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Research Article

HISTORY OF SEED PRODUCTION AND ITS KEY ISSUES

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ABSTRACT
Seed is the basic, vital and central input in agriculture which played an important role in deciding the performance of all farming systems and most efficient input compared with other agricultural inputs like fertilizer, agro-chemicals, water and the like others. Seed, the vehicle for delivering the benefits of technology, is influencing the growth and sustainability of Indian Agriculture. It is the timely availability of quality seed of the right variety in adequate quantities decides the strength and health of agricultural economy and more so in countries like India. It is said "Subeejam Shushereto Jaayaty Sapadayaty" which means the good seed in a good field produces abundantly. Therefore, it is very much required that the farmers must use pure, healthy seeds as per the minimum certification standards which have standard germination percentage. Infact the seed is foundation of farming. Adage is that 'as per you sow as per you reap'.

Key Words: *Seed, Production, SRR, Constraints, Measures*

INTRODUCTION
Seed has played a pivotal role in World's 'bio-revolution', since crop productivity is directly related to the genetic potential of the seed planted, and will continue to be an essential component for the decades to come. 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. The Green Revolution of India has been universally acclaimed as a successful enterprise of the farmers, the Scientists and the government. This land mark achievement in agriculture was due to result of a combination of inputs like introduction of high yielding varieties and others.
In fact, the importance of quality seed in agriculture has been recognized as primary wealth since ancient time. Mannu (200 BC) stated that good seed in good soil yields abundantly. Interestingly, there was even an institution such as punishment for selling of inferior seed by traders as a regulatory control over seed quality. "Seeds belong to no one; it is a gift of life to life itself."
The symbolic importance to seed started with the Famine Commission report (1871), which resulted in establishment of Indian Agricultural Research Institute in Pusa, Bihar and six Agricultural Colleges in 1905 to 1907. The first private seed company 'Suttons and Sons' came into existence in 1912 in Calcutta. The Royal Commission on Agriculture established in 1925 recommended for introduction and spread of improved crop varieties, from where started the review of importance of seed and its commercialization.
The organized seed production in the country becomes possible with formation of National Seed Corporation (NSC) during 1963, which paved the way for sound seed industry to come. NSC was the first agency to certify the seeds of all the crops. Subsequently, Seed Act 1966 was enacted in the parliament as a means to protect the quality of the seed and Seed Rules 1968 came into force throughout the country from October 1968 to regulate the seed related issues. The sixties were the most eventful times for Indian agriculture, not only because of introduction of high-yielding cereals, particularly wheat and rice but also for many other positive developments related to seed such as, constitution of Seed Review Team, enactment of Seeds Act, 1966 and formation of National Commission on Agriculture. This was the period, during which the private sector significantly stepped into the seed business. The Seeds Act stipulated that seeds should conform to a minimum stipulated level of physical and genetic purity and assured percentage germination either by compulsory labeling or voluntary certification. Further, the Act

provided a system for seed quality control through independent State Seed Certification Agencies which were placed under the control of state departments of agriculture.

Introduction of New Seed Development Policy (1988–1989) was yet another significant milestone in the Indian Seed Industry, which transformed the very character of the seed industry. The policy gave access to Indian farmers of the best of seed and planting material available anywhere in the World. The policy stimulated appreciable investments by private individuals, Indian Corporate and MNCs in the Indian seed sector with strong R and D base for product development in each of the seed companies with more emphasis on high value hybrids of cereals and vegetables and hi-tech products such as *Bt* seeds. The Seed Act 1966, which only regulated notified varieties, proposed to be replaced by Seed Bill 2004, in which all the seeds for sale must be registered on VCU (value for cultivation or use) criteria.

ICAR also promotes sponsored breeder seed production programme through the NSC/State Farms Corporation of India (SFCI), State Seeds Corporation (SSCs), *Krishi Vigyan Kendras* (KVKs) etc.

Farmer has a wide product choice and seed industry today is set to work with a 'farmer centric' approach and is market driven. However, there is an urgent need for the State Seed Corporations to transform themselves in tune with the industry in terms of infrastructure, technologies, approach and the management culture to be able to survive in the competitive market and to enhance their contribution in the national food & nutritional security.

Figure 1: Adopt a Seed, become a God parent to a Seed

Seed production is a biological process, which involves multiplying small quantities of breeder seed into larger quantities for commercial distribution, following specified stages over successive cropping seasons. Since seed is living, it is subject to the natural phenomena of aging and death. Seed therefore needs careful handling, particularly during transportation and storage. Unlike products such as fertilizers, which

are factory-manufactured in large quantities with in-built quality control arrangements, farmers under different farming conditions usually produce seed lots that need to be tested individually for quality before being offered for sale.

Characters of the Ideal Seed

1. It should be true to its type.
2. It should be free from ad mixture of other variety of seeds.
3. It should have high percentage of germination.
4. It should be free from seed born diseases.

Classes of Seed

1. *Nucleus Seed*: - It is produced by the Breeder and it is genetically pure seed.
2. *Breeder Seed*: - It is produced by the breeder from Nucleus Seed. Golden tag is affixed by the breeder.
3. *Foundation Seed*: - It is produced by the breeder seed under the supervision of the Concerned seed Certification Agency. White color tag certified by the certification agency is affixed.
4. *Certified Seed*: - It is produced from the foundation seed. Certified seed may be the progeny of certified seed provided this reproduction does not exceed three generation beyond foundation seed stage I. It is determined by the seed certification agency. Certification tag shall be of blue color (Azure Blue) for certified seed class.

To avoid cross pollination and to maintain genetic purity of seeds, seed plots have to be isolated from plots of general cultivation. These isolation distances for different crops are fixed (Table 1).

The minimum standards in terms of germination percentage and physical purity (clean and free from foreign bodies) have also been fixed for different types of seeds (see Table 2).

Table 1: Isolation distances for various crops (in meters)

No.	Crop	Foundation Seeds	Certified Seeds
I	**Self Pollinated**		
1	Rice & Wheat	3	3
2	Gram, Mung, Matki	20	10
3	Groundnut, Soyabean	3	3
4	Tomato, Methi	50	25
5	Chavali/French bean	50	25
6	Potato	20	5
II	**Cross Pollinated**		
1	Hybrid Bajra	1000	200
2	Hybrid Maize	600	300
3	Safflower/ Mustard	400	200
4	Sunflower	600	400
5	Cole crops/palak	1600	1000
6	Onion, Carrot, radish	1000	400 - 800
III	**Partially Cross Pollinated**		
1	Hybrid Jowar	300	200
2	Hybrid Cotton	50	30
3	Tur	200	100
4	Brinjal, Lady's finger, chillies	400	200

Table 2: Minimum Standards of Germination and Purity

S. No.	Crops	Germination %	Physical Purity %
1	Jowar, Bajra, Tur, Mung, Urd	75	98
2	Wheat, Gram	85	98
3	Rice, Maize, Sesamum	80	98
4	Cotton, Gourds, Lady's finger, Cauliflower	65	98
5	Groundnut, Soybean, Cabbage, Knol cole, onion, tomato, brinjal, palak, radish	70	98
6	Sunflower, chillies, methi, guar (cluster bean) carrot, sugarbeet.	60	95-98

Seed Distribution and Supply

At present, 15 State Seeds Corporation and 2 national levels (National Seed Corporations of India & State Farms Corporation of India) are functioning in the country. One of the landmarks in the history of seed programme of India has been the launching of All India Coordinated Research Project (AICRP) on seed called "National Seed Project" in 1979, with 14 centers in different Agricultural Universities. Besides, significant quantities of seeds are also produced by the State Departments of Agriculture, where the State Seeds Corporations are not in existence.

For quality control and certification, currently there are 22 State Seed Certification Agencies (SSCAs) and 104 State Seed Testing Laboratories (SSTLs). The private sector has started to play a significant role in the production and distribution of seeds. Several private seed companies have also set up seed testing laboratories for internal quality control. The annual capacity of seed testing in these laboratories is 0.72 million samples. Seed quality evaluation is done in these laboratories which play a pivotal role in modern agriculture.

There is a wide gap between quality seed production and its distribution at farmers' doorway. The public institutions producing seeds are mainly concentrating on open pollinated varieties of 60 percent and the private seed companies meeting the requirement of hybrid seed and other transgenic crops to fill up the gap. For instance in cotton, private seed companies contribute for about 90 percent of the total requirement of hybrid seed, the rest being met by different seed corporations of the states.

Good quality seed alone increases the yield by 15-20 per cent. Currently quality seeds are met to the extent of 20 per cent only. Farmers themselves meet the balance of 75 per cent through own saved seeds. The farm saved seeds does not have any quality standard. Many times non-descript varieties are also used as seeds by the resource poor farmers which result in a low crop productivity.

Importance of Hybrid Seeds

That the use of hybrid seed is improving the yield of crops is a well-known fact but still there is a great scope to bridge this gap through innovative programmes and extensive publicity among the farmers so as to make them adopt hybrid/improved seeds. A dramatic increase in the past after the introduction of hybrid wheat, hybrid cotton also established its supremacy in increasing the yield and income of the farmers. Majority of the hybrids produced in India are being produced and marketed by private seed sector thus these sectors should be given an umbrella government support in order to enhance quality seed supply.

Although there are some constraints in hybrid seed production like availability of suitable area, poor seed production performance, high seed cost and less time gap between harvest of seed and its use for sowing in some food crops. But these can be mitigated through cumulative efforts by development of consortia between state governments, SAUs and seed production agencies for production of quality seeds.

Need of Transgenic Seeds

Plant breeders can rectify problems in a crop only when there is variability available for the desired character within the compatible species complex. Transfer of useful traits from distantly related species which do not sexually cross with the crop plant is not possible through conventional recombination

breeding procedures. Considering that many problems still remain unsolved and that the currently available technologies are inadequate to solve them, there is need for alternate technologies. Recombinant DNA technology that enables movement of genes of interest across sexual incompatibility barriers is one approach plant scientists are relying upon worldwide today to find genetic solutions to specific problems. Recognizing the potential of genetic engineering and biotechnology and its relevance to India, the Ministry of Science and Technology established the Department of Biotechnology (DBT) in 1986, exclusively to develop and apply biotechnological approaches in agriculture, animal science and human health (5). Currently, transgenic research is being done on several field crops, viz. cotton, Indian mustard, corn, potato, tobacco and rice and in vegetable crops namely tomato, brinjal, cauliflower, cabbage, chillies and bell pepper. The problems receiving priority attention include insect pest control, hybridization systems and nutrition improvement (2). Genetically engineered hybrids and hybrids with unique characteristics such as pest resistance are of special interest to the private sector institutions, as they provide a degree of certainty, offsetting the risks to their investments in biotechnology (1). Transgenic seed will have a major impact on seed business. For instance, as new varieties with improved performance enter the market, shares of individual varieties will shift quickly. Dramatic increase in the annual research expenditures of private companies engaged in biotechnology research is yet another indicator to the increasing involvement of private sector in biotechnology research.

Replacement Rate

Seed/cultivar replacement rate (SRR/CRR) is the percentage of area sown out of total area of crop planted in the season by using certified/quality seeds/cultivars other than the farm saved seed. At the national level the SRR has improved to about 25% in case of self-pollinated crops, which was around 10% about a decade ago. At the national level, the average SRR per cent for major crops between the period of 2001 and 2008 was found to be higher in crops like rape seed and mustard (54.48), pearlmillet (51.52), sunflower (43.79), maize (33.77), soybean (24.16), paddy (21.70), cotton (19.08) and wheat (18.37) where hybrids are dominant. During the same period pulses showed a poor SRR like urdbean (18.86), pigeonpea (11.88) and chickpea (8.76). In pulses lack of hybrids and less involvement of private seed sector are the main obstacles. Oilseeds and pulses are C_3 plants and have less photosynthetic efficiency. The indeterminate growth habit and low genetic base are other reasons.

Table 3: All India seed replacement rate (%) of major crops

Crop	2001	2002	2003	2004	2005	2006	2007	2008	Average
Wheat	13.04	13.00	13.00	16.48	17.64	21.76	25.23	26.84	18.37
Paddy	19.22	19.31	19.16	16.27	21.33	22.41	25.87	30.05	21.70
Maize	20.98	21.35	24.41	31.50	35.39	43.78	44.24	48.48	33.77
Jowar	18.36	18.78	26.71	19.28	19.03	19.37	19.87	26.16	20.95
Bajra	45.92	48.47	51.02	44.90	55.36	55.10	48.47	62.92	51.52
Chickpea	4.17	4.23	7.09	9.87	9.41	9.04	11.90	14.38	8.76
Urdbean	16.55	17.06	20.48	17.24	15.70	13.65	23.89	26.31	18.86
Arhar	8.71	8.84	13.60	9.80	10.48	11.56	16.05	16.02	11.88
Peanut	5.20	5.50	11.00	7.11	6.89	9.79	14.29	17.04	9.60
RSM	38.39	44.64	66.96	58.48	55.36	60.71	58.62	52.67	54.48
Soybean	12.44	12.45	15.58	27.00	28.88	28.40	33.39	35.12	24.16
Sunflower	13.73	15.69	19.61	60.15	67.67	66.92	62.88	43.64	43.79
Cotton	21.21	21.86	19.84	20.73	21.78	19.84	15.30	12.07	19.08

Hence, oilseeds and pulses are genetically handicapped. However, National Food Security Mission (NFSM) was launched on 29th May, 2007 comprising rice, wheat and pulses to increase the SRR from 7-8% to up to 25%.

It is well known fact that, seed replacement rate has a strong positive correlation with the productivity and production of crops. There is a need to rejuvenate the seed sector through synergy between the public and the private sectors. Central and State governments should take seed replacement programme on higher priority and in the same sequence, they made a National Seed Plan for this.

Constraints in Supply

Production and supply of quality seeds of the crops require highly technical know-how, trained personnel and independent resources. The following factors are to be addressed immediately: (i) lack of knowledge among the hybrid seed producers, (ii) improper coordination between various seed producing associations, (iii) lack of an industry watchdog for remedy of problems, (iv) rapid urbanization and industrialization is posing a threat to availability of skilled labour; (v) large scale seed production is possible only in *Rabi* season. *Kharif* seed production is often prone to problems of seed quality (vi) a highly competitive industry has led to drastic changes in time tested production practices leading to detrimental impact on seed quality, and (vii) large volume of small lots makes difficulty in handling.

The following suggestions may help in order to alleviate the problems. Training is must to maintain the quality of seeds. Under chockfull watchdog encourage private-public partnership in production and supply of quality seeds, encourage and guide small and marginal farmers in specific areas to produce crop specific quality seeds with appropriate financial support, the State Seed Plan should focus on maximum utilization of the seed production infrastructure in the state or management of State Seed Farms can be converted into an economically viable and maximum productive farm enterprises, and adopt unified approach on broad issues of seed production in the industry with full regards of seed production programmes. The free time of the teachers and research scientists as well as the land not being used for research or teaching activities are diverted to produce seeds of the crop varieties. Small scale seed industries need to be promoted to minimize movement of seeds over long distances. Farmers are involved in this activity wherever the demand is more.

A village, wherein trained group of farmers are involved in production of seeds of various crops should be accommodated as per the needs of themselves through a "seed village" approach. Under this concept, 2-3 villages will be selected and seed production of major location specific food crops will be taken up. Seed production technologies will be passed on timely to farmers through trainings and demonstrations. To meet the increased demand for quality seed in future years can be mitigated by starting seed production through Frontline Demonstration to be conducted by research scientists (breeder) and extension personnel directly at farmers' field. '*Kishan* Service Centre's are the accurate place where farmers can not only sell their produce and buy material as per their need but also get the advance knowledge and new information's.

Points to Ponder

Agriculture is the largest sector of economy and agricultural production is under pressure from increasing demands of food as about 70% of the rural livelihoods and 60% of our labour work force depend (these figures vary from source to source) on it. It is observed that the number of varieties released is more for irrigated areas as compared to the number for rainfed areas. This is due to twin effect of hybrid seeds and proper irrigation facilities.

To save the rich bio-diversity, the seed production programme should partly be focused on traditional varieties instead of developing HYV's only. The focus of R&D in HYV is generally should be on areas which have all the amenities to reap superior yield. The lack of suitable varieties for rainfed upland and lowland areas, flood prone or cold tolerant varieties is one of the major reasons why some areas are still uncovered by modern varieties. Farmers of these areas are still sowing traditional non hybrid seeds which are sometimes inferior, susceptible and disease prone notwithstanding the cruel vagaries of weather resulting in low harvest. The seed strategy should be focused on areas which can be brought under HYV program, such that a paradigm shift can be made from emphasis on technologically saturated areas to intact areas.

Currently crucial aspect is biodiversity conservation, its enhancement and utilization such that pure line breeds are conserved without genetic erosion. Moreover quality seeds thus produced should be such that they are widely grown and are not technologically intensive, so that the benefits of quality seeds easily permeate the locality. We should give more emphasis on *in situ* conservation of biodiversity by active participation of farmers and local communities.

Emphasis should be given on policies for the production of contract farming, identification of new genotypes to overcome specific problems like resistance of insect-pest and disease syndrome, drought, soil and water salinity, etc to enhance the availability of seeds in adequate quantities.

Seed industry plays a major role in increasing employment and the production of food crops. The rural educated youths should be trained as possibilities for employment and seed production. They need to be trained on seed regulation side also, which is an important part of seed sector. Precision farming technology developed by our agricultural universities can help more than double our food production if cent percent seed replacement rate is achieved through these farming operators. A good budgetary provision must be committed for development of new varieties, hybrids and seed research with greater profitability to both researchers and farmers.

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