3.	Short course on "Recent Advances in Proteomics for Biomarker Discovery" Sponsored by Indian Council of Agricultural Research organized by animal biotechnology centre, National Dairy Research Institute Karnal (Haryana)	8–17.07. 2013	Karnal (Haryana)	Dr. Dhandapani R.
4.	National training on "Varietal Purity Testing through Conventional and Biotechnological Tools"	15–19.10. 2013	DSR, Mau	Dr. T.N. Tiwari Dr. Dhandapani R. Dr. Mandan Kumar Dr. Ramesh K.V. Dr. Elayaraja K.
5.	National training on "Quality seed production in forage crops" organized in collaboration with National Dairy Development Board, Anand	21-25.10.2013.	DSR, Mau	Dr. S. Natarajan Dr. T.N. Tiwari Dr. Udaya Bhaskar K. Dr. Arvind N. Singh Dr. Rajiv K. Singh

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
6.	National training programme "Requisites of seed production, testing & quality assurance" at Agartala, Tripura organized by Directorate of Seed Research, Mau and Department of Agriculture, Tripura on	27-28.11.2013	DSR, Mau and Department of Agriculture, Tripura	Dr. S. Rajendra Prasad Dr. S. Natarajan Dr. Arvind N. Singh Dr. Uday Bhaskar K. Dr. Umesh Kamble
7.	National Training on "Application of Nanotechnology in Agriculture" organised under World Bank funded NAIP-ICAR Project	10–19.03. 2014	CAZRI, Jodhpur.	Dr. Ramesh K.V.
Meeting/workshop				
1.	Meeting with DG, ICAR & Secretary DARE & ADG (Seed), ICAR, New Delhi about XII Plan EFC and different issued related to DSR, Mau	26.04.2013 – 01.05.2013	ICAR, New Delhi	Dr. S. Rajendra Prasad
2.	XXVIII Annual group meeting of All Iindia Coordinated Research Programme –National Seed Project (Crops)	27-29.04. 2013.	PAU, Ludhiana, Punjab	All the scientists of DSR, Mau
3.	• Meeting under the chairmanship of DG, ICAR & Secretary, DARE to discuss issues relating to production of quality breeder seed. • Meeting of the ASEAN – India Working Group on Agriculture & Forestry (AIWGAF) during May 6-7, 2013 at Training Hall, ICAR Facility, NASC Complex, New Delhi. • Visit to UAS, Bangalore & signed the lease deed to take over 25 acres of land from UAS, Bangalore in the presence of Hon'ble Vice Chancellor, Director of Research, Registrar and other senior officers of the university to initiate the work as per decision of AGM, ICAR, New Delhi	05-13.05.2013	ICAR Headquarter, New Delhi & UAS, Bangalore	Dr. S. Rajendra Prasad
4.	Meeting under the chairmanship of DDG (CS), ICAR to discuss issues relating to Proposed XII Plan EFC of DSR, Mau.	20.5.2013	New Delhi	Dr. S. Rajendra Prasad
5.	Annual Group Meet of All India Coordinated Research Project on Biological Control of Crop Pest and Weeds	24-25.05.2013	Bangalore	Dr. A.N. Singh

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
6.	Meeting with Hon'ble Secretary, DARE & DG, ICAR & DDG (CS), ICAR to discussed about taking over the land & facilities for seed production centre of DSR from UAS, Bagalore	02.06.2013	New Delhi	Dr. S. Rajendra Prasad
7.	MDP workshop on PME of Agricultural Research Projects at NAARM, Hyderabad.	18-22.06.2013	NAARM, Hyderabad	Dr. T.N. Tiwari
8.	• Meeting at NCAP, New Delhi and discussed about framework for performance indicator. • Interaction meeting with Director, PDFSR, Modipuram at NASC Complex, New Delhi and proposed the seed activities/participation of DSR in integrated farming system. • 85th Foundation Day of ICAR and Director's meeting under the Chairmanship of DG, ICAR & Secretary, DARE on 15-17th July 2013 at NCAP, New Delhi. • Visited Seed Production Centre of DSR at GKVK Campus, Bangalore arranged for sowing and prepared layout for making bunds/roads in the field.	14-22.07.2013	New Delhi	Dr. S. Rajendra Prasad
9.	Meeting for finalization the draft guidelines for crop variety testing of AICRPs, under the chairmanship of DDG (CS), ICAR	30.07.2013	NRL, Pusa Campus, New Delhi.	Dr. S. Rajendra Prasad Dr. S. Natarajan Dr. Rajiv K. Singh
10.	VIII Annual review meeting of ICAR Seed Project "Seed Production in Agricultural Crops"	26-27.08.2013	NBPGR, New Delhi	Dr. S. Rajendra Prasad Dr. Raghavendra D.
11.	Participated in one day meeting on ISO 9001	30.08.2013	DSR, Mau	All the scientists of DSR, Mau
12.	Meeting of Scientific Advisory Committee of Krishi Vigyan Kendra, Mau.	05.09.2013	KVK, Mau	Dr. A.N. Singh
13.	Meeting alongwith Director (CS), Director, DOR, Hyderabad and Director, VPKAS, Almora and discussed with the official of Department of Agriculture, Agratalla, Tripura different stakeholders of Seed Industry, NGO and Selfhelp group regarding implementation of research, seed production and extension activities	05-07.09.2013	Tripura	Dr. S. Rajendra Prasad

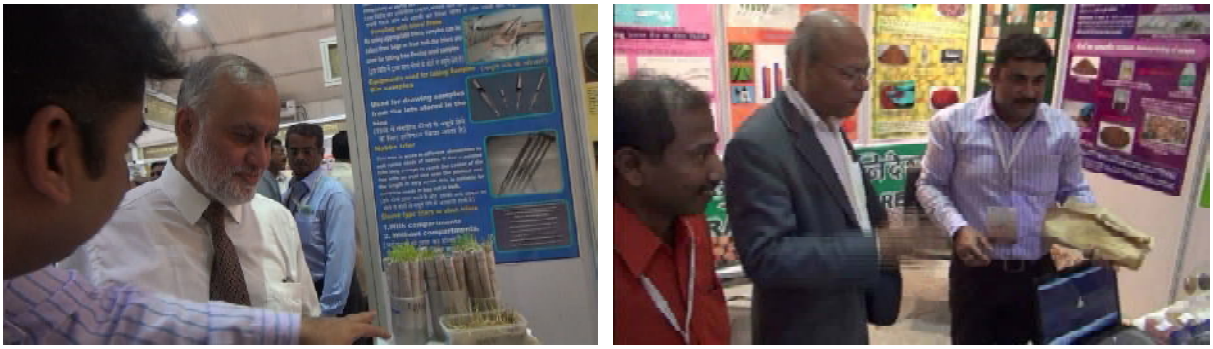
Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
14.	Presented a lead paper on Ädvances in Seed Quality Enhancement and Vigour Assessment"in 6th National Seed Congress- 2013 organized by NSRTC, Varanasi in collaboration with U P Beej Vikas Nigam & Deptt. Of Agriculture, UP, Lucknow	12-14.09.2013	Lucknow	Dr. S. Rajendra Prasad
15.	Attended the "4th Workshop cum SAS Installation Training" on under NAIP Project	20-21.09.2013	IVRI, Izatnagar	Dr. Chandu Singh
16.	Meeting of Agrinnovate India Limited (Agin), NAI and ITMU of ICAR	19.10.2013	NASC Complex, New Delhi	Dr. S. Rajendra Prasad
17.	RFD (2013-14) Midterm Review Meeting	29.10.2013	ICAR, Krishi Bhawan, New Delhi.	Dr. T.N. Tiwari & Dr. A.N. Singh
18.	Meeting on Marketing of Breeder Seed, role of Agrinnovate India at Conference Facilities, NASC Complex, New Delhi with Hon'ble DG, ICAR, New Delhi	08.11.2013	New Delhi	Dr. S. Rajendra Prasad
19.	Interface meeting with Director, ICAR Complex, Bharapani, and Director of Agriculture from NEH states, NGO's, SHG's and other stackholders of seed industries at Imphal on 12-13th November 2013 to chalk out the seed programmes and action plan. Visited seed production plots of Paddy	12-14.11.2013	village Mayang and Kakching, Imphal	Dr. S. Rajendra Prasad
20.	Meeting regarding the Brainstorming session to review the existing DUS (Distinctiveness, uniformity and Stability) policy of the PPV&FRA	05.12.2013	NASC, New Delhi	Dr. S. Rajendra Prasad
21.	Meeting of sub committee to review of the existing DUS (Distinctiveness, uniformity and Stability) policy of the PPV&FRA onwards under the Chairmanship of Dr. R. K. Chawdhary, Former PC (NSP-ICAR).	04.01.2014	DMR, New Delhi	Dr. S. Rajendra Prasad
22.	Meeting of Agrinnovate for formulation and implementation of the action plan on seed sector	17.01.2014	NASC Complex, New Delhi.	Dr. S. Rajendra Prasad
23.	Meeting of the Principal Investigator of different discipline of Seed Technology Research (STR) of AICRP- (NSP) crops	17.01.2014	NASC Complex, New Delhi.	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
24.	Annual Conference of ICAR Directors under the Chairmanship of Dr. S. Ayyappan Secretary, DARE & DG, ICAR, New Delhi.	18-20.01.2014	Baramati & Pune, Maharashtra	Dr. S. Rajendra Prasad
25.	Interaction meeting of ASEAN Trainees with Dr. S. Ayyappan, Secretary, DARE & DG, ICAR, New Delhi	05-06.02.2014	New Delhi	Dr. S. Rajendra Prasad
26.	Meeting of of XII Plan EFC of DSR, Mau	29.01.2014 – 01.02.2014	Krishi Bhawan, New Delhi.	Dr. S. Rajendra Prasad
27.	"One day sensitization workshop on migration from Internet Protocol Version 4 (IPv4) to Internet Protocol Version-6 (IPv6) organized by IASRI, DARE/ICAR transition team	26.02.2014	NASC Complex, New Delhi	Dr. Chandu Singh
28.	Breeder Seed Review Meeting of ICAR Seed Project-NSP (Crops)	07.03.2014	Jaipur	Dr. S. Rajendra Prasad
29.	Meeting regarding Agril. Development of Jharkhand under the Chairmanship Dr. S. Ayyappan, Secretary, DARE & DG, ICAR, New Delhi	10.03.2014	New Delhi.	Dr. S. Rajendra Prasad
30.	Meeting of Institute Varietal Release Committee (IVRC)	15.03.2014	IIVR, Varanasi	Dr. S. Rajendra Prasad
Monitoring				
1.	Monitoring of AICRP – NSP (Crops) & ICAR Seed Project at SKUA&T, Srinagar	05-06.04.2013	SKUA&T, Srinagar	Dr. S. Rajendra Prasad
2.	Monitoring of BSP and ICAR Seed Project activities and also visited to hybrid rice field.	01.11.2013	Raipur	Dr. S. Rajendra Prasad
3.	Visited to Seed Production Centre DSR, GKVK Campus to review the progress and also to arrange procurement of equipments/implements.	02.11.2013	Bangalore	Dr. S. Rajendra Prasad
4.	Visited to Madras Institute of Magnatobiology, Chennai to reviewed the progress of pilot project on influence of pulse magnetic field on seed yield and quality of field crops (NSP project)	04.11.2013	Chennai	Dr. S. Rajendra Prasad
5.	Monitored of BSP and ICAR Seed Project activities	18.12.2013	BHU, Varanasi	Dr. S. Rajendra Prasad
6.	Visited Breeder Seed plots of Sugarcane and reviewed the progress of ICAR Seed Project	13.09.2013	IISR, Lucknow	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
7.	Visited UAS, Bangalore and arranged for inaguration of seed production centre by Hon'ble Secretary, DARE & DG, ICAR Dr. S. Ayyappan Dr. Gautam Kalloo Ex- DDG (Hort. & CS), Director of Research, UAS, Bnagalore & other officers from UAS Bangalore.	08.06.2013	UAS, Bangalore	Dr. S. Rajendra Prasad
8.	Visited and monitored of BSP and ICAR Seed Project activities	06-07.12.2013	OUA&T, Bhubaneswar	Dr. S. Rajendra Prasad
9.	Visited CRIJAF, Barrackpore, Kolkata and seed production plots of jute and interacted with concerned scientist.	30.12.2013	CRIJAF, Barrackpore	Dr. S. Rajendra Prasad
10.	Visited NSRTC, Varanasi along with ASEAN Trainees.	07.02.2014	Varanasi	Dr. S. Rajendra Prasad
11.	Monitored Seed Technology Research Centre, Durgapura, Jaipur	08-09.03.2014	Durgapura, Jaipur	Dr. S. Rajendra Prasad
12.	Visited Seed Production Centre of DSR at GKVK Campus, Bangalore and monitored to made necessary arrangements for farm developments and research activities and also arranged for procurement of equipments/implements.	24.02.2014	Bangalore	Dr. S. Rajendra Prasad
Trainings				
1.	Professional attachment training of Scientist on probation under FOCARS	10.06.2013 – 13.09.2013	Division of Plant Physiology, IARI, New Delhi.	Dr. Ramesh K.V.
2.	Training programme on "Capacity building in taxonomy of insects and mites"	18-22.06.2013	UAS, Bangalore	Dr. Raghavendra D.
3.	Participated in Farmer Training Programme under ICAR Mega Seed Project on Seed Production Technology	25.07.2013	NDUAT, Kumarganj, Faizabad	Dr. S. Rajendra Prasad
4.	Farmers training on "Integrated nutrient management and irrigation requirement for paddy crop"	01.08.2013	DSR, Mau	Dr. T.N. Tiwari
5.	Training programme on Consultancy Project Management at NAARM, Hyderabad	01-07.08. 2013	NAARM, Hyderabad	Dr. Govind Pal
6.	Training on "Advanced training on Seed Pathology for Capacity Building".	23-30.09.2013	Department of Plant Pathology, B. A. College of Agriculture, AAU, Anand, Gujarat	Dr. Asit K. Mandal
7.	10 days training programme on "Detection and measurement of Insecticide resistance including molecular aspects in insect pests"	02-11.09.2013	NBAII, Bangalore	Dr. Raghavendra D.

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
8.	Participated in demonstrations cum training programme on seed production of field crop under TSP	06.11.2013	Maravadi Dharmapuri District, Tamilnadu	Dr. S. Rajendra Prasad
9.	21 day CAFT training in "Advanced "Omics? Techniques for Improvements in Plant and Human Health"	15.11.2013 - 05.12.2013	Biochemistry Division, IARI New Delhi.	Dr. Dhandapani R.
10.	Farmers training on seed production technologies under Seed Village Scheme.	21.01.2014 and 10.02.2014	DSR, Mau	Dr. T.N. Tiwari
11.	Farmers training programme organized by State Unit, Central Ground water board, Allahabad on status and quality of ground water in eastern Uttar Pradesh	28.02.2014 - 01.03.2014	DSR, Mau	Dr. T.N. Tiwari
12.	SAS training programme on Researchers Training –XI: Data Analysis using SAS under NAIP project, organized by IVRI	03-08.03.2014.	DSR, Mau	Dr. A.K. Sinha Dr. Govind Pal Dr. Boraih K.M. Dr. Raghavendra D. Dr. Chandu Singh Dr. Madan Kumar Dr. Ramesh K.V. Dr. Elayaraja K.
Other programmes attended by DSR staff				
1.	Plant Genome Saviour Community Award function	22.05.2013	NASC, New Delhi	Dr. S. Rajendra Prasad
2.	Foundation day of NBAIM Mau and delivered lecture on ^^/kku dh Qly ls dhV ,oa jx icU/ku**	30.05.2013	NBAIM Mau	Dr. A.N. Singh
3.	Foundation day of NBAIM Mau and delivered lecture on "Seed enhancement to improve crop productivity".	30.05.2013	NBAIM Mau	Dr. T. N. Tiwari
4.	Seminar as a Resource Person on Seed/Sapling production, Seed Processing, Storage and Marketing– Challengs and Opportunities organized by BAMETI, Dept. Of Agriculture Bihar	23-24.08.2013	Patna	Dr. S. Rajendra Prasad
5.	Discussed and finalized the EFC of Horticulture Component of ICAR Seed Project with Dr. H. Ravishankar, Director, CISH, Lucknow.	13.09.2013	Lucknow	Dr. S. Rajendra Prasad
6.	Participated in selection procedure for Principal Scientist	22-25.11.2013	ASRB, New Delhi	Dr. S. Rajendra Prasad
7.	Role of IPM in Vegetable Seed Production in Model Training	17-18.12.2013	IIVR, Varanasi	Dr. S. Rajendra Prasad

Sl. No.	Name of programme/ Meeting/ Training	Date/ duration	Venue	Participants
8.	Kisan Mahotsava Evam Mela organized by Krishi Vibhag, Uttar Pradesh.	17–22.12.2013	Mau	Dr. T.N. Tiwari
9.	Coordinated the visit of DG, Uttar Pradesh Council of Agriculture Research visited the DSR, Mau	05.02.2014	DSR, Mau	Dr. T.N. Tiwari
10.	Coordinated the visit of delegation from Nepal comprising Mr. Uttam Kumar Bhattarai, Joint Secretary, Ministry of Agriculture Development and Chairman, National Seed Company Limited and Mr. Nanu Jha, Managing Director, National Seed Company Limited under the Bill & Melinda Gates Foundation funded project "Stress Tolerant Rice for Africa and South Asia (STRASA)" visited the DSR, Mau on 6th February, 2014	06.02.2014	DSR, Mau	Dr. T.N. Tiwari
11.	Participated and put the stall of DSR, Mau in *Krishi Vasant* organized at Nagpur	9-13.02.2014	Nagpur	Dr. S. Natarajan Dr. A.N. Singh
12.	Participated and contributed expert inputs and guidance during the deliberations in the meeting of ICAR Seed Project-Horticulture Component- XII Plan held	22.02.2014	IIHR, Bangalore	Dr. S. Rajendra Prasad
13.	Participated in the 16th Indian Agricultural Scientists and Farmers' Congress during at Integral University	22-23.02.2014	Lucknow	Dr. Govind Pal
14.	Tier III Programme on "Aquifer management through participatory approach and local ground water issues	28.02.2014 – 01.03.2014	DSR, Mau	All scientists of DSR, Mau



Visit of Dr. S. Ayyapan DG, ICAR & Dr. S. Datta, DDG (CS) at the stall of DSR, Mau during Krishi Vasant on 9-13 Febuary, 2014 at Nagpur

5 Intellectual Property Rights

Brief Description

The product/ process/ idea which are outcome of the brain of a person and can be used on commercial scale for the benefit of human kind are called intellectual property. The main problem with intellectual property is that it can be copied, reproduced and used by others resulting in loss of inventor, hence protection of intellectual property is essential so that inventor can derive maximum benefits from his invention. Intellectual property rights are broadly divided in to two groups, viz primary rights & *sui generis* rights. Primary rights includes patents, copyrights, trademarks, trade secrets, trades names, industrial designs, geographical indication etc. *Sui generis* rights include database rights, mask work, plant breeder's rights, traditional knowledge, moral rights & supplementary protection certificates.

IPR Portfolio:

Patent

Patent refer to a document granting an inventor sole rights to an invention for manufacturing and marketing his product/process/invention to derive benefits. Three patents have been filed from Directorate of Seed Research. 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., attended

Title	Organized by	Persons (No)
Patent Awareness workshop	NBAIM, Mau	one

Training/ workshop/Seminar etc., organized

Title	Period	Participants (No)
Poster exhibition on 'IPR' (15th May 2013)	one day	120
Poster exhibition on 'IPR' (28th Feb. 2014)	one day	73
Training Programme on Protection of Plant Varieties & Farmers Rights (19 Spt. 2013)	one day	252

Publications/ Photographs

- Training manual published in Hindi entitled "Padap Kism aur Kisan Adhikar Sarankshan Adhiniyam" by Directorate of Seed Research, Mau, Uttar Pradesh during awareness training program organized on dated 19th Sep. 2013.

Release of training manual on Protection of Plant Varieties & Farmers Rights

- Hindi Article submitted for publication entitled "Patent Dwara Padap Sarankshan" Jitendra Kumar, Arvind Nath Singh and S. Rajendra Prasad, in Beej Patrika June-Dec. 2013 published by Directorate of Seed Research, Mau.
- Participated and Poster entitled "IPRs for Seed in India" presented in international conference on "Impact of technological tools on food security under Global warming Scenario (ITTFS)" to be held at Shobhit University, NH-58, Modipuram, Meerut, UP, India on 11-12 May 2013.

Photographs showing activities under IPR

Sl. No.	Name of programme organized	Date	Place	Coordinator
1.	Awareness Training programme on Protection of Plant Variety and Farmers' Right 2001.	19.09.2013	DSR, Mau	Dr. Arvind N. Singh
2.	Poster exhibition on IPR	15.05.2013 & 28.02.2014	DSR, Mau	Dr Arvind N. Singh

6 Awards

- Dr. Govind Pal, Sr. Scientist (Agriculture Economics), received 'Best Paper Presentation Award' in the national seminar 2013 on Social Dimensions of Extension Education in Holistic Development of Rural Livelihood during April 26-27, 2013 at Lucknow by Indian Society of Extension Education, New Delhi.

- Dr. Govind Pal, Sr. Scientist (Agriculture Economics), received 'Special Achievement Award-Agriculture' by EET CRS, Noida, Uttar Pradesh under Science and Technology Award – 2013.

- Dr. Govind Pal, Sr. Scientist (Agriculture Economics), received 'Bio-ved Young Scientist Associate Award 2014' in the field of Agricultural Economics by Bioved Research Institute of Agriculture and Technology, Allahabad

- Dr. Rajiv K. Singh, Senior Scientist (Agronomy), DSR, Mau has received Krishak Mittra Samman Award for the outstanding while attending award programme at Nanad Kharif Kisan Mela 2013 on 17.05.2013 by NEFORD, Mau.

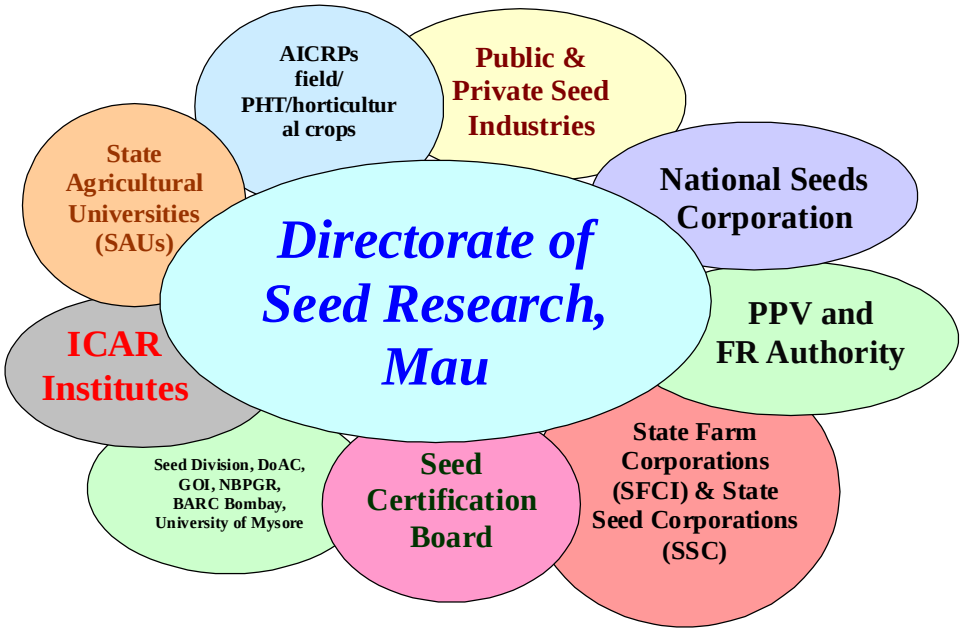
- Best poster presentation award presented for the paper "Somasundaram,G., Vijayakumar H.P, S.Natarajan, S.Rajendra Prasad and M.Bhaskaran (2013) Effect of antioxidants and plant extracts on physiological quality of sunflower seeds" during XII ISST National Seed Seminar 2013: Innovations in seed research and development held at UAS, Bangalore during 8-10 June 2013.

- Dr. S. Rajendra Prasad, Project Director, DSR, Mau, received "*Krishak Mitra Samman*" for working in the welfare of farmers of Eastern UP in facilitating the supply of quality seeds from Nand Educational Foundation for Rural Development (NEFORD) during Nand Rabi Kisan Mela 2013.

7 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.

8 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:

- 2087 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 and DSR Information Bank.
- DSR Information Bank.

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.

9 Publications

Publication in Research Journals

- Ambika Rajendran R, Nirupma Singh and Dhandapani. R. (2013). Scope of Specialty corn for income generation. Agro look: International Crop Science Magazine. October Special News Bulletin,13-18
- Ambika, R., Arunachalam, M., John. J., Ponnusam.y S., Dhandapani, R. (2014). Heterotic grouping and patterning of quality protein maize inbreds based on genetic and molecular marker studies *Turk. J. Biol.*, 38, 10-20.
- Arvind N. Singh, Soumya Rajan, Devaramane Raghavendra and S. Rajendra Prasad. (2013). Effect of Various Plant Extracts as Repellents against Adults of *Tribolium castaneum* (Herbst), *Rhyzopertha dominica* (F.) and *Sitophilus oryzae* (L.). *Indian journal of plant protection* 41(4): 296-300.
- Chandrakala, J. U., Ashish K. Chaturvedi, Ramesh, K. V., Rai, P., Khetarpal, S. and Madan Pal (2013). Acclimation response of signalling molecules for high temperature stress on photosynthetic characteristics in rice genotypes. *Indian Journal of Plant Physiology*, 18(2): 142-150.
- Chandu Singh P.R., Singh N.K., Prabhu K.V., Vinod K.K. and Singh AK. (2013). Molecular mapping of quantitative trait loci for grain chalkiness in rice (*Oryza sativa* L.). *Indian J Genet*, 73: 244-251.
- Chandu Singh P.R., Singh N.K., Prabhu K.V., Vinod K.K. and Singh AK. (2013). Variability, correlation and validation of marker trait association for grain chalkiness traits in rice (*Oryza sativa* L). *Indian J Genet*, (communicated-Manuscript number is ED – 2013 / 285)
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- gjUn ukjk;.k pkgku] jkeu;u ;kno] me'k vkj- dkEcy] Vh-,u- frokjh ,o mn; Hkk"dj d- ½2013½] Hkkjrh; df"k e flpkb lfo/kk; ,o fodkl] cht if=dk] o"k 1] vd 1] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 41&43A
- jktho d- flg] ,- ,u- flg] ,l- jktUn ilkn] e;d d- jk; ,o jkt'k d pkgku ½2013½ eDdk dh mUur mRiknu rduhdh] Qke ,u QM if=dk] fnYyh Ádk'ku forj.k Ák- fy-] ub fnYyhA
- jktho dekj flg] gjno jke] vjfoUn ukFk flg] ,-d- nc] v:.k d pronh ,o vkj-d- pkgku ½2013½] xg dk cht mRiknu rduhfd&,d ykHkdkjh vk;ke] uUn ilkj T;kfr] [kjhQ fdlku eyk fo'k"kkd 2013] it u- 20&25A
- jktho dekj flg] gjno jke] vjfoUn ukFk flg] vkj-d- pkgku] t-d- f=ikBh ,o v:.k d- pronh ½2013½] [kjhQ /kkU; Qlyk e [kjirokj icU/ku] uUn ilkj T;kfr] [kjhQ fo'k"kkd 2013] it u- 48&53A

- jktho dekj flg] gjno jke] xkfoUn iky] ih-vkj- pk/kjh] vjfoUn ukFk flg] by;k jktk d-] ,- d- nc ,o vkj- d- pkgku ½2014½] /kku dh vf/kd cht mRiknu ,o vk; nu okyh mUur'khy itkfr;k] Lekfjdk fdlku eyk 2014] it u- 5&21A
- mn; irki 'kkgh] vjfoUn ukFk flg ,o ch-ih- /;kuh ½2014½] enk mojrk e tfod [kkn dk egRo ,o r;kj dju dh fof/k] Lekfjdk fdlku eyk 2014] it u- 47&52A
- Vh- ,u- frokjh] ,- d- flUgk] ,- ,u- flg] jktho d- flg] ,- d- e.My ,o ,l- jktUn Álkn ½2014½ Ckht mRiknu dk;Øe] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 1&4A
- Vh-,u- frokjh] ,-d- pronh] fnlrh dey] t-d- f=ikBh ,o ,l- jktUn ilkn ½2013½] cht Hk.Mkj.k d nfgdh; igy] cht if=dk] o"k 1] vd 1] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 8&11A
- Vh-,u- frokjh] fnlrh dey ,o v:.k dekj pronh ½2014½] chtk dk ikjEHku dj vPNh Qly o vPNh mit çkIr dj] fdlku eyk Lekfjdk] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 34&36A
- Vh-,u- frokjh] fnlrh dey ,o v:.k dekj pronh ½2014½] fefJr [krh viukdj vf/kd ykHk dek;] fdlku eyk Lekfjdk] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 3&4A
- Vh-,u- frokjh] fnlrh dey] v:.k dekj pronh ,o xkfoUn iky ½2013½] cht ljpuk ,o mld idkj] cht if=dk] o"k 1] vd 1] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 15&19A
- Vh-,u- frokjh] fnlrh dey] v:.k dekj pronh] vEcjh'k dekj nc ,o jkeu;u ½2013½] fHkUMh dk chtkRiknu] cht if=dk] o"k 1] vd 1] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 33&34A
- vuegk iUr] vjfoUn ukFk flg] ,-d- flUgk ,o jktho dekj flg ½2013½A ckf)d lEink vf/kdkj] cht o"k 1] vd 1 it u- 44&45A
- x®fcUn iky] jktho d- flg] gjno jke ,o by;k jktk d ½2014½ of'od ifji{; e Hkkjrh; cht m|¨x] b{k if=dk] o"k 2] vd 2] Hkkjrh; xUuk vul/kku lLFkku] y[kuÅ] it u- 40&41A
- x®fcUn iky] jktho d- flg] gjno jke ,o vjfcUn ukFk flg ½2014½] xg dk Áekf.kr Ckht mRiknu ykxr ,o ykHk] fdlku eyk Lekfjdk] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 53&56A
- xkfoUn iky] jktho d- flg] gjno jke ,o Vh-,u- frokjh ½2013½] vf/kd vk; ,o jktxkj d fy, cht mRiknu] cht if=dk] o"k 1] vd 1] cht vul/kku fun'kky;] d'kekj] eÅ] it u- 38&40A

Leaflet

- Boraiah, K.M., Sinha, A.K., Vetriventham, M., Raghavendra, D., Chandu Singh and Prasad Rajendra, S. "Uttar Pradesh ke liye saraso ki anukool prajatiya aur sankar kisme" published at *Kissan Mela* organized by DSR, Mau on 14.03.2014.
- Mandal, A. K., Tiwari, T. N., Singh, R. K., Kumar, M., Hardevram, R., Rahgavendra, D., Pundey, N. and Prasad, S. R. Shukhsmajeebi dara beej ka jaibik upchar. Published at *Krishi Mela* organized by DSR, Mau on 14.03.14.
- Raghavendra D., Singh, A. N., Bhaskar, U. K., Kamble, U.R., Mandal, A.K., Kumar, S., Chauhan, H.N and Prasad , S.R. Dalhani phasalo ka mukhya akikrit keet prabandhan. Published during Kissan Mela organized by DSR, Mau on 14.03.2014.
- Tiwari, T. N., Sinha, A. K., Singh, A. N., Singh, R. K., Mandal, A. K., Kumar, M., and Prasad, S. R. Beej utpadan karyakram. Published at *Krishi Mela* organized by DSR, Mau on 14.03.14.
- Tiwari, T.N. Singh A.N., Kamble Umesh R. and Prasad, S. Rajendra. Technological recommendation on seed enahcement, seed protection and seed production. Published at Krishi Mela organized by DSR, Mau on 14.03.2014.

Research Guidence

Sl. No.	Name of students with course programme	Title of thesis dissertation	Institutions concerned	Duration of dissertation	Supervisor
1.	Ms. Kanu Priya B. Tech. student	Molecular characterization of KBSH-53 sunflower hybrid and revalidation of informative SSR marker for hybrid purity testing	Jaipur national university, Jaipur	6 months	Dr. Dhandapani R. Scientist (Pl. Physiol.)
2.	Ms. Suman Singh B.Sc. (Biotech) student	Biopriming for seed quality enhancement of Chickpea (*Cicer arientinum*)	Dr. M.P.S. College, Agra (Affiliated to Dr. B.R.A. University, Agra)	3 months	Dr. Asit K. Mandal Scientist (Pl. Pathology)
3.	Mr. Nitin Kumar Yadav B.Sc. (Biotech) Student	Seed priming induced changes in seed quality parameters and enzyme activity in early and late shown wheat varieties.	Dr. M.P.S. College, Agra (Affiliated to Dr. B.R.A. University, Agra)	6 months	Dr. T.N. Tiwari, Sr. Scientist (Pl. Physiology)

Radio/Doordarshan Talk

Sl. No.	Name of the speaker	Subject	Date	Organizer
1.	Dr. Govind Pal	Beejotpadan Ke Arthik Pahalu	10.07.2013	Doordarshan Kendra, Mau
2.	Dr. T.N. Tiwari	Integrated nutrient management in paddy crop	10.07.2013	Doordarshan Kendra, Mau
3.	Dr. Rajiv K. Singh	Seed production technology in paddy	10.07.2013	Doordarshan Kendra, Mau
4.	Dr. Elayaraja K.	Package of practices of hybrid maize for Eastern UP in Kharif season	10.07.2013	Doordarshan Kendra, Mau
5.	Dr. Govind Pal	Gunavattayukta Beej Utpadan Ka Mahatva Va Isme Aay Vyay	11.09.2013	Doordarshan Kendra, Mau
6.	Dr. T.N. Tiwari	Integrated nutrient management in rabi crops	11.09.2013	Doordarshan Kendra, Mau
7.	Dr. Hardev Ram	Toria ke beej utapadan takniki	11.09.2013	Doordarshan Kendra, Mau
8.	Dr. Rajiv K. Singh	Seed production technology in mustard	11.09.2013	Doordarshan Kendra, Mau
9.	Dr. A.K. Sinha	Chana ke desi aur kabuli prabhedo ke beej utpadan me aawashyak sawdhaniyan	11.09.2013	Doordarshan Kendra, Mau
10.	Dr. Madan Kumar	Importance of micronutrients in crop plants	31.12.2013	Doordarshan Kendra, Mau
11.	Dr. A.K. Sinha	Purvanchal ke liye gehu ke upyukt prabhedo ki visheshtayen	31.12.2013	Doordarshan Kendra, Mau

10 Extension Activities

A. Seed Village Scheme

- 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 from *Kharif* 2013 and Rabi 2013-14.

No. of districts covered	:	Mau, Ballia, Ghazipur, Varanasi and Chandauli
No. of villages covered	:	750 Villages
Area covered	:	14691 acres
Seeds distributed	:	4141.71 quintals
No. of farmers benefited	:	14691 farmers
Crops	:	**Pigeon pea** (Narendra Arhar-1 & 2)

Paddy (MTU 7029, MTU 1010, Sarju-52, PR-113, PR-118, CSR-36, IR-36, Kalanamak, BPT-5204, IPB-1, Pusa Sugandh-3, Pusa Sugandh-5 and Malviya Sugandha-105)

Mustard (Pusa Tarak, Ashirwad, Rohini, NDR 8501 & Varuna)

Lentil (DPL 62, IPL 406, IPL 81, HUL 57)

Chick pea (Pusa 362, Avarodhi, KPG 59 & DCP-92-3)

Wheat (HD 2733, DBW 39, PBW 621, HD 2967, KRL 213, PBW 343, PBW 502, PBW 550, WH 711, PBW 373, PBW 154, HD 2643, HD 2687, WR 544, NW 2036, UP 2338, Raj 3765, Raj 3777 and Unnat Halna)

Mk- vVku ijdk;LFkk] l;Dr lfpo ¼cht½] df"k ,oa lgdkfjrk foHkkx] Hkkjr ljdkj fdlkuksa dk vkfkZ; ,oa iekf.kr cht forj.k djrs gq,

B. Kisan Mela/ Kisan Gosthi organized

Kisan Mela

Directorate of Seed Research (DSR), Kushmaur, Mau, organized Kisan Mela on 14th March, 2014. Kisan Mela was inaugurated by Dr. A.K. Sharma, Director, NBAIM, Mau. Whereas, as special invitees Dr. Nepal Singh, Deputy Director, Uttar Pradesh State Seed Certification Agency, Mau; Dr. P.S. Pathak, Ex-Director, IGFRI, Jhansi; Dr. R. K. Singh, Director, NEFORD and Sh. Harivansh Dwivedi, Progressive farmer were present and graced the occasion.

Dr. S. Rajendra Prasad, Projector Director of this Institute welcomed the Chief Guest, dignitaries, farmers and students and highlighted the major achievements of the Institute. He said that the techniques developed by the institute are performing very well in the eastern Uttar Pradesh. Different prizes were awarded to best exhibition stalls and farmers. Dr. TN Tiwari anchored during the entire programme of *Kisan Mela* and Dr. Arvind Nath Singh, Senior Scientist and Convener of *Kisan mela* proposed vote of thanks at the end.

Organization of *Kisan Mela* on 14.03.2014 at DSR, Mau

C. Field day/Kisan Gosthi organized

S. No	Name of activity	Coordinator	Date	Venue
1.	Field Day on Paddy	Dr. Arvind N. Singh	19.10.13	DSR, Mau

Field day organized at DSR, Mau

D. Kisan Mela/ Kisan Gosthi attended and displayed stall

The Scientists of DSR have attended the following Kisan Mela/Gosthies and delivered the lectures on their topic and the also put the stall and seed sale counter.

S. No	Venue	Organizer	Coordinator	Date
1	BHU Varanasi	Institute of Agriculture sciences, BHU, Varanasi	Dr. Arvind N. Singh	07.03.2014 to 08.03. 2014
2	Mau	NEFORD, Mau	Dr. Arvind N. Singh	17.05.2013
3.	Krishi Vasant, Nagpur	Ministry of Agriculture and Confederation of Indian Industry (CII)	Dr. Arvind N. Singh	09.02.2014 to 13.02.2014
4.	*Kisan Mahotsava* Mau	Agriculture Department, Mau, U.P.	Dr. Arvind N. Singh	23 to 25-12-2013
5.	Mau	NEFORD, Mau	Dr. Arvind N. Singh	31.10. 2013
6.	Mau	Office, Chief Development Officer, Mau.	Dr. Arvind N. Singh	13.06.2013
7.	Patna	ICAR Research Complex For Eastern Region, Patna.	Dr. Arvind N. Singh	6- 7.12.2013
8.	Varanasi	Indian Institute of Vegetable Research, Varanasi.	Dr. Arvind N. Singh	1.02.2014

Participation of Project Director, DSR and Scientists at Kisan Mela/Kisan Ghosthi organized by NEFORD in Mau

E. Seed Selling Counter facility

Different classes of seeds of following crop varieties were available and sold on seed sale counter at DSR, Mau during 2013-14.

Crop	Class of seed	Varieties
Paddy	Breeder, foundation, certified and truthful labeled seeds	Sarju 52, MTU 7029, HUR 105, BPT 5204, Pusa Sugandh-2, Pusa Sugandh-3, Pusa Sugandh-4 (Pusa 1121) Pusa Sugandh-5, Pusa Sugandh-6, and Improved Pusa Basmati 1
Mustard	Breeder, foundation, certified and truthful labeled seeds	Pusa Tarak, Ashirwad, Rohini, NDR 8501 & Varuna
Lentil	Breeder, foundation, certified and truthful labeled seeds	DPL 62, IPL 406, IPL 81 & HUL 57
Chickpea	Breeder, foundation, certified and truthful labeled seeds	Pusa 362, Avarodhi, KPG 59 & DCP-92-3
Field pea	Breeder, foundation, certified and truthful labeled seeds	KPMR 400
Barley	Breeder, foundation, certified and truthful labeled seeds	Gitangali
Wheat	Breeder, foundation, certified and truthful labeled seeds	HD 2733, DBW 39, PBW 621, HD 2967, KRL 213, PBW 343, PBW 502, PBW 550, WH 711, PBW 373, PBW 154, HD 2643, HD 2687, WR 544, NW 2036, UP 2338, Raj 3765, Raj 3777 & Unnat Halna
Mungbean	Breeder, foundation, certified and truthful labeled seeds	SML 668 & Pusa Vishal

Seed sale at seed sale counter during rabi 2013 at DSR, Mau

11 jkt Hkk"kk dk okf"kd izxfr izfrosnu

iR;d o"k dh Hkkfr o"k 2013&14 e jkt Hkk"kk dk;kUo;u lfefr }kjk fgUnh dh mi;kfxrk c<ku] bld ipkj&ilkj ,o ikR lkgu gr vudk dk;Øe cht vul/kku fun'kky; e vk;kftr fd; x;A fgUnh d ipkj&ilkj dk c<kok nu gr fnukd 14 flrEcj 2013 l 13 vDVcj 2013 dh vof/k e Øe'k fgUnh fnol] llrkg] i[kokMk ,o pruk ekl d vk;ktu fd; x; ftld vUrxr fofHkUu idkj d dk;Øe ,o ifr;kfxrkvk dk vk;ktu gvkA Mk- ,l- jktUn ilkn] ifj;ktuk fun'kd dh v/;{krk e vk;kftr bl lekjkg d nkjku oDrkvk u fgUnh d fujUrj i;kx] ipkj@ilkj ,o mld ifr lei.k }kjk ml vkj vf/kd le) cuku dh vko';drk ij cy fn;kA ifj;ktuk fun'kd Mk- ,l- jktUn ilkn u viu mnck/ku e fgUnh Hkk"kk dk c<kok nu dh vko';drk ij tkj fn;k rFkk oKkfudk] vf/kdkfj;k ,o depkfj;k dk fofHkUu ifr;kfxrkvk e Hkkx yu d fy, ifjr fd;kA mUgku dgk fd fgUnh gekjh jkt Hkk"kk g vkj ftldk fgUnh dk dk;lk/kd Kku ikIr ugh g o 'kh?k gh Hkkjr ljdkj d if'k{k.k dUn l ick/k] ioh.k o iKk d ikB;Øek e lfEefyr gkdj fgUnh dk Kku ikIr dj rFkk tk ykx {k= ^d^ l lEcfU/kr g o viuk 70 ifr'kr dk; vfuok; :i l fgUnh e djA blh fnu fgUnh fucU/k y[ku ifr;kfxrk ¼oKkfud ox] xj fgUnh Hkk"kh½ lEiUu gb] ftle oKkfudk u mRlkg l Hkkx fy;kA

fgUnh pruk ekl d nkjku vk;kftr fd;s tkus okys dk;Øeksa dk foLr`r fooj.k fuEukuqlkj gA

fnukd o le;	dk;Øe@ifr;kfxrk	ifrHkkxh
16-09-2013] vijkUg 3%30 ct	dk;Øe dk 'kHkkjEHk ,o fgUnh fucU/k y[ku ifr;kfxrk	oKkfud lox ¼xj fgUnh Hkk"kh½
01-10-2013] vijkUg 3%00 ct	i'u ep ¼lkeU; Kku i'ukUkjh ifr;kfxrk½	leLr lox
03-10-2013] vijkUg 3%30 ct	fucU/k y[ku ifr;kfxrk	oKkfud lox ¼fgUnh Hkk"kh½
04-10-2013] vijkUg 3%30 ct	fucU/k y[ku ifr;kfxrk	i'kklfud lox
05-10-2013] vijkUg 3%30 ct	fgUnh Vd.k ifr;kfxrk	leLr lox
07-10-2013] vijkUg 3%30 ct	fucU/k y[ku ifr;kfxrk	rduhdh lox
08-10-2013] vijkUg 3%30 ct	rkRdkfyd Hkk"k.k ifr;kfxrk	leLr lox
09-10-2013] vijkUg 3%30 ct	dkS; ikB	leLr lox
10-10-2013] iokUg 11%00 ct	dk;'kkyk@xk"Bh % Hkkjrh; [kk| lj{kk e cht dk ;kxnku	leLr vf/kdkjh ,o depkjh rFkk yxHkx 100 fdlku
16-10-2013] vijkUg 3%30 ct	ifj;ktuk fun'kd egkn; }kjk fot;h ifrHkkfx;k dk ijLdkj forj.k mnck/ku ,o lekiu lekjkgA	

fgUnh dk;Z'kkyk@xk"Bh dk vk;kstu % fgUnh pruk ekl d vUrxr fgUnh dk;Z'kkyk@xk"Bh fnukd 10-10-2013 dk vk;kftr dh x;h ftldk 'kh"kd ^^Hkkjrh; [kk| lj{kk e chtk dk ;kxnku^^ Fkk tk i.k:i l fgUnh Hkk"kk e FkhA mijkDr dk;Z'kkyk e 100 l vf/kd {k=h; fdlkuk u Hkkx fy;k rFkk chtk vul/kku fun'kky; d fofHkUu oKkfudk@fo"k; fo'k"kKk }kjk Hkkjrh; [kk| lj{kk e chtk d ;kxnku ij viu&viu fopkj 0;Dr fd; x;A dk;Øe dk vk;kstu fgUnh lfefr }kjk fd;k x;k ftle Mk- Vh-,u- frokjh ,o v:.k dekj pronh u dk;Øe dk dk;kUo;u lQyrkiod fd;kA

pruk ekl d lekiu volj ij fofHkUu ifr;kfxrkvk e fot;h jg ifrHkkfx;k dk Mk- ,l- jktUn ilkn] ifj;ktuk fun'kd] chtvul/kku fun'kky; ,o fof'k"B vfrFk Mk- v:.k dekj 'kekZ] fun'kd] jk"Vh; df"k mi;kxh l{etho C;jk }kjk iek.k i= ,o ijLdkj inku fd;k x;kA

12 Distinguished Visitors

Sl. No.	Name	Date	Designation
1.	Dr. L.V. Subba Rao, Member, IMC	06.07.2013	Pr. Scientist, DRR, Hyderabad
2.	Dr. V. K. Singh, Member, IMC	06.07.2013	Pr. Scientist, PDFSR, Meerut
3.	Dr. Arun Kumar MB, Member, IMC	06.07.2013	Sr. Scientist, DSST, New Delhi
4.	Dr. H. C. Prasanna, Member, IMC	06.07.2013	Sr. Scientist, IIVR, Varanasi
5.	Sh. Joginder Singh, Member, IMC	06.07.2013	Progressive Farmer, Mau
6.	Sh. A. K. Srivastava, Member, IMC	06.07.2013	F &AO, IISR, Lucknow
7.	Dr. R.R.Hanchinal, Chairman, RAC	18.09.2013	Chairman, PPV & FRA, New Delhi
8.	Dr. J.S.Chauhan, Member, RAC	18.09.2013	ADG (Seeds), ICAR, New Delhi
9.	Dr. N. Seetharama, Member, RAC	18.09.2013	Ex. Director, DSR, Hyderabad
10.	Dr. R.K. Chowdhury, Member, RAC	18.09.2013	Former Project Coordinator (NSP) & Former OSD, DSR, Mau
11.	Dr. V. Sankaran, Member, RAC	18.09.2013	Director, Quality Management (QM), Krishidhan Seeds Ltd., Aurangabad Road, Jalna
12.	Dr. M. Bhaskaran, Member, RAC	18.09.2013	Prof. & Head, Department of Seed Science & Technology, TNAU, Coimbatore
13.	Dr. Ram Kathin Singh, Member, RAC	18.09.2013	Director, (NEFORD) , Lucknow
14.	Dr. N.N.Singh, Chairman, DPC	21.08.2013	Ex-VC, BAU, Ranchi
15.	Dr. Major Singh, DPC, Member	21.08.2013	Head & Principal Scientist, IIVR, Varanasi
16.	Dr. S.P.Singh, DPC, Member	21.08.2013	Professor, BHU, Varanasi
17.	Dr. Kodandaram MH, DPC, Member	21.08.2013	Sr. Scientist, BHU, Varanasi
18.	Dr. S.N.Sinha Chairman, DPC	12.12.2013	Ex-Principal & Head, IARI, New Delhi
19.	Dr. P.S.Singh, DPC Member	12.12.2013	Prof., Deptt. Of Ento. & Agric. Zoology, IAS, BHU, Varanasi
20.	Dr. Razi Ahamad, DPC, Member	12.12.2013	Ex-Principal Scientist, IIPR, Kanpur
21.	Dr. A. B. Rai, DPC Member	12.12.2013	Principal Scientist, IIVR, Varanasi
22.	Dr. Rajendra Kumar	05.02.2014	DG, Uttar Pradesh Council of Agriculture Research, Lucknow
23.	Mr. Uttam Kumar Bhattarai	06.02.2014	Joint Secretary, Ministry of Agriculture Development and Chairman, National Seed Company Limited, Nepal
24.	Mr. Nanu Jha	06.02.2014	Managing Director, National Seed Company Limited, Nepal
25.	Dr. Kalyan Singh (Chairman, DPC)	25.02.2014	Ex-Head, Deptt. of Agronomy, BHU, Varanasi
26.	Dr. S. P. Singh, DPC Member	25.02.2014	Ex-PS, IARI, New Delhi
27.	Prof. S. P. Singh, DPC, Member	25.02.2014	Ex- Director & OSD, IAS, BHU, Varanasi

Visit of Hon'ble members of RAC on DSR farm

Visit of delegation from Nepal comprising Mr. Uttam Kumar Bhattarai, and Mr. Nanu Jha at DSR, Mau

International training programme (valedictory session) on 08. Feb. 2014 at DSR, Mau

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

13.1. Research Advisory Committee

Dr. R.R. Hanchinal	:	Chairman
Dr. J. S. Chauhan	:	Member
Dr. S. Rajendra Prasad	:	Member
Dr. S.K. Rao	:	Member
Dr. N. Seetharama	:	Member
Dr. R.K. Chowdhury	:	Member
Dr. M. Bhaskaran	:	Member
Dr. V. Sankaran	:	Member
Dr. Ram Kathin Singh	:	Member
Shri Joginder Singh	:	Member
Dr. T. N. Tiwari	:	Member Secretary

13.2. 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. Natarajan	:	Member Secretary

13.3. Institute Management Committee (IMC)

Dr. S. Rajendra Prasad	:	Chairman
Shri Mukesh Gautam	:	Member
Dr. P.L. Maliwal	:	Member
Dr. V.P. Kannaujia		Member
Dr. Ram Kathin Singh	:	Member
Shri Joginder Singh	:	Member

Dr. Arun Kumar M.B.	:	Member
Dr. H.C. Prasanna	:	Member
Dr. L.V. Subba Rao	:	Member
Dr. V.K. Singh	:	Member
Dr. J.S. Sandhu	:	Member
Shri A.K. Srivastava	:	Member
Shri Ajay Kumar Soni	:	Member Secretary

13.4. List of Personnel

Research Management Position (RMP)

Dr. S. Rajendra Prasad	-	Project Director

Scientific Staff

Dr. T.N. Tiwari	-	Senior Scientist (Plant Physiology)
Dr. Dhandapani R.	-	Scientist (Plant Physiology)
Shri Madan Kumar	-	Scientist (Plant Physiology)
Sh. Ramesh K.V.	-	Scientist (Plant Physiology)
Dr. Asit K. Mandal	-	Scientist (Plant Pathology)
Dr. S. Natarajan	-	Principal Scientist (Seed Technology)
Shri Vijaykumar HP	-	Scientist (Seed Technology)
Shri Somusundaram G.	-	Scientist (Seed Technology)
Shri Umesh Ravindra Kamble	-	Scientist (Seed Technology)
Dr. Udaya Bhaskar K.	-	Scientist (Seed Technology)
Dr. Dinesh Kumar Agarwal	-	Principal Scientist (Genetics & Plant Breeding)
Dr. A.K. Sinha	-	Senior Scientist (Plant Breeding)
Shri Chandu Singh	-	Scientist (Plant Breeding)
Shri Boraiah K.M.	-	Scientist (Plant Breeding)
Dr. Elayaraja K.	-	Scientist (Plant Breeding)
Dr. Bhojraja Naik	-	Scientist (Plant Breeding)
Dr. Rajiv K. Singh	-	Senior Scientist (Agronomy)
Sh. Hardev Ram	-	Scientist (Agronomy)

Dr. A. N. Singh	-	Senior Scientist (Entomology)
Shri Deveramane Raghavendra	-	Scientist (Entomology)
Dr. Govind Pal	-	Senior Scientist (Economics)
Radhika C.	-	Scientist (Economics)

Technical Staff

Shri S.A.M. Rizvi	-	T-5	Shri Nanhak Singh	-	T-5
Shri Arun Kumar Chaturvedi	-	T-2	Shri J. K. Tripathi	-	T-2
Shri Abhishek Kumar Rai	-	T-2	Shri Sudheer Kumar Singh	-	T-1
Shri Ambrish Dubey	-	T-1	Shri Rajesh Chauhan	-	T-1
Shri Sunil K. Kannujiya	-	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

14 Staff position

Manpower

At present the directorate has 02 principal scientists, 05 senior scientists, 15 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 31.03.2014
Project Director	01	01
Scientist	37	22
Technical	22	09
Administrative	15	06
Supporting	08	01
Total	**83**	**39**

15 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	Total
A. Recurring								
Pay & Allowances	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	97.11
HRD	1.00	2.00	4.50	0.00	1.00	1.81	4.21	14.52
Contingencies	120.00	100.00	138.60	206.98	163.47	204.19	249.12	1182.36
Total (A)	**127.00**	**110.00**	**156.60**	**222.92**	**180.47**	**222.00**	**275.00**	**1293.99**
B. Non – Recurring								
Equipments	120.00	46.00	185.90	232.39	45.16	52.05	70.96	752.46
Works	10.00	0.00	1.38	24.99	58.79	117.69	0.00	212.85
Library	20.00	10.00	8.26	11.99	15.58	24.10	6.55	96.48
Land	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	65.75
Total (B)	**173.00**	**56.00**	**202.61**	**280.83**	**119.53**	**213.47**	**82.10**	**1127.54**
Grand Total (A+B)	**300.00**	**166.00**	**359.21**	**503.75**	**300.00**	**435.47**	**357.10**	**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

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

R- Deposit Schemes

Name of R- Deposit Scheme	2013-14	
	Budget	Expenditure
Annual Oil Seed Scheme funded by DAC	0.00	0.00
ICAR Seed Project: Seed production in agricultural crops (ICAR institute fresh sanction and SAUs spill over revelidated)	490.00	489.25
AICRP- NSP (Crops)	1980.00	1978.48

16 List of in-house Research Projects (2013-14)

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.)

(M. Ventriventhan, S. Rajendra Prasad, Hari D. Upadhyaya and Raghvendra D.)

Seed Physiology, Storage & Testing

5. Studies on seed priming induced physico-chemical and isozyme changes and its effect on crop performance in pegion pea (*Cajanus cajan* L)

(T. N. Tiwari & Dhandapani R.)

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

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

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 & Certification

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

(Rajeev Kumar Singh, T. N. Tiwari & 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)

Seed Protection

13. Resistance to commonly used insecticides in important storage insect pest and their management.

(A. N. Singh & T. N. Tiwari)

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

(A. K. Mandal and Dhandapani R.)

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.)

Seed economics & policy research

16. 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.)

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

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

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

(Udaya Bhaskar K.)

5. Intellectual Property Rights

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

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 certificate carry a gold label.

Note

Note

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agri search with a human touch

Towards second green revolution through use of quality seeds

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