



DIRECTORATE OF SEED RESEARCH
चत वुक्ला/क्कु फुन्स'क्क्य;



VISION 2030





Directorate of Seed Research

(Indian Council of Agricultural Research)

Kushmaur, Kaithauli, Mau 275 101 (U. P.)

www.dsr.org.in

VISION 2030



Directorate of Seed Research
Kushmaur, Kaithauli
Mau 275 101 (UP)
INDIA

PRINTED : July, 2011

Compiled & Edited by : Drs. T.N. Tiwari, R.K. Singh, A.N. Singh,
Dhandapani R., Sh. Vijayakumar HP &
Somasundaram G.

Published by : Project Director
Directorate of Seed Research
Kushmaur, Mau 275 101, UP

Cover designed by : Sh. A.K. Chaturvedi

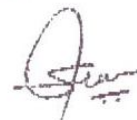
Copyright : All rights reserved. Source of information has to be
acknowledged. No. part of this publication may be
reproduced, stored in a retrieval system, or
transmitted in any form or by any means,
electronic, mechanical, photocopying, recording or
otherwise, without the prior written permission of
the publisher

Foreword

The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

Seed is the basic and most critical input for sustainable agriculture. The response of all other inputs depends on quality of seeds to a large extent. It is estimated that the direct contribution of quality seed alone to the total production is about 15 - 20% depending upon the crop and it can be further raised up to 45% with efficient management of other inputs. In augmenting seed sector, establishment of Directorate of Seed Research was a phenomenal which has led to sea change in the seed sector as witnessed by increase in production of all classes of seed through the projects including AICRP-NSP (Crops) and seed production in agricultural crops. Ample scope exists to augment agricultural production in almost all crops in near future simply by capitalizing the benefits of quality seeds. On the other hand, ICAR has the onus to protect the seeds of traditional varieties so as to maintain the genetic diversity in different crops as well as to protect the farmers' interest for traditional varieties. Emerging new tools and techniques must be used judiciously in seed enhancement research as well as in testing genetic purity of inbred / hybrid / transgenics in the days to come more precisely with ease and confidence.

It is expected that the analytical approach and forward looking concepts presented in the 'Vision 2030' document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.



(S. Ayyappan)

Dated the 8th July, 2011
New Delhi

Secretary, Department of Agricultural Research & Education (DARE)
and Director-General, Indian Council of Agricultural Research (ICAR)
Krishi Bhawan, Dr. Rajendra Prasad Road,
New Delhi 110 114

Preface

Directorate of Seed Research is an important institute coordinating seed research in the country, established during December, 2004 by up grading AICRP-NSP (Crops) as Project Directorate. The directorate has made the significant achievements in the previous years by conducting basic, applied, strategic and anticipatory research in seed science and technology and effective coordination and monitoring of four nationwide network projects, as envisaged in its mandate. The progress of Breeder Seed Production during 2009-10 was spectacular and touching the level of 115866.81q. Under Annual Oilseed Scheme, the production of breeder seed was 23370.84q against an indent of 17519.80q in groundnut, 7163.75q against 11901.20q in soybean and 68.01q against 18.58q in sunflower, respectively. Under the project 'Seed production in agricultural crops' the total production of quality seeds including all classes were 637618 q along with 606.17 lakh plating materials. Molecular characterisation of two cotton hybrids (CICR-2 and CSHH198) along with their parents was done by cotton specific SSR markers to assess the genetic purity at genomic level. Priming of rice seeds with 20 – 30mM KNO₃ for 12 h significantly enhanced the seed germination, seedling dry weight and vigour index and it might be considered as efficient seed enhancement technique for the farmer's saved seed. The pathogenic micro-flora associated with the seed of all the commercially cultivated wheat varieties in eastern Uttar Pradesh was studied and *Alternaria triticina*, *Helminthosporium sativum*, *Alternaria alternata*, *Alternaria tenuissima* and *Curvularia lunata* were the common pathogens among them. The probable alternate sites for hybrid seed production were identified in rice, sunflower, maize castor, sorghum, pearl millet and pigeon pea crops. First and final count either singly or in combination with seedling dry weight can assess the planting value in sorghum and soybean while accelerated ageing test for 96 h is good for assessing storability. Carbondioxide (CO₂) provide complete killing of storage insects of paddy and maize at 40% conc. (v/v) upto 12 months of storage under ambient conditions with seed germination above the IMSCS.

The first attempt to envision the challenges, opportunities and scope in the field of seed science and technology was undertaken in the previous years by preparing the prospective plan 2025 by the Directorate. Now to address the changes that had taken place in the field of seed science research and quality seed production, the present document DSR VISION 2030 articulates the strategies to overcome the challenges by harnessing the potential of research and undertaking partnership with different stake holders in seed supply chain at national and international level.

I would like to express my sincere gratitude to Hon'ble Secretary DARE and Director General, Indian Council of Agricultural Research for his invaluable guidance in preparing DSR VISION 2030. I am thankful to Hon'ble Deputy Director General (Crop Science) and Assistant Director General (Seed) who has taken keen interest in preparing this document. I also appreciate the efforts made by Drs T.N. Tiwari, A.N. Singh, R.K. Singh, Sh. Vijayakumar H.P. and Somasundaram G. in bringing out this document. I am sure that DSR VISION 2030 would provide a direction to leverage the power of science for achieving high quality research in seed science and technology and quality seed production in the country.

(D.K. ARORA)
Project Director
Directorate of Seed Research

Preamble

It is mentionable that agriculture constitutes the lifeline of villages where more than 70% of Indian population lives. Agricultural research and development constitutes the most important component in the gamut of hectic activities to bring forth agriculture in fast motion by development of appropriate technological backstopping to augment productivity and production of the country. Indian agriculture has undergone tremendous metamorphosis especially during the post independence days to ensure food and nutritional security of its burgeoning population. Food production from mere 50 million tons in 1950 has touched an all time record of approximately 235 million tons in 2010-11. While retrospectively this spectacular achievement, significant contribution of agricultural technologies, hard work of the farmers and enabling policy support from the Governments are found to be the prime mover in enhancing productivity *sensu lato*. Development of technologies, their fine tuning to address niche specific demands, large-scale adoption and dovetailing of technologies gleaned from diverse disciplines of agriculture in well orchestrated manner actually derives the driving force to affect successful agriculture. Since India is endowed with diverse agro climatic zones with contrasting climatological parameters across the country and the kinds of agricultural crops and commodities being cultivated are also diverse, the task of managing the requirements of such a highly diversified agriculture is obviously a stupendous job which needs redressal of the existing and emerging problems through deployment of both conventional and cutting edge frontier science to have speedy remedy synergistically.

Quality seed constitutes the key input for increased productivity, production and profitability. It has been realized that the pace of progress in agricultural production will largely depend upon the extent of progress of quality seed production programme. Inadequate availability of quality seed is a major constraint limiting productivity and it largely depends upon development and deployment of new and improved varieties of crops with superior genetics and an efficient system for timely supply of quality seed to the farmers.

Indian Council of Agricultural Research (ICAR) – the apex organization for conduct and coordination of agricultural research and education in the country, mounted serious efforts to back up seed programme by launching National Seed Project (Crops) in 1979-80 and creation of a separate Project Coordination Unit dedicated exclusively for nucleus and breeder seed production and also to conduct seed technology research to strengthen quality seed production countrywide. Since the inception of DSR sincere efforts have been made to improve modern productive

technology intervention by providing quality seeds. It's premature and would not be logical to claim that DSR has made sea change in agriculture in a short span. However, massive efforts were made with utmost devotion, dedication and commitment by disseminating compatible technologies among the farmers. It is mentionable that in spite of perception about the fact that for successful spread of high yielding varieties, seed is the most important component, the seed replacement rate (SRR) under farmer's field in the countryside is still exceedingly low in comparison to developed countries in respect of both self and cross pollinated crops. This has to be improved substantially to inflate agricultural productivity and production as well. In spite of many efforts, value addition for seed enhancement in today's agriculture is very less, seed processing and storage are still inadequate. Owing to globalization of technologies, the competition in the international market is becoming stiff. To sustain and perpetuate over these challenges, excellence in terms of technology generation and their subsequent dissemination across entrepreneurs has to be achieved and thus clear and distinct vision is essential for seed science research, which need to be contemplated to fulfill future demands to ensure food and nutritional security of the fellow countrymen. DSR started from scratch in a remote locality however, DSR is poised to work hard with highest dedication and commitment to emerge as a centre of excellence in undertaking seed science research and to coordinate national level network projects country wide for food and nutritional security of the people in India through use of quality seeds and compatible technology.

The Directorate of Seed Research strives to take ahead to the mandate of the Indian Council of Agricultural Research for serving the great cause of agriculture in the country. Vision 2030 document recount the key challenges and opportunities in the sector for developing a roadmap to eloquent role of the institute in decisive the coming agricultural research.

Content

<i>Foreword</i>	<i>iii</i>
<i>Preface</i>	<i>iv</i>
<i>Preamble</i>	<i>vi</i>
1. Indian seed scenario	1
2. Harnessing Science for quality seed production	6
3. Directorate of Seed Research 2030	9
4. Strategy and framework	13
Epilogue	16

Indian Seed Scenario

For a long time, seed production in the country was mainly depends on the farmers who used to save seeds for their own use as well as for nearby farmers of the locality. The Royal Commission on Agriculture (1928) was given stress on increased breeder seed production and varietal purity and suggested to have a separate organization within agriculture department to deal with seed distribution and testing. In 1945, the private vegetable seed companies had developed facilities for producing seeds of temperate vegetables in Quetta and Kashmir valley; these companies formed an All India Seed Producers Association in 1946. A standing committee on seeds was constituted in 1952 to formulate a programme for strengthening seed production and distribution in the country. Systematic seed production based on scientific principles was initiated by formation of National Seed Corporation (NSC) at central level in 1963 and state seed corporations in state level with the primary responsibility of foundation seed production of varieties of national importance. After the introduction of All India Coordinated Crop Improvement Project (AICRP) in maize during 1957 and sorghum & pearl millet during 1960, led to development of several hybrids which necessitated the enactment of seed legislation. In 1966, Seed Act was passed to regulate the sale of seed in the country. One of the landmarks in the history of seed programme of India has been the launching of AICRP on seed called "National Seed Project" in 1979, with 14 centres in different Agricultural Universities. In 1991, another AICRP on "Seed Borne Diseases" was merged with it and now this project has 35 "Breeder Seed Production" (BSP) centres and 23 "Seed Technology Research" (STR) centres in the country at various Agricultural Universities/ ICAR institutes. With upgradation of Project Coordination Unit, the project is now coordinated by Directorate of Seed Research, Mau. Under AICRP-NSP (Crops), adequate quantity of nucleus and breeder seeds of high quality as per national requirements is being produced. The research on various aspects of seed technology including seed production, drying, processing, storage, value addition etc. is being conducted throughout the country. The basic information on seed certification standard including seed health has been generated. The information and technologies on seed production, processing, storage, packing, quality control and seed health were disseminated throughout the country *via* SAU's and ICAR institutes. The strength of the system lies in the excellent infrastructural facilities, well equipped laboratories, excellent expertise and trained manpower. The progress of Breeder Seed Production (BSP) during 2009-10 was spectacular touching a production level of 115866.81q. This is a record production

so far. The mis-match between indent and production has come to a very low level even in crops like pulses, groundnut, soybean, etc. Under Annual Oilseed Scheme, production of breeder seed was 23370.84q against an indent of 17519.80q in groundnut, 7163.75q against 11901.20q in soybean and 68.01q against 18.58q in sunflower, respectively. There is hardly any other similar programme in the world where such diverse activities like breeder seed production, seed technological research, research on morphological, biochemical and molecular characterization of varieties, quality maintenance of nucleus and breeder seed, techniques for seed certification and maximization of hybrid seed production are carried out under same umbrella. The new policy on seed development of 1988 heralded a new era of private enterprise in the seed sector in india. Under 1988 policy, vegetable seeds could be imported freely while seeds of oilseeds, pulses and coarse grains like maize, sorghum and millet could be imported for two years by the companies having collaboration agreement with foreign company. With the view to further strength seed production infrastructure, ICAR launched another mega seed project captioned "Seed production in Agricultural Crops and Fisheries", the country's biggest seed project ever. The project was launched during 2005 -06 of X five year plan (FYP) involving 85 cooperating centers of SAU's and ICAR institutes. The major achievements during last three years in this project in terms of quality seed production is as under (Table 1):

Table :1. Quality seed production under ICAR Seed Project during last three years

Seed category	2007-08		2008-09		2009-10	
	Target	Production	Target	Production	Target	Production
Nucleus Seed (q)	3232.81	4729.95	3935.09	8546.73	2059.50	6285.12
Breeder Seed(q)	148887.00	182347.40	73253.48	120842.36	83492.26	95537.73
Foundation Seed(q)	163281.00	181310.50	75169.70	97038.47	63917.78	77448.21
Truthfully Labeled Seed(q)	382723.00	380444.90	122891.75	151130.57	102752.06	139140.37
Participatory Seed Production (q)	51795.00	106498.40	86518.50	203411.22	113504.75	234913.78
Planting Material (q)			38402.25	53193.65	68820.00	84293.36
Total	749918.00	855331.20	400170.77	634163.00	434546.36	637618.57
Planting Material (lakh)	557.1	340.33	447.1	472.26	194.51	604.16
Tissue culture plants (lakh)	0.25	0.15	2.42	1.22	1.58	2.01

Total	557.35	340.48	449.52	473.48	196.09	606.17
--------------	---------------	---------------	---------------	---------------	---------------	---------------

Directorate of Seed Research has close linkages with All India coordinated Research Project in field crops, SAU's, Seed Division of Department of Agriculture and Co-operation, Government of India, public and private seed industries seed certification board and PPV & FR authority. India owns an agriculture based economy with more than 70% population lives in the countryside and about 65% of population is engaged in agriculture. Agriculture accounts for 14.2% of the GDP (at constant 2010-11 prices) & contributes ~ 10.59 % of total exports during 2009-10. The estimated growth rate of agriculture & allied sectors in GDP during 2010-11 is 5.4 %. About 93 % farmers possess < 4 ha land and operate on 55% of the arable land and 32 % of population live below poverty line. Only 37% agriculture land is irrigated, that produces 60 % food grains. Seed replacement rate (SRR) is exceedingly low, which is a serious constraint to augment productivity (Table 2).

Table : 2. Seed replacement rate of major crops

Crop	SRR%		Crop	SRR%	
	2007-08	2008-09		2007-08	2008-09
Wheat	25.23	26.84	Arhar	16.05	16.02
Paddy	36.77	30.05	Ground nut	14.29	17.04
Maize	44.24	48.48	Rape seed Mustard	76.34	52.67
Jowar	19.87	26.16	Til	25.0	-
Bajra	48.47	62.92	Sunflower	69.17	43.64
Ragi	30.34	-	Soybean	33.39	35.12
Barley	16.84	-	Linseed	1.35	-
Gram	18.35	14.38	Castor	31.34	-
Lentil	15.86	-	Safflower	15.69	-
Peas	16.27	-	Cotton (-82% of the cotton area is under GM crop)	15.30	12.07
Urd	23.89	26.31	Jute	32.88	35.4
Moong	21.75	21.94	Potato	1.49	-

www.seednet.com

In the entire production technology gamut, low availability of quality seed at affordable price in right place and time is a serious constraint to bring about rapid transformation in our rural economy. Since 'Green Revolution', the productivity in major crops are increasing, however much more increment is essential to feed the people. The Indian agriculture is at the crossroad though it has made significant strides by estimated production of 235.88 million tonnes of food grains during 2010-

11. To bring about everlasting second green revolution, quality seeds are deemed to be the major propelling factor.

Existing resources in seed sector

Indian sub-continent has varied agro ecological regions having potential to grow a range of food, fodder and other crops. Indian sub-continent is endowed rich crop genetic diversity offering large scope for varietal improvement. Basic genetic material necessary to develop new varieties are available with Bioversity international, NBPGR, New Delhi and private seed companies. ICAR, SAUs and its research centres located in different parts of the country are focusing on various agro-climatic zones for quality seed production. The seed scientists working in the National Agricultural Research System (NARS) are having rich experience in seed production, processing, storage, value addition, seed marketing, extension and teaching.

Through existing massive network projects, funds are provided to strengthen infrastructural facilities to undertake improved seed production in different ICAR institutes and State Agricultural Universities (SAUs) in the country. The quality of the seed produced is monitored with the organized quality control mechanism – state seed certification agencies and seed testing laboratories.

Besides the formal seed production system, the ICAR institutes and State Agricultural Universities (SAUs) are also involved in organizing the participatory seed production in farmers' field and providing latest seed production technologies to the farmers in order to improve their strength and capacity for quality seed production.

Future breeder seed requirement:

The estimated breeder seed requirement in different field crops up to 2030 is furnished below (Table 3)

Table : 3. Breeder Seed Requirement of Major crops in the country

	A	B	C	D	E	F	G	H	
CROP	2009-10 Breeder seed production (in q.)	Gross Cultivated Area (2008-09) (M ha)	Seed Rate (Kg/ha)	Total certified seed requirement (in 000' tonnes)	Target SRR (%)	Certified seed requirement * (in 000' tonnes) as per targeted SRR	SMR (Ratio)	Foundation seed Requirement (in 000's tonnes)	Breeder seed requirement (in tonnes) (2030) ¥
				(AXB)		(CXD)		(E/F)	(G/FX1000)
Food Grains									
Rice	20774.7	45.6	50	2280	0.5	1140	100	11.4000	114.0000
Wheat	34893.55	27.2	125	3400	0.5	1700	20	85.0000	4250.0000
Sorghum	349.51	7.7	15	115.5	0.75	86.625	160	0.5414	3.3838
Pearlmillet	31.31	8.7	5	43.5	0.75	32.625	200	0.1631	0.8156
Maize	458.25	8	25	200	0.75	150	80	1.8750	23.4375
Pigeonpea	1619.54	3.4	15	51	0.75	38.25	100	0.3825	3.8250
Chickpea	13878.87	8.2	80	656	0.5	328	10	32.8000	3280.0000
Oilseeds									
Groundnut\$	23276.74	6.2	200	1240	0.5	620	8	77.5000	9687.5000
Rapeseed & Mustard	420.23	6.3	6	37.8	0.75	28.35	100	0.2835	2.8350
Soybean	10198.03	8.9	75	667.5	0.5	333.75	16	20.8594	1303.7109
Sunflower	33.3	1.9	10	19	0.75	14.25	50	0.2850	5.7000
Other cash crops									
Cotton** @	159.82	9.5	3	28.5	0.75	21.375	50	0.4275	8.5500
Jute	22.18	0.8	3	2.4	0.5	1.2	100	0.0120	0.1200
		-	-	-	Total	4494.425	-	231.5294	18683.8779

- Calculated on the basis of 25% replacement in self pollinated and 35 % replacement in cross-pollinated OPV's for the year 2010.
- No distinction has made with respect to hybrids and open pollinated varieties

¥ - Figure in the parenthesis is seed requirement by 2030 which is calculated on the basis of 50 % SRR in self pollinated crops, 75 % in cross pollinated crops.

** - 80% area in cotton being under hybrid, this may need to be re-estimated on the basis of parental line seeds

@ - Majority of the cotton area is cultivated with hybrids from private companies

\$ - For Groundnut, foundation seed requirement has been calculated on the basis of two stage certified seed production

Harnessing Science for Quality Seed Production

Directorate of Seed Research would strive to harness the power of science in enhancing the quality seed production with reducing cost and post harvest losses through conventional techniques and new scientific knowledge and tools. In the present context, technological challenges are becoming more complex than before as demand of seed is increasing and supply sources are dwindling. To cope up the demand of seed in diverse field of agriculture, the emerging new tools & techniques, methods and approaches with the advancement of science will be the technological break through to accomplish the mission.

1. Maintenance of genetic purity

- Maintenance breeding to maintain high genetic purity and stability of the varieties.
- Development of quick and reliable molecular detection kit (DNA bar coding) for genetic identification of varieties and hybrids.

2. Seed biology

- Determination of molecular and biochemical basis of seed biology in relation to seed dormancy, germination and vigour.

3. Seed enhancement

- Seed enhancement through priming, coating, pelleting and magnetism etc.

4. Transgenic/GM seeds

- Developing certification standards for GM seeds and also cost effective kits for detection of transgenes
- Use of nano-technology for advance research in seed science & technology

5. Seed health

- Development of diagnostic tools for different seed borne diseases and storage pests
- Development of minimum seed standards of different seed borne diseases
- Survey of seed health of farmers' saved seeds

6. Development of hybrid seed production technology

- Optimization of hybrid seed production technology particularly for rice, pigeonpea, mustard and castor

- Manipulation of flowering of parental lines towards synchronization to enhance the hybrid seed production

7. Seed storage

- To search the innovative seed storage techniques for various field crops to improve the seed storability

8. Refinement of seed processing standards

- Refinement of seed processing standards to maximize the quantity of the graded seed and to search new techniques to minimize the seed damage during processing

9. Enhancing productivity of seed yield

- Production of nucleus, breeder and foundation seed in different field crops
- Production of quality seeds of newly released varieties of various field crops
- Identification of potential seed production areas for different crops
- Training of farmers to produce the quality seeds

10. Coordination, monitoring and review of seed production and seed technology research in the country - AICRP-NSP (Crops)

- Monitoring and evaluation of network projects related to seed production and seed technological research in various ICAR institutes & SAUs.
- Coordination of different network projects including AICRP-NSP (Crops), Annual Oilseed Scheme, ICAR Seed Project – Seed Production in Agricultural Crops etc.
- Functioning as apex centre for coordinated trials for quality seed production in the country

Thrust areas in Seed Science and seed technology research

- Maintenance breeding for genetic purity and stability of the cultivars
- Strengthening seed production in Groundnut, Soybean, Pulses and Forage crops.
- Identification of alternate area for seed production in off-season as a contingent planning.
- Validation of molecular tools as an alternative of GOT.
- Basic research on genomics of seed quality traits, seed health and seed ageing.
- Hybrid seed production technology – Rice, Pigeonpea, Mustard and Castor

- Development certification standards and detection of GM seed.
- Development of diagnostic tools for different seed borne diseases.
- Strategic involvement of private seed sector for symbiotic partnership.
- Integration of Information and communication technologies for online database management system for effective coordination.

11. Human Resource Development & Monitoring

- Human Resources Development in seed sector – Training of scientists at national and international level to impart training to seed personnel and farmers.
- Regional hubs for enhanced monitoring and coordination.

12. Transfer of technology to farming community

- Transfer of optimum seed production technology to farmers.
- Strengthening of seed village programme to promote the need based technology for the farmers through launching different extension activities.
- Organizing seed *mela/ gosthies* before start of crop season.

Directorate of Seed Research 2030

The Directorate of Seed Research is the leading coordination unit of seed science research and quality seed production in the country marching ahead with renewed vigour to face the challenges and harness the domestic and global opportunities for the welfare of seed growers, farmers and other stake holders in seed supply chain. This effort would make the DSR a responsive, sensitive and vibrant organization in the ICAR system.

Vision

Ensure the quality seed security to the farmers through technological intervention and sustainable agriculture

Mission

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

Mandate

- To conduct basic, applied, strategic and anticipatory research in diverse fields of seed science and technology
- To function as apex centre for coordinated trials for quality seed production in the country
- To coordinate implementation of "PVP and FR Act- 2001" with special reference to DUS testing through ICAR-SAU system
- To undertake HRD through imparting training to field staff and scientists in different fields of seed production, testing and certification in field crops

Focus

To accomplish the vision and mission of DSR, it gives the highest priority to the farmers and the entire strategy is based on farmer first. It would concentrate on the following key areas

Strengthening frontier research in diverse fields of seed science & technology for enhancing agricultural production and productivity

- Survey and collection of farmer saved seeds in different field crops under different agro-climatic zones to understand the status of seed biology in respect of seed viability and longevity so that the crop wise need based research programme may be formulated accordingly.

- Standardization of Molecular tools & Techniques for identification of varieties and genetic purity/hybridity testing.
- Use of nano-technology for advance research in seed science & technology
- Maintenance breeding for continuous supply of basic seed with high genetic purity.
- Determination of molecular and bio-chemical basis of seed dormancy and longevity.
- Development of seed enhancement techniques in different field crops.
- Value addition of seeds through seed enhancement techniques including priming, coating, pelleting and magnetism etc.
- Gene pyramiding, biotechnology research to support conventional breeding.
- Development of vigour test in major field crops.
- Study on seed health status of farm saved seeds particularly in eastern Uttar Pradesh.
- Development of new standards for seed health in major field crops.
- Determination of seed borne diseases with special reference to development of molecular diagnostics
- Development of suitable storage techniques for various field crops.
- Development of dormancy breaking methods for enhancing seed germination in forage species.
- Understanding the effects of different stresses on storability & viability of seeds.
- Identification of chemicals for synchronization of flowering between male and female parents in hybrid seed production.
- Strengthening of scientific seed processing, storage and effective quality control system

Enhancing productivity of field crops through production & supply of quality seeds

- Production of quality seeds
- Production of TFL seeds of rice, wheat and pulses to popularize newly released varieties
- Identification of potential hybrid seed production areas in India.
- Enhancing quality seed production/ crop productivity *per se* through insect pollinators
- Maximizing seed production through nutritional and agronomical manipulations
- Determining the influence of climate change on quality seed production

Coordination, monitoring and review of seed production and seed technology research in the country

- Monitoring and evaluation of network projects related to seed production and seed technological research in various ICAR institutes & SAUs.
- Coordination of different network projects including AICRP-NSP (Crops), Annual Oilseed Scheme, ICAR Seed Project – Seed Production in Agricultural Crops and others
- Functioning as apex centre for coordinated trials for quality seed production in the country

Thrust areas in seed production and seed technology research under AICRP-NSP (Crops)

- More emphasis for maintenance breeding.
- Strengthening seed production in Groundnut, Soybean, Pulses and Forage crops.
- Identification of alternate area for seed production in off-season as a contingent planning.
- Seed genetic purity using molecular tools.
- Basic research on genomics of seed quality traits, seed health and seed ageing.
- Hybrid seed production technology – Rice, Pigeonpea, Mustard and Castor
- Developing certification standards and procedures for transgenic/GM seed. Development of cost effective detection kits for transgenic seed.
- Development of diagnostic tools for different seed borne diseases.
- Development of seed enhancement techniques
- Strategic involvement of private seed sector for symbiotic partnership.
- Integration of Information and communication technologies for online database management system for effective coordination.
- Development of seed testing protocols and standards for forage crops.
- Creation of referral laboratories for seed quality testing in different parts of the country.

Human Resources Development

- Human Resources Development in seed sector – Train scientists at national and international level to impart training to seed personnel and farmers.
- Regional hubs for enhanced monitoring and coordination.

Transfer of technology

- Transfer of optimum seed production technology to farmers
- Strengthening of seed village programme to promote the need based technology for the farmers, through launching different extension activities.
- Organizing seed *mela* before start of crop season.

Strategy and framework

A five point following strategy would be adopted to accomplish the vision and goals of Directorate of Seed Research as mentioned below :

Goal	Approach	Performance measure
Strengthening frontier research in diverse fields of seed science & technology for enhancing agricultural production and productivity	Maintenance breeding to maintain high genetic purity.	Molecular detection kit identified for genetic purity testing of varieties
	Development of user friendly molecular detection kit for fast and accurate identification of varieties and hybrids.	
	Enhancing the seed multiplication rate under the changing global climate using molecular techniques	
	Determination of molecular and bio-chemical basis of seed dormancy and germination in different crop species and varieties to understand the status of seed biology.	Number of molecular and biochemical traits identified
	Development of seed enhancement techniques in different crops.	Techniques evaluated
	Developing certification standards and procedures for transgenic/GM seeds and also cost effective detection kits	Number of cost effective detection kits and number of transgenic seeds developed
	Development of transgenic seeds tolerant to biotic and abiotic stresses through molecular tools and techniques.	
	Development of diagnostic tools for different seed borne diseases and storage pest	Number of diagnostic tools developed
	Optimization of hybrid seed production technology for rice, pigeon pea, mustard and castor	Number of crops in which hybrid seed production technology optimized
	Development of suitable storage techniques for various field/horticultural crops.	Number of techniques developed
Search of chemicals for synchronization in flowering of male and female parents in hybrid seed production.	Number of chemicals identified	

	Development of seed processing standards for different seed size lots in different crops	Number of seed lot for which seed processing standard developed
Enhancing productivity of field crops through production & supply of quality seeds.	<p>Production of Nucleus, breeder, foundation and TFL seed in different field crops</p> <p>Development of DNA bar coding system for tracking the breeder seed production and supply system.</p> <p>Identification of potential seed production area</p> <p>Development of organic seed production technology</p>	<p>Quantity of seed produced in respective classes</p> <p>Number of crops in which DNA bar-coding system developed</p> <p>Number of crops for which potential area identified</p> <p>Number of crops for which organic seed production technology developed</p>
<p>Coordination, monitoring and review of seed production and seed technology research in the country</p> <p>(The thrust areas of seed production and seed technology research have been identified and future research programme would be formulated and implemented accordingly at different cooperating centres of BSP and STR under AICRP-NSP (Crops))</p>	<p>Monitoring and evaluation of network projects related to seed production and seed technological research in various ICAR institutes & SAUs.</p> <p>Coordination of ICAR Seed Project – Seed Production in Agricultural Crops and others</p> <p>Functioning as apex centre for coordinated trials for quality seed production in the country</p> <p>Coordination of Annual Oilseed Scheme</p>	<p>Collection & analysis of seed production and seed technology research data pertaining to AICRP-NSP (Crops)</p> <p>Collection & analysis of seed production data pertaining to ICAR seed project</p> <p>Timely holding of Annual Group Meeting of AICRP-NSP (Crops)</p> <p>Timely holding of Annual Review Meeting of ICAR Mega Seed Project</p> <p>Quantity of various classes of seeds produced under the network project</p> <p>Quantity of breeder seed produced</p>
Human Resource Development	<p>Human Resource Development in seed sector – Training scientists at national and international level to impart training to seed personnel and farmers.</p> <p>Regional hubs for enhanced monitoring and coordination.</p>	<p>Number of training and personnel's organized/trained</p> <p>Frequency of monitoring</p>

Transfer of technology	<p>Transfer of optimum seed production technology to farmers</p> <p>Strengthening of seed village programme to promote the need based technology for the farmers, through launching different extension activities.</p> <p>Organizing seed <i>mela</i> before start of crop season.</p>	<p>Farmers training, organized/ attended</p> <p>Villages/blocks covered</p> <p>Number of seed <i>mela/gosthi</i> organized</p>
-------------------------------	---	--

Epilogue

Quality seed is the most vital and basic input in ushering sustainable agricultural production through enhancing crop productivity. Presently, majority of the farmers are using their farm saved seeds of conventional varieties. Seed replacement rate in the country is around 25% for self pollinated crops and 35% for crops pollinated crops. Private seed sector is mainly involved in production & supply of high value-low volume crop seeds to the farming community. So, in order to safeguard the farmers, public seed sector *viz*, SAU's, ICAR institutes, SSCs, NSC & SFCI are involved in production and supply of quality seeds of improved varieties/hybrids of low value- high volume crops to the farmers. DSR made concerted effort to enhance supply of quality seed to the farmers by SAUs and ICAR Institutes, through strengthening of seed production infrastructure, which ultimately leads to sustained crop productivity, better farm income & livelihood security and agricultural growth in the country. Through AICRP-NSP (Crops), DSR would be making concerted effort in coordination and monitoring of breeder seed production of field crops in the country to meet increasing requirement for further multiplication into foundation, certified/TFL seed. To meet the high demands of quality seed by the farmers, cooperating centres would be promoted to undertake participatory seed production at farmers field and popularization of high yielding varieties/ hybrids through linking KVKs. DSR would also involve in finding alternative areas of seed production mainly to sustain the domestic seed sector and to promote export oriented seed production. DSR would also committed to bring awareness about use of quality seed among farming community at tribal areas through its network project Poverty Alleviation in tribal areas through use of quality seed. DSR intends to develop strategies to respond to the changing needs of seed sector for the benefit of stake holders. DSR would focus on conducting, coordinating & monitoring of seed technology research to solve the problems with respect to seed production and certification, seed physiology & testing, storage, seed pathology, seed entomology and seed processing.