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Rapporteur's Report on Contemporary Trends in the Seed Industry

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In labour-abundant and land-scarce countries such as ours, biological innovations occupy the central place in technology development.[1] As a result, agricultural growth in India and similarly endowed countries stems primarily from rising productivity of land. The generation and diffusion of high-yielding technologies is therefore critical in sustaining agricultural growth. As varietal development is embedded in seed, it is the principal vehicle for delivering new technologies to producers. Other inputs such as water and fertilisers are important as well but principally to exploit the full potential of the new seeds.[2] Although the green revolution technologies are criticised for their adverse environmental impacts, interregional disparities and distorting equity potentials, among others, it is hard to think of any other policy, institutional reform or technology that has had comparable impact on rural wages and poverty in India. During 1960s, it was worthwhile to concentrate on quantity of food to feed millions than on the possible ill effects of such a technology revolution.

Seed, a living embryo, is vital but basic input for attaining sustained growth in agricultural production in different agro-ecological conditions and the most important catalyst for other inputs to be cost effective. In ensuring sustainability, good crop productivity, enhanced profitability, biodiversity at a reasonable level and environmental protection, seed plays a vital role. Much of the farmer's efforts and investments on costly inputs like chemical fertilisers, farm machinery, irrigation, pesticides, etc., would go waste if these inputs are not bundled with quality seeds. Scientific research for a farmer would be of little value unless he gets seeds which are genetically true-to-type and possess other desired qualities, such as vigour, stout germination potential, freedom from exogenous mixtures and undesired weeds. It may not be wrong to say that the story of Green Revolution in India would have been totally different if certified high-yielding varieties (HYVs) of seeds were not available to the farmers.

Realising the pivotal role of quality seed in meeting the challenge of raising agricultural production needed for the burgeoning population, the Government of India has taken several steps to strengthen seed research and development in the country. A gamut of state agricultural universities, several ICAR institutes, private companies/corporations including multinational companies (MNCs) spread across the country has been involved in seed research and development, and over years, the

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research capability and quality has enhanced. Initially, the research in seed had been predominantly with public sector in India. However, of late, the private sector participation had been increasing, especially in the field of genetic engineering. The provisions of TRIPS under World Trade Organisation (WTO) and the passing of Plant Variety Protection and Farmers' Rights Acts in 2001 are expected to increase private sector participation in the seed research, production and distribution. From a few units the private seed industry has grown to more than 160 seed companies/corporations.

Seeds of the organised seed industry were planted with the identification of the first maize hybrids under the collaborative programmes of the ICAR and the Rockefeller Foundation in the early sixties. The seed industry expanded through the stimulus given by the new and strikingly superior hybrids of maize in 1961, sorghum in 1964, bajra in 1965, and new short and high-yielding fertiliser responsive adapted varieties of wheat from Mexico and paddy from Taiwan. A further boost came through the evolution of hybrid cotton in the late sixties. The seed industry has developed rapidly during the last two decades. Seed production, which was just 0.18 million quintals in 1953-54 had risen to 8 million quintals in 2000-01. Despite such impressive gains seed production is far short of demand for all major crops of cereals and oilseeds. Similar situation exists with regard to seeds of most of the vegetables. Only one-fourth of the required seeds for cereals and pulses is produced and marketed by the organised public and private seed sector. The balance comes from traditional sources such as farm-saved seed, sale of grain as seed in the local mandi (market) and exchange of seed between the farmers.

Apart from quantity-gap between demand for and supply of seeds, the problems of time-gap and quality-gap between demand and supply make the situation still worse. While seed differs from other inputs in terms of relative importance, it also differs from other inputs in terms of variety and complexity of problems it is involved with. Hence, the theme on "Contemporary Trends in the Seed Industry" has been rightly chosen for thorough discussion in the Conference. Apart from the Keynote paper by Bharat Ramaswami, 25 papers have been accepted for discussion at the Conference. In majority of the cases, the paper covered more than one sub-theme. The extent of coverage of sub-themes by the papers received for the Conference is furnished in Table 1.

TABLE 1. COVERAGE OF SUB-THEMES BY THE PAPERS RECEIVED FOR THE CONFERENCE

	Sub-Theme	Number of papers	Percentage*
I.	Seed Policy, Seed Legislation and Role of Central and State Governments	5	19.23
II.	Impact of WTO, Public Sector and Genomic Revolution	5	19.23
III.	Structure, Growth and Functioning of Seed Industry, Public-Private Sector Interface and Role, Constraints in Seed Production and Distribution	7	26.92
IV.	State Seed Corporations – Role and Performance	4	15.38
V.	Gaps between Declared and Actual Yield Rates, Accountability of Research and Extension Systems	2	7.69
VI.	Sources and Composition of Seed Supply, Seed Replacement Rates, Access to Quality Seed	5	19.23
VII.	Demand-Supply: Estimation and Imbalances	6	23.08
VIII.	Seed Trade - Middlemen's Margins, Inter-Agency Price Differentials and Seed Export	3	11.54
	Total Papers Received	26	100.00

* Do not add to 100 since most papers covered more than one sub-theme.

I

SEED POLICY, SEED LEGISLATION AND ROLE OF CENTRAL AND STATE GOVERNMENTS

Of the five papers that discuss this issue, the keynote paper by Bharat Ramaswami and the papers by S.R.Asokan and Gurdev Singh, and Gursharan Singh Kainth, have covered the policy and legislation issues in detail.

Bharat Ramaswami broadly summarises the state of knowledge of seed industry and points to some issues that deserve research. The government regulates the seed industry through various acts, the recent one being Seed Policy, 2002, in which variety registration is mandatory and allows imports and exports of seeds of all crops. He feels that Indian seed regulation offers little protection to breeders and small farmers as well. There is a prevalence of non-competitive market for hybrid seeds as farmers quickly change over to band of high-yielding cultivars reflecting the specific marketing success of individual company.

The Government of India, realising the importance of a strong and modern seed system, initiated various policy measures to vitalise the seed sector (Asokan and Gurdev Singh, 2002). The launching of the All India Coordinated Maize Project (1957) followed by similar projects for bajra and sorghum (1960) by ICAR, establishment of National Seed Corporation (1963), implementation of Seed Act (1966), starting of Tarai Development Corporation and State Farms Corporation of India in 1969, setting up of State Seed Corporations with World Bank assistance under the National Seed Project in 1975, setting up of the National Bureau of Plant Genetic Resources in 1976, Seed Control Order of 1983, Seeds Policy of 1988 are some of the important milestones in the development of the industry. The Seed Act of 1966 and the Seeds Control Order of 1983 provide statutory backing to the system of

variety release, seed certification and seed testing. Varieties are released after satisfactory performance at multi-location trials for a minimum of three years. Varieties approved are 'notified' which is a pre-requisite for certification. While all public sector varieties go through this process, it is not mandatory for private sector varieties. Often private seed firms do not submit their varieties for certification either because they do not wish to go through the time consuming process of notification or because they have their own quality control processes. However, uncertified seeds are required to be truthfully labelled listing quality attributes on the label.

The 1980s marked significant development in the seed sector.[3] In 1983, the Government of India decided to provide public bred breeder seeds to the private seed companies for multiplication and distribution. In 1986, the Department of Biotechnology was established in the Ministry of Science and Technology. In 1987, the government abandoned its earlier protectionist stand towards the sector and allowed MRTP and FERA companies to participate in seed activity. New Policy on Seed Development was announced in 1988, which allowed import of seeds of coarse cereals and horticultural crops. The New Industrial Policy announced in 1991 marked a radical departure from the earlier stance of foreign investment in the seed sector. Under the policy, seed industry was identified as a high priority sector and foreign collaboration with Indian seed companies was encouraged. This was further modified in 1998 paving the way for 100 per cent equity participation of the foreign companies in the seed sector.

The entry of multinational seed companies was expected to benefit in many ways, such as leading to an overall increase in investments in the sector especially in private sector research on development of new varieties/hybrids. The Government of India has passed the Plant Variety Protection and Farmers' Rights Act in 2001 as per the WTO requirements. In March 2002, the Department of Bio-Technology approved the genetically modified cotton known as Bt cotton developed by Mahyco-Monsanto for commercial use, thus marking another vital step in the evolution of the Indian seed industry. In June 2002, the government announced the New Seeds Policy, according to which variety registration will now be mandatory for all varieties, new and extant. However, certification will continue to be voluntary. The New Seed Policy of 2002 allows imports and exports of seeds of all crops. However, all imported seed is also required to go through the process of registration. The policy seems to facilitate private sector rather than to control it.

G.S. Kainth adds that the seed multiplication and marketing activities were under the control of government agencies. Since these agencies could not meet the seed requirements of the entire country, there was an urgent need to formulate a national policy and effectively implement it to ensure the uninterrupted supply of seeds to farmers. Therefore, the National Seed Policy (NSP) was formulated and National Seeds Project (NSP)-I and NSP-II were launched in 1976 and 1978 respectively. Andhra Pradesh, Haryana, Maharashtra and Punjab participated in the NSP-I phase while Bihar, Karnataka, Orissa, Rajasthan and Uttar Pradesh joined in NSP-II. This is

now followed by NSP-III of the project, which extends assistance to private sector as well, with three components under quality control: (i) The setting of National Seeds Training Centre (NSTC); (ii) Development of 10 elite seed testing laboratories; and (iii) Secretariat support to the Central Seed Committee (CSC) and the Central Seed Certification Board (CSCB).

Suresh Pal and Robert Tripp, while discussing about rice seed industry in Andhra Pradesh and R.P.Singh *et al.*, while analysing maize seed industry in India, have briefly touched upon certain seed policy issues in India, most of which have been discussed earlier in this report.

II

IMPACT OF WTO, PUBLIC SECTOR AND GENOMIC REVOLUTION

Under the WTO provisions, the Trade Related Intellectual Property Rights (TRIPS) was probably the most debated accord. The TRIPS agreement envisages that each member country would be obliged to arrange for a system of protection for new plant varieties through patents or through a *sui generis* system. To fulfil its TRIPS obligations, the Indian Parliament passed in 2001 a bill for protection of plant varieties and farmers' rights. What implications the TRIPS agreement would have for India's seed industry is still a debating issue. In particular, the patenting of seeds and genes carries a lot of controversy around it. An opinion avers that the farmers have to buy their seeds every year from the multinational seed companies and that they cannot exchange seeds with the fellow farmers. To put the record straight, TRIPS agreement does not require us to patent seeds. However, it was other forms of propagation material as obliged under the WTO's Plant Breeders' Rights (PBR). With such measures, the participation of the private sector in the Indian seed industry may get some impetus. But then, it is felt in certain quarters that the existing land ceiling limits may prove to be a hindrance for the large-scale participation of the private seed companies in seed production.

Ever since Indian agriculture became a part of the world production and trade regime, the seed industry in the country has moved into new directions. The most significant of the post-WTO developments are the emergence of biotechnology as the central focus of agricultural research and the expanding clientele of the genetically modified (QM) or transgenic seeds. At the moment, transgenic seeds are the monopoly of a handful of MNCs, such as Monsanto, Dow Chemicals, DuPont, Novartis, Zeneca, BASF and Aventis. But it is unlikely to remain so for long, most surely in India, primarily because the Indian public sector research organisations, most notably, the Indian Agricultural Research Institute under ICAR, the Department of Bio-Technology, the State Agricultural Universities and other research institutes, have already made considerable headway in developing transgenic seeds. As is widely known, the transgenic seeds are not free from controversies, especially from the viewpoint of human health and environmental jeopardy; the most vocal example of this is Bt-cotton.

According to Y. Radha and K.R. Chowdry, formation of WTO in 1995 resulted in a liberalised trade followed by permission for a free trade in 715 articles in 2000 and lifting of ban on quantitative restrictions on 714 goods in April 2001. The most important effect of WTO that influences the Indian seed industry and the peasants is TRIPS. Of the seven items under TRIPS, Patent Rights have great impact on agriculture. Plants, livestock and genes, which are not inventions but only discoveries, were also brought under the regime of General Agreement on Tariffs and Trade (GATT). They further opine that the multinationals with their large infrastructure and investments in various developed countries have influenced the WTO in formulating the guidelines for TRIPS and also in including the agriculture related innovations under a world-wide IPR regime, so that they can monopolise the varieties developed by them for longer period.

In their paper, R.S. Chithra Gopal and N. Nagaraj are of the opinion that with the linkage of seed sector with Intellectual Property Rights issues, the farmers will be obliged to approach the seed companies for fresh seeds each season. There are cases in European countries where the Monsanto, the world's largest biotech company threatened farmers with law suits for open pollination of GM seeds to use it in the next season. The issue assumes serious proportions in India wherein majority of farming community depends on the seeds from previous season to raise crops in the ensuing season (Ramanathan, 2001).[4] A classic Indian example of violation of farmers' rights to safe seeds is that of Monsanto and Mahyco trials which were carried out in some parts of the country without clearance from the Genetic Engineering and Approval Committee (GEAC).

Sudarshan Iyengar and N.Lalitha, in their review article, reports that in future, it is possible that since the Bt cotton seeds have the government certification to go for commercialisation, there could be a tremendous demand, which could lead to hike in prices and adulterated seeds. There should be an undertaking by the company for eventual compensation of the farmers if the seeds fail. The authors suggested that keeping the positive impacts in mind, the government should conduct the trials in a more methodical manner and make available the technology with adequate precautions. The paper by Subodh Dhawan reports that in the case of Bt cotton, key issue in the use of Bt cotton is development of resistance to Bt in the pests. No model has been developed in India to determine critical size of the refugia. In its absence, the GEAC has adopted the US model where 20 per cent area as refugia is recommended. In India, average size of holding is 1.55 ha in 1990-91. If scientific norms were followed, small farmers would be excluded from the cultivation of Bt cotton. But adoption of new technology is class-neutral. It will give rise to health risks and environmental risks. Therefore, author advises to develop capacity to deal with peculiar risks before going for Bt cotton.

While reviewing the existing literature on GM crops and its food security and food safety in the context of WTO and TRIPS, A. Amarender Reddy and I.P.S. Yadav observe that one sector of people is arguing that, due to patents/IPR, only

MNCs get monopoly over the technologies in poor countries as done by creating terminator gene. Another argument by environmentalists is that excessive use of genetically modified chemical compounds might increase vulnerability to frequent pest/disease attacks. Since the advent of GM technology, researchers have used antibiotic resistance genes as selective makers for the process of genetic modification. The concern has been raised that the widespread use of such genes in plants could increase the antibiotic resistance of human pathogens. Therefore, there is a need for a thorough risk assessment of likely consequences at an early stage in the development of transgenic plant varieties, as well as for a monitoring system to evaluate these risks in subsequent field tests and releases.

III

STRUCTURE, GROWTH AND FUNCTIONING OF SEED INDUSTRY, PUBLIC-PRIVATE SECTOR INTERFACE AND ROLE, CONSTRAINTS IN SEED PRODUCTION AND DISTRIBUTION

Seven papers cater to this sub-theme. According to Bharat Ramaswami, the most important characteristic of the seed industry is its heterogeneity in many dimensions - coverage of crops, product type (hybrids versus open pollinated varieties), etc. In terms of organisation, the seed industry consists of a large public sector and a growing private sector. Public sector institutions are the major generators of new technologies in food crops while private sector participation is mostly in high value low volume crops. The share of private to public sector participation in Indian seed industry is around 60:40 by volume of turnover (Chitra Gopal and Nagaraj). Shiva and Crompton (1998)[5] estimate the share of private sector to be in the range of 60 per cent to 70 per cent. The annual seed requirement was to the tune of 0.7 million tonnes in 1996 which reached a level of 1.1 million tonnes in 2001. The deficit in the availability of good quality seeds is estimated by the Seed Association to be 20,000 tonnes per year on an all-India basis. Currently, the size of the industry in value terms is estimated to be Rs.25 billion. The increasing demand for quality seeds enabled mushrooming of indigenous seed companies. With the liberalisation of Indian economy and elimination or reduction of restrictive trade policies, the MNCs have entered the Indian seed industry in an unprecedented big way.

The major players in the Indian seed industry include the National Seed Corporation, the State Farm Corporation of India, 13 State Seeds Corporations, 19 State Seed Certification Agencies, 96 State Seed Testing Laboratories and several MNCs. The corporations multiply and market the varieties bred by the public sector institutions. The important MNCs include Novartis, Cargill, ITC Zeneca, Pioneer Seeds and Proagro Seeds. There are no firm estimates of the number of private domestic seed firms. Estimates vary from 200 to 500. The dominant ones are Maharashtra State Seed Corporation, Maharashtra Hybrid Seed Company Ltd. (Mahyco), Nath Seeds Corporation, Sheetal Seeds, Mahindra Hybrid Seeds, Rallis India Ltd., Ankur Seeds and Namdhari Seeds. Private seed firms are heterogeneous with respect to size, research capacity and product segments. Research component is

prevalent mostly in larger firms. Unlike the public sector, wherein research is separate from production and marketing, these functions are integrated in the private firms. The other striking difference is in product types. The private sector focuses largely on hybrid seed. In terms of ownership, private firms are closely held and not listed in the stock exchanges although some of the large firms have sold equity to foreign seed companies. Seed firms, whether in the private or public sector, outsource the production of seeds to contract growers. These growers are supplied with the foundation seed that is used to produce commercial seed. For the cereal crops of rice and wheat, the principal source of seeds is not the seed industry, whether private or public, but the farmers themselves.

R.P. Singh *et al.*, while analysing the organisation and performance of maize seed industry in India, observe that profit oriented firms are unlikely to assume functions that cannot easily be exploited for commercial gain. Hence, government agencies would continue to play an important role in supporting basic research, conducting applied research targeted at marginal environments. Moreover, equity considerations should be backed up apart from efficiency and effectiveness in order to address the concerns of resource poor farmers. The maize seed industry, which attained an all time high seed production of about 35,000 metric tonnes in 1998, is still hovering around the same level in spite of the presence of large transnational seed companies. The industry is finding difficulty to break this threshold and hence is constrained to increase their production capacity.

Contract farming of seed in India: A study of private and public sector performance conducted by Sukhpal Singh examines important seed agencies to study the practice of contracts and to analyse their nature and performance in the seed sector with a view to locate more suitable organisational form from the production side. It compares contracts of public and private seed agencies for their farmer friendliness. Concept and logic of contract farming was concisely and precisely presented. Apart from this, a comparative assessment of contracts and performance was analysed. He opines that there is a need to maintain and encourage vertically co-ordinated structures, for better contracts and protection of contract grower's interest in contract seed production in India. R.K. Singh and Govind Babu in their case study of Uttar Pradesh revealed that institutional support made available to wheat research coupled with imperative need for food security resulted in high gains. The study suggested for development of an accountable research and extension system by involving mechanism for trade-off between private and public sector research to cover concerns around human, ecology and comparative advantage.

Breeder seed production of pulses in India was analysed by Brahm Prakash and V.P. Tyagi. Secondary data were used to know the current status of breeder seed production of pulses. According to this study, the breeder seed production has increased from 1,882 quintals to 4,082 quintals during the period 1994-95 to 1998-99. Important constraints in breeder seed production of pulses were varietal mismatch and shortfall in production, non-lifting of indented varieties by indenters and lack of

storage facility. While analysing the problems in production and marketing of cotton seed in Andhra Pradesh, G.V. Krishna Rao found that low procurement price, delay in seed certification, shortage of labour, non-availability of pure foundation seed and lack of technical guidance were the major constraints in seed production, whereas traders reported that unhealthy competition existed in the seed marketing and were negatively affected by the entry of the multi-national companies.

IV

STATE SEED CORPORATIONS – ROLE AND PERFORMANCE

This sub-theme is covered by four papers which analyse the organisational structure, growth and role of State Seeds Corporations in Madhya Pradesh, Rajasthan, Andhra Pradesh and Maharashtra States.

R.M. Sahu *et al.*, in their study on the role of MP Rajya Beej Vikas Nigam in supply of quality seeds in Jabalpur division of Madhya Pradesh, attempted to study the demand and supply projections and also to know the gap between demand and supply of certified seeds from 1999-2000 to 2001-02. The data on procurement and sale prices were also collected to know the extent of price spread in sale of certified seeds by the Beej Nigam. It is clear from the study that percentage gap between supply of and demand for seed has significantly narrowed down from 65 per cent to 15 per cent during the period 1999 to 2002, which is a good sign of prosperity of seed industry. Also the awareness of the farmers increased during the period as indicated by the increased demand for seed during the last three years and this reflects in increased productivity of crops in the region during this period. It is also revealed from the study that the quantity of seed supplied and percentage gap between demand and supply of certified seed was directly associated with area under the crop. Similarly, the organisation, structure and growth of Seed Corporation in Rajasthan was studied by D.C. Pant *et al.*, using secondary data from 1996-97 to 2001-02. During the study period seed production increased for all the crops except wheat and oilseeds. The Corporation has processed (2,67,667 tonnes) and distributed (23,494 tonnes) a sizeable quantity of seeds during the year 2001-02, with an increase of nearly 50 per cent over the year 1996-97. The Corporation was able to distribute only 4 per cent of cereals, one per cent of pulses, 11 per cent of oilseeds and 33 per cent of mustard seed requirements in the state.

The performance of the Andhra Pradesh State Seeds Development Corporation (APSSDC) was evaluated by S.Hyma Jyothi *et al.,* using principal component analysis (PCA). As the main objective of the study was to analyse the performance of the APSSDC, time-series data were abstracted from the annual reports of the APSSDC for a period of ten years from 1991-92 to 2000-01. As many as 19 financial indicators were identified for the study. The study revealed the existence of three dimensions in the performance of the Corporation. The first dimension explained 58.24 per cent of the total variation, while the second dimension explained 18.19 per cent of the total variation and the third explained 15.14 per cent of the total variation.

The study concludes that, in order to meet the growing demand for the seeds, the Corporation has to increase the total assets and should accumulate sufficient resources and surplus in future. R.R.Suryawanshi *et. al.,* studied production and marketing management of MAHABEEJ Seeds in Maharashtra, using primary data from 90 farmers. The authors reported that Maharashtra State Seeds Corporation Limited (MSSCL) only manages seed production on farmers' fields, which increased at a compound growth rate of 10.46 per cent per annum from 1986 to 2000. The MSSCL started its R & D activities from 1983 and has released nine varieties. It has helped the producers appropriate a share of more than 60 per cent in the consumer price. Farmers and dealers experienced best quality, reasonable prices, good demand and better services of MSSCL seeds.

V

GAPS BETWEEN DECLARED AND ACTUAL YIELD RATES, ACCOUNTABILITY OF RESEARCH AND EXTENSION SYSTEMS

While hardly any paper has touched upon, in depth, the issues of gaps between declared and actual yield rates as well as accountability of research and extension systems, a superficial coverage by two papers (Singh and Babu; H.N.Atibudhi and Binodini Sethi) of related issues like varietal decay across time and accountability in research and extension, merits a mention here. Singh and Babu, while analysing the decay of wheat varieties over time, observe that the degree of longevity is specific to a given variety and environment. The longevity of new resistance wheat varieties also increases if they are grown alongside susceptible varieties. Frequent varietal replacement also incurs costs due to breeding, seed multiplication, distribution and extension. The released genotypes of wheat at Kanpur have kept their average field life for more than 7 years, which poses a little challenge to plant breeders in meeting a target replacement time of five to six years in Uttar Pradesh wherein the area under wheat is 9 million hectares. However, it is realised that one or two varieties should be pipelined each year. The study suggests for development of an accountable research and extension system by evolving mechanism for trade-off between private and public sector research to cover concerns around human, ecology and comparative advantage.

The decline in yields of rice varieties was analysed by Atibudhi and Sethi in their study on rice seed management in Orissa using both primary and secondary data. They also attempted to know about the source of rice seed, its management and farmers perception regarding quality of seeds. The decline in yield is more drastic for every subsequent recycling of seed. About 70 per cent of the farmers in different districts opined that there would be 12 to 21 per cent decline in yield if farm saved seed of previous season is used, whereas the yield decline would be 26 to 32 per cent if two seasons old seeds are used.

VI

SOURCES AND COMPOSITION OF SEED SUPPLY, SEED REPLACEMENT RATES, ACCESS TO QUALITY SEED

Distribution of right quality seed at right time and at right place is most important for desired growth of agricultural sector. However, the distribution of seeds is not efficient in the country. There are basically two systems of seed distribution. The first system is an organised/formal seed industry. Under this system, seed is distributed through a network of distributors/dealers, own retail outlets, farmers' fairs, etc. The public seed agencies also take the help of State Department of Agriculture in the distribution of seeds because, in most of the cases subsidy is given by the government on the seeds distributed by the Agriculture Departments. In some states, the distribution of seeds is also through co-operatives. The second type of seed distribution system is unorganised sector mainly comprising the unauthorised seed dealers. There is reluctance on the part of these dealers to get their seeds certified. They generally sell truthfully labelled (TL) seeds of different crops. Some seed companies also sell TL seeds. There are malpractices at various stages right from seed procurement to distribution all over the country, and in net terms, the seed users (farmers) remain the most exploited segment of the chain. Again, it has become a general practice to release new variety rather frequently so that a decisive improvement in yield rate is not to be expected in all cases. All such unhealthy practices in the Indian seed industry need to be checked.

This sub-theme has attracted the attention of five papers. Pal and Tripp, in their study pertaining to Andhra Pradesh, found that between 20 and 30 per cent of the paddy seed sown in any one year is acquired from other farmers. In the majority of cases, farmers either pay a premium (approximately 25 per cent) over grain price or repay loaned seed in kind at 50 per cent interest. This illustrates both the inadequacy of the seed-saving myth and the importance of commercial seed transactions even at the village level. The seed turnover rate is exceptionally high - between 40 and 70 per cent, depending on the area. Farmers of all wealth categories acquire seed from commercial sources not only to change variety, but also for quality preferences. The study on sources of seed potato supply and seed replacement rates in Hoogly and Burdwan districts of West Bengal conducted by Nalini Ranjan Kumar *et al.* reveals that the major source of seed supply was the self retained previous crop (50.57 per cent), followed by seeds purchased from village traders/local traders (38.83 per cent) and government agencies (9.50 per cent). The study also reveals that the seed replacement rate (SRR) was only 9.50 per cent in the case of certified seeds and 38.83 per cent in the case of quality seeds. Most of the farmers cited inadequate availability and high price of certified seeds as the main reasons for low SRR. Hence to increase the SRR of certified and quality seeds, the authors feel that there is a need to arrange loan, increase the productivity of certified seeds and to strengthen public agencies and their distribution network.

In their study on rice seed management in Orissa, Atibudhi and Sethi observed that farmers' preference for seed sources was mainly Agriculture Department followed by farm-saved seeds and fellow farmers. About 29-32 per cent of the farmers in the state felt that use of one-season-old seeds will not lead to decline in the yield. Seed turnover rate in the state is very low (10.3 per cent). The network for distribution of certified seeds in Uttar Pradesh consists of Agricultural Department, co-operative societies and private traders who jointly had distributed more than 95 per cent of certified seeds of pulses during 1998-99 (D.K.Singh). Of the total quantity, more than 50 per cent was distributed by Agricultural Department. The SRR in pulses is very poor in Uttar Pradesh, specifically, 1.22, 1.49, 3.12 and 6.16 for lentil, gram, arhar and pea respectively, thereby indicating that nearly 95 per cent of the area under these crops was covered by traditional varieties in Uttar Pradesh.

A.Narayanamoorthy has attempted to estimate the share of certified seeds in the total seed consumption by the farmers of Sangli and Amravati districts of Maharashtra. He found that about 79 per cent of the sample farmers of the selected districts have used certified seed and the remaining farmers have used truthful seed in the adopters' group. Non-availability of certified seed in time was the main reason for using truthful seeds. More interestingly, bulk of the farmers, who used truthful seeds supplied by the private traders, expressed dissatisfaction over the extent of germination of seed and felt that the seed prices differ between the private and government agencies at times of seed scarcity.

VII

DEMAND-SUPPLY: ESTIMATION AND IMBALANCES

It is generally felt that estimation of demand for quality/certified seeds is very difficult. This is because seed demand depends on the area under that particular crop and variety. And it is well-known how difficult it is to get varietywise area under a crop. Similarly, estimation of supply under unorganised sector is a difficult task. As regards demand-supply imbalances, it is established that demand exceeds supply in both the seasons and in most of the crops, barring few exceptions.

Six papers cater to this sub-theme. Estimation of demand and supply and adoption of quality seeds in Haryana by R.S.Chauhan *et al.* reveals that paddy, wheat, rapeseed and mustard acreage were expected to increase to 813, 2,330 and 619 thousand hectares in 2005-06 from 795, 2,019 and 601 thousand hectares respectively in 1996-97. The seed requirement of paddy, wheat and rapeseed will increase in future even at existing replacement rate of 11.69 per cent, 11.59 per cent and 16.24 per cent respectively. In cotton, it will decrease in future due to decline in the expected area. The estimated availability of seed of the crops will increase in future because many seed producing agencies in corporate and private sectors have entered into the seed business. Between 1996-97 and 2005-06, the availability of paddy quality seed will increase by 26.15 per cent and that of cotton by 25.87 per cent, but the requirement of

cotton quality seeds will be more even at existing seed replacement rate than its projected availability. Therefore, more emphasis has to be given on cotton quality seed production.

Asokan and Singh in their study revealed that despite the impressive gains in production of seed, the gap between requirements and production of quality seed is consistently high for major cereals and oilseeds crops. For wheat, the shortfall had been nearly two-thirds of the requirement in recent years and for rice, it was between 40 to 50 per cent. The situation was still worse in the case of jowar and maize. With regard to oilseeds, the shortfall decreased in recent years for sunflower; however, for groundnut and mustard the gap is persisting around 90 per cent and 70 per cent respectively. The situation is no better with regard to vegetable seeds. The seed production is lower than the requirements while seed enterprises are facing the problem of carry over of unsold seeds almost every year. The reason could be that the seed replacement rate is very low for all important crops. This means that the farmers used crop produce as seed or exchanged it with fellow farmers or even purchased unbranded seed from market. In spite of India's distinct advantages over many countries in seed production, the share of India's export in the total global seed trade is a mere 0.4 per cent, which is a very low figure for a country of India's size and potential.

Seasonwise and cropwise demand-supply gap of certified seeds supplied Madhya Pradesh Beej Nigam has been studied by Sahu *et al.* The triennium (ending 2001-02) data indicate that the demand-supply gap was 30 per cent in *kharif* and 49 per cent in *rabi*, leading to overall gap of 38 per cent. The cropwise analysis indicates that during *kharif*, the demand-supply gap ranged from 30 per cent in paddy to 498 per cent in greengram, while in the case of maize, there was excess supply (-56 per cent). In *rabi*, the demand-supply gap ranged from 40 per cent in gram to 390 per cent in toria, whereas there was excess supply in the case of pea (-21 per cent), safflower (-18 per cent) and berseem (-20 per cent). The authors conclude that the supply of certified seeds and demand-supply gap were directly associated with the area under the crop.

On the contrary, the study by Narayanamoorthy does not show any demand-supply gap in all the four crops selected, namely, groundnut, soybean, tur and gram. This is not only true in the case of large and medium size-groups of farmers but also among marginal and small groups of farmers. However, this does not mean that the farmers have not faced any problem in getting seed from the private or government agencies. It is reported that the farmers unwillingly purchased seeds from the private traders due to non-availability of seed in the government shops. Some farmers had to visit the co-operative societies several times to get the required quality of seeds.

Demand for HYV seeds will continue to increase in view of the decreasing cultivable land-man ratios caused by growing population and land requirement for infrastructure. B.R.Atteri and Pramod Kumar have attempted to project demand for HYVs of cereal crops by 2004-05, 2009-10, 2014-15, 2019-20, using regression method with suitable predictions on independent variables. The study showed that the

area under HYVs would increase from 90.87 million hectares in 2004-05 to 126.17 million hectares by 2019-20, accounting for only about 60 per cent of the cropped area in 2020. The cropwise analysis of projection of demand revealed that almost 97 per cent of rice area will be under HYVs by 2020. The demand for HYVs of wheat will be 2.86 million tonnes by 2019-20, while it will be 0.08, 0.12 and 0.02 million tonnes for jowar, maize and bajra respectively. Thus, owing to the need for increasing area under HYVs, the country needs to invest more for undertaking rigorous research on HYV Programme.

In spite of best efforts of both public and private sectors, we supply only about twelve per cent of the total seed used for sowing each year. Hence, large area is still sown with farmers saved seed, and therefore, it is imperative to improve the availability of quality seed to raise the seed replacement rate. R. Prashantkumar Wadear *et al.,* in their study on seed industry in India, observe that though the certified seed production has increased from 2.98 lakh tonnes in 1981-82 to 7.24 lakh tonnes during 1995-96, the seed replacement rate is still far from satisfactory. The area coverage under hybrids is quite low ranging from 3.45 per cent in cotton to 26.79 per cent in pearlmillet. The area under HYVs of cereals increased from 1,886 hectares in 1966-67 to 71,127 hectares in 1995-96, thus registering a compound annual growth rate of 8.52 per cent per annum. Sorghum registered highest growth (11.39 per cent), followed by paddy (9.31 per cent), bajra (8.82 per cent), maize (8.76 per cent) and wheat (7.31 per cent). The decadal analysis reveals that the growth in area under HYVs was highest (30.05 per cent) in the first decade (1966-75), which declined to 5.60 per cent in the second decade (1976-85) and 2.77 per cent in the third decade (1986-95).

VIII

SEED TRADE – MIDDLEMEN'S MARGINS, INTER-AGENCY PRICE DIFFERENTIALS AND EXPORT

Of the papers received, three papers, one each touched upon the issues of trade margins, inter-agency price differentials and seed export. The study on marketing of quality seeds of wheat and pearlmillet in Ahmednagar district of Maharashtra by S.N.Tilekar *et al.* attempts to analyse market structure of sellers (seed selling centres) and buyers (farmers) of quality seeds and also price spread in marketing of wheat and pearlmillet quality seed. The results reveal that the per cent share of marketing cost in the price paid by the farmers accounted for about 23 per cent in pearlmillet and 17 per cent in wheat, thus implying that the remaining share (i.e., 77 per cent and 83 per cent respectively) was appropriated by the seed supplying agencies. Among the different items of marketing cost, the dealer's margin was the highest (16 per cent and 10 per cent in pearlmillet and wheat respectively), followed by distributor's commission and transportation expenses, in both the crops.

Narayanamoorthy, while evaluating the seed use in pulses and oilseeds in Maharashtra, observed that, in the selected crops, namely, groundnut, soybean, gram and tur, the prices of seed tend to vary between the private and government agencies during the scarcity period. Although prices of seeds are fixed by the Maharashtra State Seed Corporation (MSSC) in consultation with the State Department of Agriculture, it is often argued that the private traders at the retail level do not always follow it. A comparison by the author of the seed prices fixed by the MSSC and prices paid by the farmers reveals no difference between the two, whereas farmers have expressed that the prices of seeds were relatively higher in the private shops especially during the scarcity season.

On the issue of seed export, Asokan and Singh have explored India's seed exports over the years (1990-91 to 1999-2000) in quantity and value terms. India exported 4,433 tonnes of seed worth Rs.9.6 crores during 1990-91. Though the exports in terms of volume remained the same during 1999-2000, in terms of value it increased to Rs.73.56 crores. Exports in 1990-91 constituted mainly high volume but low value forage crops. Over the years, exports of forage crops declined and exports of low volume high value vegetable crops increased. However, the share of India's export in the total seed trade is mere 0.4 per cent. This is woefully low figure for a country of India's size and potential. India has distinct advantages over many countries in producing seed. The climatic conditions in India are so diverse that it has been divided into 120 agro-climatic sub-zones. The variations in the climate make it possible to grow a particular crop for seed production all the year round in one or the other part of the country. There is a vast pool of high calibre agricultural scientists as well as cheap agricultural labour. However, this potential is hardly exploited to carve a niche for India in the world trade on seeds. Further, there is enormous scope for custom production of seeds by the Indian companies for foreign clients. Barring a couple of private companies others had not tapped the potential. If India wants to be a big player in the international market on seed it has to chalk out a strategy assessing its strength in catering to different markets for different crops. According to the authors, the government must desist from adhoc decisions and spell out a comprehensive seed policy, which would enable the seed companies to plan their activities accordingly.

IX

ISSUES FOR DISCUSSION

	Sub-theme	Issues for discussion
1.	Seed Policy, Seed Legislation and Role of Central and State Governments	What is the impact of various Seed Policies? What more interventions by Central and State Governments needed for rapid development of seed industry? Certification to be mandatory for private sector varieties? Regulation of the functioning of MNCs needed? If yes, what are the policy options?

Sub-theme	Issues for discussion
2. Impact of WTO, Public Sector and Genomic Revolution	What could be the implications of TRIPS in the context of Plant Varieties Protection and Farmers' Rights Act, 2001 and New Seed Policy, 2002? Whether the problems associated with the GM technology make it worse than the traditional alternative? If we are to live with GM technology, whether research to tackle next generation problems to be initiated in the immediate future?
3. Structure, Growth and Functioning of Seed Industry, Public-Private Sector Interface and Role, Constraints in Seed Production and Distribution	What more options are available for strengthening public-private complementary sectoral interface? Can 'seed distribution' be totally left to private sector?
4. State Seed Corporations-Role and Performance	What are the critical factors responsible for deteriorating or poor health of the State Seed Corporations (SSCs)? What are the feasible and sustainable options to bring the SSCs back on track? Accountability can be built into the system?
5. Gaps between Declared and Actual Yield Rates, Accountability of Research and Extension Systems	Whether extent of gaps between declared yield rates and actual yield rates be linked to social accountability of research and extension systems? What are the solutions for wide gaps between declared and actual yield rates? How to insure farmer against suicidal yield differences?
6. Sources and Composition of Seed Supply, Seed Replacement Rates, Access to Quality Seed	Whether the existing seed replacement rates are to be increased? If so, how to encourage farmers to do so? Can seed replacement targets be fixed for each state? If so, rolling plan for each state for seed production with proper monitoring and evaluation mechanisms be thought of? How to deal with supply of spurious seeds? Any option other than legal?
7. Demand-Supply: Estimation and Imbalances	Can we afford to have the existing demand-supply gap with respect to quality seeds to continue for ever? If not, how to narrow down the gap? Can we institutionalise the regular and accurate estimation of demand and supply, region-wise, crop-wise and variety-wise and maintenance of database thereof? A separate organisation "Seed Board" is necessary/possible?
8. Seed Trade - Middlemen's Margins, Inter-Agency Price Differentials and Seed Export	Whether the existing level of market imperfections are harmful to the growth of the seed industry? Given the demand-supply gap in the domestic market, should exports be allowed unregulated?

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