

# Seed System Innovations in the Semi-Arid Tropics of Andhra Pradesh



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### **Abstract**

An effective seed supply system is necessary to make good quality seed available to farmers at the right time and at low cost. Given the critical role played by improved varieties in increasing production of grain and quantity and quality of stover for livestock fodder in conventional cropping systems, agriculture decision-makers have the challenge of developing an integrated and cost-effective seed system that is capable of generating and delivering improved seed varieties to farmers. Such a system would be an important step toward ensuring seed security and enhancing livelihoods, particularly of dryland farmers.

Issues related to seed multiplication and delivery systems in India are discussed in this publication. The book outlines the development of the seed industry in India and highlights the changes made to seed policies over the years. It records the experience from an attempt to improve the local seed systems in four dryland agricultural districts that are typically representative of the semi-arid areas of Andhra Pradesh state. Using specific seed delivery models, it presents ways of strengthening seed systems to address the needs and vulnerabilities of smallholder farmers including those associated with livestock and fodder security in these areas.

This book is not an all-encompassing summary of the seed systems in Andhra Pradesh, nor does it try to provide magical solutions to constraints encountered by poor farmers. It does, however, attempt to illustrate alternative approaches to strengthen the seed systems by employing new approaches as well as implementing tested approaches in new ways constituting innovation. Given the ever rapid changes taking place in the technological, socioeconomic and policy environments, understanding some of the processes and mechanisms involved in these changes as has been presented in this document will help in continuous development of an appropriate seed system and contribute to enhancing the livelihoods of poor farmers in the semi-arid areas of India.

### **Acknowledgment**

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# Seed System Innovations in the Semi-Arid Tropics of Andhra Pradesh

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## Foreword

The power of a seed is unlimited. As a powerful agent of change, seeds can be a means of overcoming production constraints, thereby making a difference in the lives of the poor and hungry. This requires seed demand and supply to be balanced by way of a secure seed supply system. This would give farmers access to adequate quantities of good quality seed of the desired type at the required time and at affordable cost.

Seeds are key components in the conservation and ownership of biodiversity. Accordingly, sustainable seed supply and implementation of seed security are among the major activities outlined in the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. Seeds therefore represent hope for the future of mankind.

Throughout our history, farmers' informal seed systems have had a great influence on the evolution of modern agriculture, by practising conservation of agrobiodiversity at the gene, farmer and ecosystem levels. Within this framework, women in particular have played a crucial role, as has been identified by a recent analysis, in sustaining the informal seed sector, and more widely, in ensuring food security. However, informal seed systems are heavily dependent on local resources and inputs, and highly vulnerable to natural disasters and sociopolitical disruptions. Therefore, investing in a range of approaches in order to strengthen local seed systems assumes great urgency.

While the formal hybrid seed industry led by the private sector has tended to focus on profit-making species and crops, the informal sector has concentrated on crops – mainly self- or open-pollinated varieties – that are crucial to local food production systems. Given such a scenario, national seed policies concludes helping to strengthen the informal sector. International support too continues to be mainly engaged with the formal sector. Perhaps matching support is required to encourage continued development of informal seed systems.

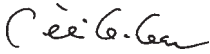
In this context, the concept of 'seed villages', which advocates self-sufficiency in production and distribution of good quality seed, is fast gaining ground. Seed villages, or village seed banks, operate under supervision and utmost transparency, inculcating mutual trust and social responsibility among farmers, thereby reducing their dependence on external inputs.

Several initiatives have been launched to revive this traditional concept, such as those initiated by the Indian Council of Agricultural Research (ICAR), the National Research Centre for Sorghum (NRCS) and state agricultural universities (SAUs). Similarly, the seed bank concept is part of ICRISAT's projects in collaboration with the Asian Development Bank (ADB), Tata-ICRISAT project in Vidisha and Guna districts of Madhya Pradesh and the Andhra Pradesh Rural Livelihoods Project (APRLP) in Kurnool district in Andhra Pradesh and other ongoing efforts in the states of Maharashtra and Karnataka.

In low-rainfall, dryland agricultural areas, cereals and legumes serve the dual purpose of providing food and income for poor farmers and fodder for their cattle. Given the critical role played by improved varieties in increasing conventional crop production, a key question arises: how do we facilitate the development of an integrated and cost-effective seed system that is capable of generating, producing and distributing improved seed varieties that meet the needs of resource-poor farmers?

This book is an attempt to review and document the existing seed multiplication and delivery systems in four dryland agricultural districts of Andhra Pradesh: Anantapur, Kurnool, Mahbubnagar and Nalgonda. While analyzing the problems associated with different seed systems in these districts, the book makes a strong case for strengthening alternative seed systems and seed delivery models that address the needs of small farmers in the context of constantly changing dynamics on the national, international, political and socioeconomic fronts.

I am sure this book will be a valuable reference source for those engaged in strengthening local seed systems as a step toward food security in the semi-arid tropics of India.

  
**William D Dar**  
Director General  
ICRISAT

# Part III: Seed Industry Development in India

**CHAPTER III: Developments in the Seed Industry in India**

**CHAPTER IV: Overall Policy Framework for Seeds in India**

**CHAPTER V: Issues Relating to Plant Variety Protection and Seed Industry in India**

# Developments in the Seed Industry in India

*This chapter traces the history of the Indian seed industry along the various milestones passed since 1957 up to the current scenario. It sketches the contours of India's formal and informal seed systems, and examines the respective roles of the private and public sector seed industries.*

## Introduction

India is served by both formal and informal seed systems. The formal component consists of public and private sector companies, which have divergent objectives and financial arrangements. Within the informal sector one can differentiate between seed saved on-farm and that obtained from the trading and exchange subsystems within the community, this considered a distinct market

## Main Milestones

Efforts to give shape to India's formal seed system began during the Second Five Year Plan period (1956–61) when special emphasis was laid on multiplication of nucleus and foundation seed, which acted as the basis for further multiplication and distribution of seed. The All-India Coordinated Maize Improvement Project was launched in 1957 as a result of collaboration between the Indian Council of Agricultural Research (ICAR) and the Rockefeller Foundation. Other All India Coordinated Crop Improvement Schemes followed and several agricultural universities initiated efforts to develop new crop varieties and hybrids. This enabled chain multiplication of certified/quality seed – from breeder to foundation seed and from foundation to certified seed – and making it available to the farming community. The Maharashtra Hybrid Seeds Company Limited (MAHYCO), a private sector seed enterprise, was established in 1961, and the National Seeds Corporation (NSC) was established in 1963 to produce foundation seed. In 1964, state variety release committees (SVRCs) were established to monitor the timely release of new varieties to farmers The

Seed Act came into existence in 1968–69 and at the same time the Central Seed Committee (CSC) was constituted under the Seed Act. It took over the functions of the Central Variety Release Committee (CVRC). The National Seeds Project (NSP) was formulated in 1975 to establish the State Farms Corporation of India (SFCI), four state seeds development corporations (SSDCs) and breeder seed production units in state agricultural universities (SAUs). These were mandated to provide support to NSC. In 1985, during the second phase of NSP, 13 additional SSDCs were established to promote seed quality standards. Nineteen state seed certification agencies were also established under the NSP. In 1988, NSP's third phase focused on encouraging expert-oriented horticulture industry. The Seed Act, decreed by Parliament in 1966 to regulate the quality of seed production and marketing in the country, was amended in 1972. It was only in 1983 that the Seed Control Order was issued, but was not implemented by various states until 1994. Liberalization of the Indian economy paved the way for the entry of multinational corporations (MNCs) into the Indian seed sector.

## Sources of Seed Production

The seed production process consists of a sequence of stages in which seed of a new variety is multiplied to obtain sufficient quantities of commercial seed. With regard to millets and groundnut seed, the earlier stages are referred to as breeder seed and the intermediate stages as foundation seed. Together, these precursors of commercial seed are known as source seed. Source seed production is beset by serious bottlenecks in many national seed systems, but India has taken major steps to improve access to the seed.

Prior to 1994, breeder seed production was coordinated at the national level in India but now much of the breeder seed production of state-released varieties is managed at the state level, although some states still depend on the centralized system. The National Seed Project (NSP) meets many of the requests from these states, as well as providing breeder seed of centrally released varieties. Public sector seed corporations, private seed companies and cooperatives that wish to obtain breeder seed submit a request ('indent') to the state agricultural university or the ICAR institute producing the breeder seed along with a prepayment. The Indian Council of Agricultural Research (ICAR) establishes the price of breeder seed. The indents are submitted once a year, and the university then distributes them among its



## Important Events in India's Seed Industry

1957	First All India Coordinated Maize Improvement Project established
1960	Similar projects on sorghum and pearl millet started
1961	First four maize hybrids released
1963	National Seeds Corporation established
1965	First hybrid in pearl millet released; 250 tons of seed of dwarf varieties of wheat imported from Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT); All India Coordinated Project on wheat established
1966	Seed Act passed
1968	Report of Seed Review Team submitted; Seed Act operational
1969	State Farms Corporation of India created, UP Seeds & Terai Development Corporation established
1971	National Commission on Agriculture constituted; Indian Society of Seed Technology established; minimum seed certification standards adopted
1975	National Commission on Agriculture's report submitted; report of National Seeds Project (NSP) submitted
1977–78	NSP phase I launched with World Bank assistance of US\$52.7 million
1978–79	NSP phase II launched with World Bank assistance of US\$34.9 million
1979–80	All India Coordinated National Seed Project (Crops) launched; All India Coordinated Project on Seedborne Diseases launched
1981	First workshop on seed technology held under NSP
1988	Separate section on seed created in ICAR; new seed policy implemented
1989–90	Special project on hybrids in nine selected crops and seed, National Technology Research Project started by ICAR
1990–91	NSP phase III launched
1991	All India Coordinated Research Project (AICRP) on Seedborne Diseases merged with NSP (Crops)
1994	Government of India signs the General Agreement on Tariffs and Trade (GATT)
2001	Protection of Plant Variety and Farmers' Rights Act passed
2003	National Seed Policy formulated
2004	Directorate of Seed Research established
2005	New seed bill introduced in Parliament

research stations to increase the supplies. Ideally, breeder seed production of a variety should be managed by the station that developed the variety, but in some cases (particularly for very popular varieties) several other stations are assigned the task. For the breeder seed produced, the plant breeder is responsible for the quality, as its production does not undergo the seed certification process (breeder seed production is monitored by a group nominated by the respective All India Crop Improvement Projects). Upon receiving the required supplies of breeder seed, the companies multiply them to produce foundation seed. It takes approximately two years from the time an indent is made for breeder seed until the resulting commercial seed is ready for the market; so seed producers need to carefully plan their inventories. They also need to know which varieties are likely to be in demand. University research stations also produce some foundation seed, which is used mostly for demonstrations or for distribution to farmers to promote new varieties. Some stations also produce foundation seed for use in the Seed Village Programme of the DOA.

## Formal Seed Supply Systems

Seed supplied in the formal, or organized (Camargo et al. 1989) seed sector is characterized by planned production, some form of (mechanized) processing, inclusion of only identified/notified varieties and a system of quality control. Large quantities of seed are transacted in the formal seed system.

Formal seed supply systems (Figure 5.1) consist of seed production by

National government agencies

- (i) State government agencies
- (ii) Government-assisted and other cooperatives
- (iii) Multinational corporations (MNCs) or transnational corporations (TNCs)
- (iv) Domestic private sector companies
  - a) with their own research and development (R&D)
  - b) without their own R&D
- (v) Joint venture companies
  - a) between MNC and domestic private company
  - b) between two domestic companies, etc.

However, the formal seed sector – through its involvement in variety development, evaluation and release; seed production, marketing and

distribution; and quality control operations – can offer only a limited range of varieties and operates within specified quality standards. In practice, these may constrain its ability to meet the diverse needs of farmers. There are serious concerns over the appropriateness of the varieties available in the formal seed sector, the quantity and quality of seed delivered, seed production costs and prices and timeliness of supply. More importantly, rigid government policies and regulations, poor organizational linkages and inadequate infrastructure contribute to the problems of the formal system in developing countries.

Moreover, the existence of even a relatively developed formal sector at the national level certainly cannot yet guarantee small-farmer seed security at the community and household levels. Private seed companies are reluctant to produce and market varieties of sorghum, pearl millet, pigeonpea and groundnut because of low returns. Even if they did, they might not reach smallholder farmers in remote areas due to lack of infrastructure. Moreover, once seed of a variety has been sold to a farmer, he/she is likely to save his/her own seed for the next season and not buy again. This adds up to a disincentive for private seed companies to get involved.

## Informal Seed Supply Systems

Informal seed supply systems (Figure 5.1) are characterized by a lack of functional specialization; they are heterogenous in space and flexible in time. These systems are traditional and informal, operating mainly at the community level through exchange mechanisms. They involve limited quantities per transaction (Cromwell et al. 1992).

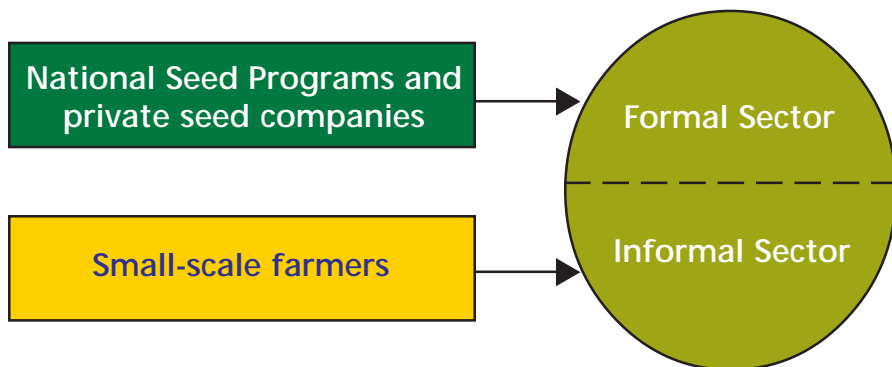


Figure 5.1. Components of formal and informal seed systems.

Informal seed supply systems broadly include:

- (i) Farm-saved seed and farmer-to-farmer exchange
- (ii) Farmers' cooperatives
- (iii) Community groups
- (iv) Seed growers' associations
- (v) Nongovernmental organizations

More than 80% of the food crops in India are sown from seed stocks selected and saved by farmers. These systems have been variously called farmer-managed seed systems (Ball and Douglas 1992), informal seed systems (Cromwell et al. 1992), traditional systems (Linnemann and de Bruijn 1987) or local seed systems (Almekinders et al. 1994). They are semistructured, and may depend on indigenous knowledge of plant and seed selection, sourcing, retaining and management as well as local diffusion mechanisms. These systems play an important role in the seed security of local landraces at the household and community levels and can be linked to germplasm conservation, enhancement and utilization. Infact a clear distinction between grain and seed may not exist in the informal system. Good quality grain may be offered as seed as the next sowing season approaches.

## Integrated Seed Supply Systems

Integrated seed supply systems, in the context of this presentation, are mechanisms to supply seed of new varieties to farmers which combine methods from both the formal and informal sectors including local seed supply systems. Variety use and development, seed production and storage by farmers under local conditions, and seed exchange mechanisms are the three principal components of a dynamic system that forms the most important seed source of food crops for small farmers in the semi-arid tropics. In fact, the strengths and weaknesses of local seed systems indicate that local seed systems and the formal system are complementary. Integrated approaches in breeding and seed production and distribution have been shown to have promising potential for improving seed supply to small farmers. Organizations facilitating seed industry development in developing countries is depicted in Figure 5.2.

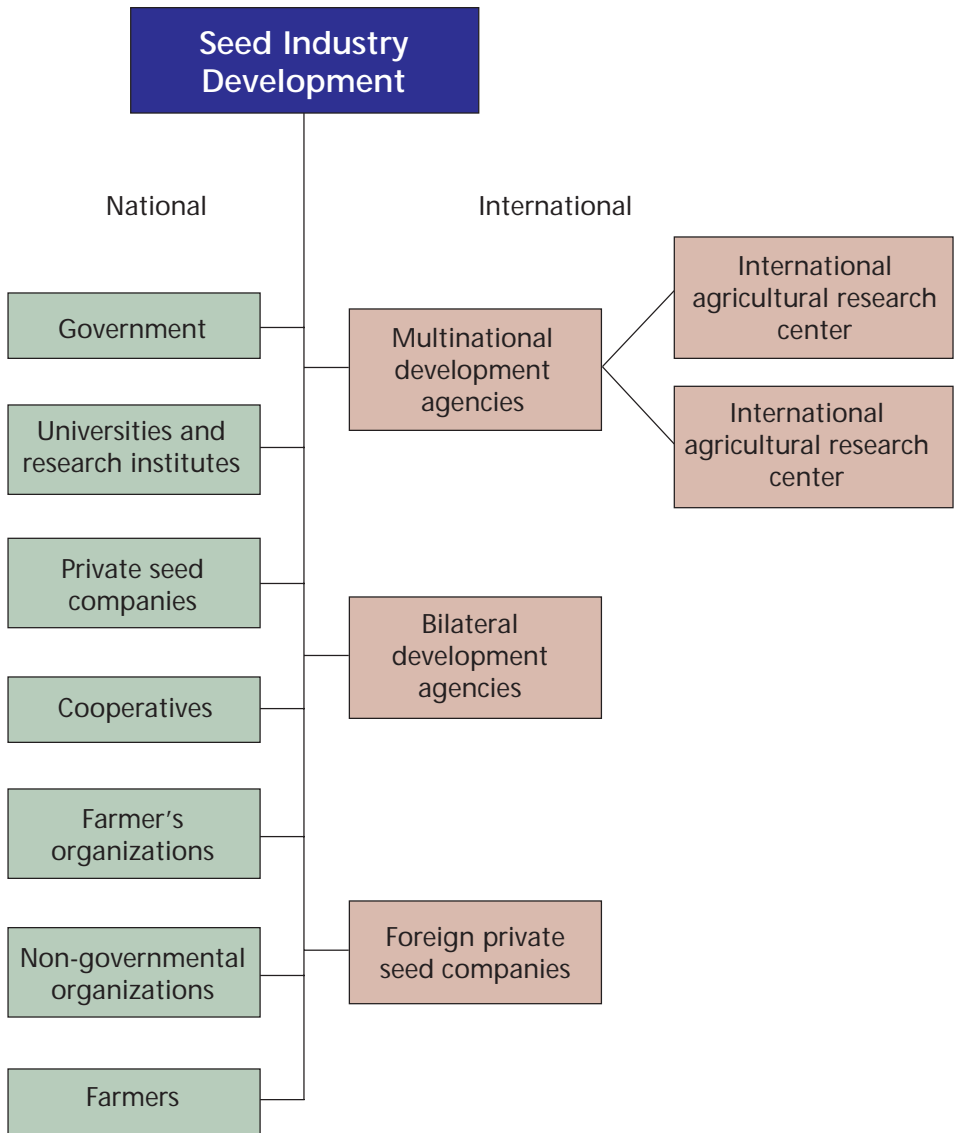


Figure 5.2. Institutions facilitating seed industry development in developing countries.

## Seed System Development

Domestication of wild species probably started with the collection, storage and utilization of seeds not only for food but also for sowing. This was a major step in the evolution of settled agriculture. For centuries, farmers relied entirely on their own seed supply, and these highly adapted populations became recognized as landraces. For much of agricultural history, crop improvement and seed supply remained farmer-based activities. With the development of commercial agriculture, plant breeding and seed production evolved into different disciplines: one engaged in the development of new varieties and the other in multiplying and delivering seed to farmers. As this process of specialization continued in seed production, it brought about significant changes in seed supply systems, giving birth to the modern seed industry.

Definitions of seed systems (Feistritzer and Kelly 1978; Cromwell 1990) have tended to emphasize seed production by the formal sector, but now include the role of the informal sector too in their ambit. The seed system therefore has been defined as the sum total of the physical, organizational and institutional components, their actions and interactions that determine seed supply and use, in quantitative and qualitative terms (van Amstel et al. 1996). Thus, two distinctive but interacting types of seed delivery systems, formal and informal are now recognized.

The organized seed sector in India developed rapidly during the 1960s with the release of hybrid varieties of maize, sorghum and pearl millet, and dwarf high-yielding varieties of wheat and rice. Another important development was the enactment of the Seed Act in 1966. Until the early 1980s, the public sector dominated production and sale of certified cereal seed, with a market share exceeding 70%. In 1988, a new seed policy introduced significant deregulation and attracted several national and multinational companies into the seed business. Incentives encouraged private companies to undertake seed production and conduct research on hybrids and high-yielding varieties. This has had a significant impact in recent years; private-bred hybrids now play a key role in seed production. Between 1993 and 1997, the value of private sector seed sale rose from Rs 6000 million to Rs 15,000 million while the corresponding increase for the public sector was from Rs 4,000 million to Rs 6,000 million. At present, the public sector comprises the National Seed Corporation and 13 state seed development corporations, which produce and market seed of state-bred varieties.

The private sector consists of several multinational corporations, joint-venture companies and domestic research-based seed companies, which are all involved in producing, processing and marketing both public and private varieties. In addition, there are about 50 small- and medium-sized seed companies engaged in the production and marketing of improved seed through both public and private channels. These companies produce seed on contract for larger companies, but also supply seed to small dealers and key farmers within their localities. A lot of these companies are owned by progressive and influential farmers who have experience in seed production and jointly taking advantage of the potential synergies by hands with technically competent persons such as experts in postharvest technology, storage and processing, marketing and financial management.

## Conclusion

Total seed consumption worldwide is estimated at 120 million t per year (Kelly and George 1998). Seed systems in most countries in the Asia-Pacific region consist of public, private and civil sectors. Even though the private sector is increasing its share of the market, it is the civil sector (farmer-saved seed and exchange systems) which produces much of the seed for the majority of staple food crops. In India, the formal (public and private) seed sector holds a market share greater than 10% in only a limited number of major crops (Turner 1994). In developing countries, over 80% of the seed used for sowing is farmer-saved (Jaffee and srivastava 1991).

The private sector responds to commercial incentives, and it is not surprising that India's private seed industry (like that of most other countries) has concentrated on hybrids – seeds of which normally have to be purchased every year – and other high-value seeds. But many of India's most important crops (such as rice, wheat, groundnut and pulses) are based on nonhybrid seed, which farmers can save from year to year. Private sector participation in this type of seed has been more modest, and there are questions about their potential role in such crops. In addition, the highest demand for formal sector seed comes from the more commercially orientated farmers. There are concerns that without proper incentives the private sector may ignore the seed requirements of farmers in marginal areas. In theory, the public sector alternative should be able to address the needs of those farmers who cannot participate in the commercial sector, but the record to date has been uneven. The efficiency of public enterprises is increasingly being called into question.

Although a number of India's public seed enterprises have managed to perform effectively, others are beginning to drop by the wayside. As a dynamic private input marketing system takes hold in the country, many observers are advocating a facilitating role for the public sector in seed production (Jaffee and Srivastava 1994).

The option of decentralization of seed provision is also part of the debate. Seed provision at the local level may be able to respond to farmers' needs more effectively than large public or private enterprises. Cooperative seed production is a possible alternative. In addition, there are a number of initiatives that can be taken by government agencies and nongovernmental organizations to stimulate village-level seed production. No matter how the debate over seed production is resolved, there are a number of key supporting roles for the public sector in seed system development. Although private sector plant breeding has experienced rapid growth in recent years, the greater part of seed sold in India is still based on public owned germplasm. Public sector plant breeding will certainly maintain an important role, but how it should interact with private and local seed production? In addition, any seed system requires a regulatory framework, and seed policy must identify the appropriate public contribution to the regulation of an expanding and diversifying seed sector. Finally, what should be the public sector's role in providing information to farmers about the growing number of seed options should be better defined.



# Overall Policy Framework for Seeds in India

*For any seed system to be viable and sustainable, the right kind of policy framework and interventions are essential prerequisites. This chapter deals with the national seed policy of India and its implications. It also outlines the country's efforts to promote seed trade, variety development, seed production, quality assurance, distribution and marketing, infrastructure facilities, seed import and export, promotion of domestic seed industry and strengthening of monitoring mechanisms for the implementation of the policy.*

## Introduction

As part of the wide-ranging Seeds Policy 2003, a series of initiatives have been planned by the Government of India including plant variety protection protocols, a National Gene Fund, acceleration of seed production and export, and seed quality enforcement through a National Seed Board (NSB). Seed sales, imports and exports would be regulated by a new Seeds Act under which all seeds would have to be compulsorily registered with NSB, which will replace the Central Seed Committee and the Central Seed Certification Board.

The seed policy envisages an increase in India's share of the global seed export market from 1% to 10% and import of the best planting material. It also concedes that genetically modified seeds would increase productivity and improve quality, but would have to adhere to environmental, health and biodiversity safety norms set up under the Environment Protection Act. Transgenic seed varieties would be released only after clearance by the Genetic Engineering Approval Committee (GEAC) and testing by ICAR to assess their agronomic value. The export initiative includes encouraging custom production of seeds, strengthening of seed export promotion zones, quality promotion programs and creation of a data bank on international market potential. When all these measures are in place, India's seed industry is likely to get a great boost. While agriculture will continue to be a subject delegated to the state governments, the central government will complement the efforts of the states in ensuring progress and minimising regional imbalances.

## National Seeds Policy and Its Implications

Agricultural development, in its comprehensive definition, is central to all strategies for planned socioeconomic development in India. Agrarian reforms instituted in the first three Five-Year Plans (1951–56, 1956–61, 1961–66) provided the first surge of momentum for the growth of agriculture in the Indian economy. This period saw investments in irrigation and agricultural education stepped up in tandem. This was followed by the introduction of a succession of high-yielding varieties. A well-designed extension network for spreading knowledge and skills was also created. The spread of high-yielding variety technology, particularly in wheat and rice, in the mid 1960s in conjunction with associated inputs and efficient delivery systems brought about a dramatic change in India's agriculture, which has come to be known as the Green Revolution. As a result of it, foodgrain production has almost quadrupled in the last five decades. Impressive growth has been achieved in commercial crops like oilseeds, sugarcane and cotton. Fruits and vegetables, particularly potatoes, too have shown spectacular growth.

The increase in agricultural production, however, has brought in its wake uneven development across regions, crops and also across different sections of the farming community. In the 1990s, there was a marked slackening of the pace of growth, pointing to the need for infusion of fresh vitality. Of the various agricultural inputs such as fertiliser, nutrients, agrochemicals and seed, the latter is perhaps the most important determinant of agricultural production on which the efficacy of other inputs depends. Seeds with appropriate characteristics are necessary to meet the demands of diverse agroclimatic conditions and cropping systems. Sustained increase in agricultural production and productivity enhancement is dependent to a large extent on development of new and improved varieties and an efficient system through which timely supply of quality seed in adequate quantities can be made to farmers. The progress of the seed sector has been impressive enough over the last three decades. The area under certified seed production has increased from less than 500 hectares in 1962–64 to over 500 000 hectares in 1999–2000. The quantum of quality seeds produced has crossed 10 million tons. The Seeds Act, 1966, and the Seed Control Order and the New Policy on Seeds Development 2003 in India form the basis for promotion and regulation of the seed industry. However, far-reaching changes have taken place in the national economic and agricultural scenario and in the international environment since the enactment of these legislations and policies. There is now considerable need for seed sector

reforms with a framework covering seed production and distribution, quality control and seed legislation, import and export of seeds, plant quarantine and plant breeders' and farmers' rights.

## Promotion of Seed Industry

It is evident that in order to achieve food production targets, major efforts will have to be made to enhance the seed replacement rates of various crops. This would require a substantial increase in the production of quality seed, in which the private sector is expected to play a major role. The creation of a facilitative climate for the growth of the seed industry, encouragement of import of useful germplasm and boosting of exports are core elements of the agricultural strategy for the future.

## Biotechnology and Seed Development

Biotechnology is likely to be a key factor in agricultural development in the coming decades. Genetic engineering/modification techniques hold enormous promise in developing crop varieties with higher tolerance of biotic and abiotic stresses. There is an urgent need for a conducive atmosphere for the application of frontier sciences in varietal development and for enhanced investment in research and development. At the same time, concerns relating to possible harm to human and animal health and biosafety as well as the interests of farmers must be borne in mind.

## Economic Liberalisation and Seed Trade

Globalisation and economic liberalisation have brought new opportunities as well as challenges. While providing the appropriate climate for the seed industry to utilize available and prospective opportunities, safeguarding the interests of Indian farmers, protecting and conserving agrobiodiversity and traditional knowledge are also central concerns. While unnecessary regulation must be avoided, there is a need to ensure that farmers' interests are protected. There is need for a new regulatory system that will encompass quality assurance mechanisms coupled with facilitation of a vibrant and responsible seed industry.

## Varietal Development and Plant Variety Protection

Development of new and improved varieties and their availability to farmers are of crucial importance in the attainment of sustained productivity enhancement. An appropriate policy framework and programmatic interventions are necessary to stimulate varietal development in tune with market trends, scientific-technological advances and suitability for various biotic and abiotic stresses, as well as farmers' needs. Accordingly, an effective *sui generis* system of intellectual property protection is to be instituted to encourage investment in research and development of new plant varieties and to facilitate the growth of the seed industry. A Plant Varieties & Farmers' Rights Protection (PVP) Authority will be established to undertake registration of extant and new varieties in a Plant Varieties Registry to accord intellectual property protection to them. Registration of new plant varieties will be based on the criteria of novelty, distinctiveness, uniformity and stability. The criteria of distinctiveness, uniformity and stability (DUS) will be relaxed for registration of extant varieties, which will be done within a specified period to be decided by the Authority. All plant genera or species notified by the Authority will be registered in a phased manner.

The PVP Authority will develop characterization and documentation of plant varieties registered under the PVP Act and compulsory cataloguing facilities for all varieties of plants. The policy promises to safeguard the rights of farmers to save, use, exchange, share or sell farm produce of protected varieties with the proviso that they shall not be entitled to sell branded seed of a protected variety. Researchers will continue to have the right to use the seed/planting material of protected varieties for bona fide research and breeding. Similarly, benefits that may accrue to a breeder from commercialisation of seeds/planting materials of a new variety will be protected. This proposed initiative also includes a system of rewards for farmers/group of farmers/village communities for any significant contribution they may make to the development of a new variety. The National Gene Fund will implement the benefit-sharing arrangement and pay compensation to village communities for their contribution to the development and conservation of plant genetic resources. Access to plant genetic resources in public collections will be allowed to seed companies as per the provisions of the 'Material Transfer Agreement' under Biological Diversity Bill. Regular interaction will be fostered among private and public researchers, seed firms/organizations and development agencies to promote the growth of a healthy seed industry in the country. To keep abreast of global

developments in the field of plant variety protection and for technical collaboration, India may consider joining various regional and international organizations.

## Seed Production

The Indian seed program adheres to the limited three-generations system of seed multiplication, the three generations being breeder, foundation and certified seed. Breeder seed is the progeny of nucleus seed, which is the seed produced by the breeder to develop a particular variety. Breeder seed is directly controlled by the originating or sponsoring breeder/institution for the initial and recurring multiplication of foundation seed. As per the policy framework envisaged in India, public sector seed production agencies will continue to have free access to breeder seed under the national agricultural research system. Private seed production agencies too will have access to breeder seed, subject to terms and conditions to be decided by the Government of India. State agricultural universities will have the primary responsibility for production of breeder seed as per the requirement of the respective states.

Foundation seed is the progeny of breeder seed; it may also be produced from foundation seed. Production of foundation seed stage-1 and stage-2 may be permitted, if supervised and approved by the certification agency and if the production process is so handled as to maintain specific genetic purity and identity. Certified seed is the progeny of foundation seed, or of certified seed itself. In the latter case, reproduction will not be allowed to exceed three generations beyond foundation stage-1 and subject to assessment by the certification agency that the genetic identity and purity of the variety was not significantly altered.

A number of other initiatives are also envisaged to promote seed production and boost the use of quality seeds, especially at the local level. With the latter objective in view, it is planned to progressively raise the seed replacement rates (SRR) and upgrade the quality of farmer-saved seed. Preparatory to a major thrust on seed production and distribution, the Department of Agricultural Cooperation (DAC), in consultation with ICAR and the state governments, will draw up a National Seed Map to identify potential areas for seed production of specific crops. Each state will prepare a perspective plan for seed production and distribution over a rolling ten-year period. One of the aims of this program is to extend seed production to areas which are

outside the traditional seed-growing areas. In addition, the Seed Village Scheme will be promoted to facilitate production and timely availability of seed of the desired crops/varieties at the local level. Foundation seed will be provided to farmers to build up adequate stocks of certified/quality seed. Also, they will be supplied seed kits to popularise newly developed varieties. To cut the lag time between varietal development and seed delivery, seed producing agencies will be encouraged to enter into agreements with research institutions for commercialization and promotion of new varieties. Support will be provided for production of hybrid seed.

Seed Banks will be established for stocking seed of required crops/varieties as a contingency during natural calamities, production shortages, etc. Seed storage facilities at the village level will be encouraged to take seed crop insurance, which covers the risk of unforeseen situations.

## Quality Assurance

The new seed bill, which is in the parliamentary process, governs the sale, import and export of all seeds and planting materials of agricultural crops throughout India. This includes horticulture, forestry, medicinal and aromatic plants and fodder and green manure. The mandate for executing the provisions of this law and advising the Government on all matters relating to seed planning and development will pass to the National Seed Board (NSB) when it is established in place of the existing Central Seed Committee (CSC) and the Central Seed Certification Board (CSCB). The NSB will be the country's apex body in the seed sector.

Under the new regime, all seeds offered for sale and distribution in the market would have to be registered with NSB. The registration protocol would require new varieties to be put through multilocation trials over a minimum of three seasons to determine their value for cultivation and usage (VCU). The VCU trials would be conducted by ICAR, SAUs and private organizations accredited by NSB, and registration would be granted for a fixed period. Varieties that were already in the market before the seed law was enacted will have to get registered within a time period to be fixed by the Government. Varieties that are submitted for registration after just one season of trials rather than three will be granted only provisional registration. The Government will have the power to exclude certain kinds of varieties from registration to protect public order or public morality or human, animal and plant life and health, or to avoid serious prejudice to the environment.

Similarly, NSB can cancel the registration granted to a variety if it was obtained by misrepresentation or concealment of essential data; if the variety is obsolete and has outlived its utility; and if the prevention of commercial exploitation of such a variety is necessary in the public interest.

It would be mandatory for seed processing units to be registered too. For this, their processing standards would have to meet NSB's minimum benchmarks. Seed certification would continue to be voluntary although the certification tag/label provides an assurance of quality to the farmer. To meet quality assurance requirements for seed exports, seed testing facilities would be established in conformity with guidelines and standards specified by NSB. The Board will accredit individuals or organizations to carry out seed certification including self-certification on fulfilment of prescribed criteria.

Under this new regulatory regime, farmers will retain their right to save, use, exchange, share or sell their farm seeds and planting materials without any restriction. They will be free to sell their seed on their own premises or in the local market without any hindrance provided the seed is not branded. The sale of spurious or misbranded seed will carry a major penalty. Minor infringements committed by dealers and seed producers will attract minor penalties to obviate an opportunity for harassment by enforcement staff.

Apart from maintaining the National Seed Register and other regulatory functions, NSB is mandated to coordinate and assist the states in their efforts to provide quality seed to farmers. It will prescribe minimum standards for parameters including germination, genetic purity, physical purity, and seed health.

## Seed Distribution and Marketing

India's seed policy plans to put in place an improved distribution system and efficient marketing set-up to ensure timely availability of quality seed to farmers throughout the country. As part of this objective, it hopes to encourage the private seed sector to expand its role and restructure and reorientate its activities to cater to nontraditional areas. Seed distribution and marketing facilities will be aided in securing access to term finance from commercial banks.

## Infrastructure Facilities

New infrastructure facilities would have to be created and existing ones strengthened to meet the enhanced requirement of quality/certified seeds.

The National Seed Training Centre being set up at Varanasi in Uttar Pradesh is vested with the task of building capacity in various disciplines of the seed sector. A Central Seed Testing Laboratory is being set up at this center to perform referral and other functions as required under the Seed bill 2004 (Annexure I). Seed processing capacity will have to be augmented in view of the anticipated increase in seed production. Accordingly, modernization of seed processing facilities will be supported in terms of modern equipment and techniques such as seed treatment for enhanced seed performance. Conditioned storage for breeder and foundation seed and aerated storage for certified seed would be created in different states.

A computerised National Seed Grid will be established to provide information on the seed inventories available with various production agencies, their location and quality. This will facilitate optimum utilisation of available seed during any given season. Initially, public sector seed production agencies would be connected with the grid, but progressively the private sector will be encouraged to join it.

The state governments, or the National Seed Board in consultation with them, may establish one or more seed certification agency in the states. The states will establish appropriate systems for effective implementation of the objectives and provisions of the Seed bill 2004 (Annexure I), to promote seed growers, seed associations and cooperatives.

## Transgenic Plant Varieties

Before their commercial release, all genetically engineered crops/varieties would have to be tested for adherence to environmental and biosafety norms as per the regulations and guidelines of the Environment Protection Act (EPA), 1986. Seeds of transgenic plant varieties needed for research purposes can be imported through the National Bureau of Plant Genetic Resources (NBPGR). But before commercial release, transgenic crops/varieties would have to prove their agronomic value for at least two seasons under the All India Coordinated Project Trials of ICAR.

Once a transgenic plant variety is commercially released, its seed can be marketed subject to the seed laws. They would be required to bear a label indicating their transgenic character. The performance of a transgenic plant variety in the field will be monitored for 3-5 years by the Ministry of Agriculture and the department of agriculture of the relevant state.



Transgenic varieties would be protected under PVP legislation in the same manner as nontransgenic varieties. All such seeds imported into the country will be required to carry a declaration and a certificate from the competent authority of the exporting country, certifying their transgenic character. If the seed or planting material is a product of transgenic manipulation, its import will be allowed only with the approval of the Genetic Engineering Approval Committee (GEAC).

## Import of Seeds and Planting Material

The objectives of the import policy are to provide the best planting material available in the world to Indian farmers, and to increase productivity, farm income and export earnings, while ensuring that there is no adverse effect on the environment, human and animal health and biosafety. Therefore, while imports of seeds and planting materials will be allowed freely subject to requirements, they will be subjected to stringent plant quarantine procedures to prevent entry of exotic pests, diseases and weeds detrimental to Indian agriculture. .

According to the Fruits and Seeds Order (Regulation of Import into India), 1989, and its subsequent amendments, seeds and planting materials imported for sale in India have to meet the prescribed standards of seed health, germination, and genetic and physical purity. All seed imports will require a permit granted by the Plant Protection Advisor to the Government of India. Importers are required to make available a specified quantity of imported seeds for accession to the gene bank maintained by NBPGR. The existing policy, which permits free import of seeds of vegetables, flowers and ornamental plants, cuttings, saplings of flowers, tubers and bulbs of flowers by certain specified categories of importers, will continue. Tubers and bulbs of flowers will be subjected to postentry quarantine. After the arrival of consignments at the port of entry, quarantine checks would be undertaken which may include visual inspection, laboratory inspection, fumigation and grow-out tests. For the purpose of these checks, samples will be drawn and tests conducted concurrently.

## Export of Seeds

Given its diverse agroclimatic conditions, strong seed production infrastructure and market opportunities, India has significant seed export

prospects. The Government is planning to evolve a long-term policy for export of seeds with a view to raising the country's share of the global seed export market from less than 1% at present to 10% by 2015. Specifically, custom production of seeds for export is one point of emphasis in this policy, which will be based on a long-term perspective rather than a case-by-case consideration. To give momentum to this policy, seed export promotion zones will be set up and strengthened with special incentives. A data bank will be created to provide information on international markets and the export potential of Indian varieties in different parts of the world. At the same time, the database will keep an inventory check to assess the impact of exports on domestic availability of seeds. Various promotional programs will be taken up to improve the quality of Indian seeds to enhance their acceptability in the international market.

## Promotion of Domestic Seed Industry

While encouraging exports, India's seed policy will provide incentives to the domestic seed industry to step up production of seeds of high-yielding varieties and hybrids. A liberal climate will be created to facilitate the seed industry's marketing efforts, both domestic and international. Membership of international organisations and seed associations such as the International Seed Testing Association (ISTA), Organization for Economic Cooperation and Development (OECD), International Union for the Protection of New Varieties of Plants (UPOV), International Association of Plant Breeders for the Protection of Plant Varieties (ASSINSEL) and World Intellectual Property Organization (WIPO) will be encouraged at the national and individual levels.

Special efforts will be directed toward increasing the quality of farmers' saved seeds. Financial support for capital investment, working capital and infrastructure strengthening will be facilitated through the National Bank for Agriculture and Rural Development (NABARD), commercial and cooperative banks. Tax rebates and concessions will be considered on expenditure incurred on in-house research and development for development of new varieties and other seed-related research aspects. Special incentives such as a transport subsidy will be provided to seed-producing agencies operating in these marginal. Reduction of import duty will be considered on machinery and equipment used in seed production and processing.

## Strengthening the Monitoring System

The Seeds Division of the DAC will supervise the overall implementation of the National Seeds Policy. Adequate infrastructure support would be required for undertaking, monitoring and servicing the National Seed Board and its activities. Human resource development in the seed sector is another area that requires attention.

# Issues Relating to Plant Variety Protection and Seed Industry in India

Legislation relating to plant variety protection and farmers' rights in India are aimed at strengthening local seed systems and giving freedom to farmers to save, exchange and sow their own seed. We discuss in this chapter the salient features of the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001 (Annexure II), and the draft Seed Bill, 2004 (Annexure I), and their implications for research, the seed industry, seed exchange, plant variety protection and farmers' rights.

## Introduction

After India became a signatory to the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement in 1994, a legislation was required to be formulated to give effect to its provisions. Article 27.3 (b) of this agreement requires member countries to mandate protection of plant varieties either through patents or an effective *sui generis* system of intellectual property rights (IPR) protection, or by any combination thereof. Thus, TRIPS signatory countries had the choice of framing legislations that suit their own system. India exercised this option.

The existing Indian Patent Act, 1970 (Tonapi et al., 2004), had excluded agriculture and horticulture from patentability. While bringing these activities into the purview of IPR legislation, India opted for a *sui generis* system of plant variety protection, providing for the rights and equity concerns of farmers, breeders and researchers in a single legislation. These provisions were the outcome of an intense public debate involving all interest groups and an elaborate exercise by a Joint Convention on Biological Diversity and the FAO Declaration on Farmers' Rights, to which India is a party.

- The PPV&FR Act seeks to establish an independent Plant Varieties and Farmers' Rights Protection Authority comprising a chairperson appointed by the Government of India, and 15 members. It will also set up a Plant Varieties Registry headed by a registrar-general headquartered in New Delhi and supervising registrars in Bangalore, Pune, Bhopal, Patna and Guwahati. The legislation also mandates a Plant Variety Tribunal with the status of a district court to settle disputes connected with this Act.

# Salient Features of Protection of Plant Varieties and Farmers' Rights Act

## *1. Protection of Plant Varieties and Farmers' Rights Authority*

This authority will have a chairperson and 15 members including eight ex-officio representatives from various departments and institutions of the Government of India and seven others representing farmers' associations, tribal organizations, industry, agricultural universities, national-level women's organizations and state governments. The registrar-general of the Plant Varieties Registry will be its member secretary. The authority will be assisted by committees and officers such as the registrars.

## *2. Functions of the authority*

1. The authority will promote the development of new varieties and protect the rights of farmers and breeders;
2. In particular, it will provide for
  - a. Registration of extant and new plant varieties and essentially derived varieties subject to the relevant terms and conditions;
  - b. Characterization and documentation of varieties registered under the Act;
  - c. Documentation, indexing and cataloguing of farmers' varieties;
  - d. Compulsory cataloguing facilities for all plant varieties;
  - e. Ensuring that seeds of varieties registered under this Act are available to farmers, and providing for compulsory licensing of such varieties if the breeder does not arrange for production and sale of seeds in the manner prescribed;
  - f. Collecting data and information on plant varieties, including the contribution of any person at any time to their evolution or development in India or abroad, for compilation and publication;
  - g. Ensuring the maintenance of the National Register of Plant Varieties.

## *3. Powers of the authority*

1. The Plant Varieties and Farmers' Rights Protection Authority will have all the powers of a civil court to receive evidence, administer oaths, enforce

the attendance of witnesses, compel the discovery and production of documents and issue commissions for the examination of witnesses.

2. Its orders would be executable as the decrees of a civil court.

#### **4. Registration of varieties**

1. A National Register of Plant Varieties will be kept at the head office and branch offices of the Plant Varieties Registry in which the particulars of all varieties will be registered. The register will be maintained under the direction of the Central Government. It will be kept under the control and management of the Plant Varieties and Farmers' Rights Protection Authority.

#### **5. Criteria for registration**

A variety will be registered if it fulfils the criteria of novelty, distinctiveness, uniformity and stability.

#### **6. Persons who can apply**

An application for registration can be made by

- a) The breeder of a variety;
- b) A successor of the breeder;
- c) An assignee of the breeder;
- d) A farmer or a group or community of farmers claiming to be breeders of a variety;
- e) A person authorised by any of those specified above to make an application on their behalf;
- f) A university or publicly funded agricultural institution claiming to be the breeder of a variety.

#### **7. Duration of registration**

Registration of a variety will be valid for a period of

- a) Nine years for trees and vines;
- b) Six years for other crops.

This can be renewed further for the remaining period of

- a) 18 years in respect of trees and vines;
- b) In the case of extant varieties, 15 years from the date of notification of the variety under section 5 of the Seeds Act, 1966;

- c) In other cases, 15 years from the date of registration. It would be mandatory for the breeder to deposit the seeds or propagating material in the National Seed Bank.

### *8. Rights of breeder or his successor*

Registration of a variety confers an exclusive right on the breeder or his successor, agent or licensee to

- a) Produce, sell, market, distribute, import or export the variety;
- b) A breeder may also authorise any person to produce, sell, market, or otherwise deal with the registered variety subject to the relevant conditions.

### *9. Exclusion of some varieties*

Registration will not be granted to some varieties if it is necessary to prevent their commercial exploitation in order to protect public order or public morality or human, animal and plant life and health or to avoid serious prejudice to the environment.

### *10. Researchers' rights*

For the purpose of research, any person can use a registered variety as an initial source in an experiment to create other varieties. For further repeated use of the variety as a parental line, the breeder's permission would be required.

### *11. Farmers' rights*

- a) A farmer who has bred or developed a new variety would be entitled to registration and other protection extended to a breeder;
- b) A farmer's variety shall be entitled for registration if the application contains a declaration as specified in clause (h) or subsection (1) of section 18 of the Act;
- c) Farmers who conserve landraces and wild relatives of plants of economic importance and work on their improvement through selection and preservation would be entitled to recognition and reward from the National Gene Fund if their material is used as gene donors to varieties registered under this Act;

- d) Farmers would continue to be entitled to save, sow, resow, exchange and share or sell their farm produce including the seed of a protected variety. However, they would not be entitled to sell branded seed of a protected variety.

### **12. Right to claim compensation and exemption from payment of fees**

If the propagating material fails to provide the expected performance under the prescribed conditions, farmers can petition the Plant Varieties and Farmers' Rights Protection Authority for compensation. Moreover, farmers are protected from innocent infringement of the provisions of the PPV&FR Act. The Act exempts farmers from having to pay a fee in any relevant proceedings before the authority or registrar or tribunal or the High Court.

### **13. Constitution of National Gene Fund**

The National Gene Fund, to be established by the Central Government, will receive funds from

- a) The proceeds of benefit sharing received from breeders;
- b) The annual fee payable to the authority by way of royalty under subsection (1) of section 35;
- c) The compensation deposited in the National Gene Fund under subsection (4) of section 41;
- d) Contributions from national and international organizations and other sources.

The fund will be used to meet the following expenses:

- a) Payouts by way of benefit sharing under subsection (5) of section 26;
- b) Compensation payments under subsection (3) of section 41;
- c) Expenditure for supporting conservation and sustainable use of genetic resources including *in situ* and *ex situ* collections and for strengthening the capabilities of village administrations to carry out such activities;
- d) Expenditure on schemes relating to benefit sharing framed under section 46.

### **14. Compulsory licensing**

Breeders, having got a compulsory license for a variety from the Plant Varieties and Farmers' Rights Protection Authority, can license an individual or company for the production, distribution and sharing activity.



## *15. Plant Variety Protection Appellate Tribunal*

The Central Government will constitute an appellate tribunal to hear grievances arising out of the decisions of the authority regarding registration, claims, benefits, licenses and compensation.

The PPV&FR Act, 2001, is yet to be enforced since rules have not been framed and notified. Any administrative problems can be visualized only after the issue of rules and regulations.

## **Implications of PPV&FR Act**

### *1. Agricultural research*

Implementation of the PPV&FR Act promises to bring monetary returns to institutions and individuals on their investment in research. By granting plant breeders' rights (PBRs), the legislation is likely to encourage plant breeding activity and stimulate research. Henceforth, researchers in the public and private sector would not only compete with each other but also with farmers in developing location-specific varietal and sustainable crop management technologies and innovations. There would be increased interest in realizing the commercial potential of research.

However, there is concern that projects with commercial potential may dominate the research agenda at the cost of basic research with little direct income potential. There is likely to be increased pressure to seek new sources of funding, and public-private or private-private collaborative programs on mutually agreed conditions may become the order of the day.

### *2. DUS and multilocation testing*

With the enactment of the PPV&FR Act, India is gearing up to give effect to plant breeders' rights (PBRs) to recognize and protect the rights of farmers and breeders. These rights can be granted for a variety that is new, distinctive, uniform and stable in other words, one that measures up to a test of distinctiveness, uniformity and stability (DUS). Farmers' varieties need not comply with the novelty provision but all other types of varieties claiming PBR have to do so. The DAC of the Ministry of Agriculture and the Indian Council of Agricultural Research (ICAR) have initiated the process for DUS testing. The department has been allocating funds since 2000 to

various ICAR institutes to strengthen their DUS test facilities. The council has identified 35 crops for finalizing the DUS test guidelines and 43 centers for undertaking the tests. Many of these centers are project-coordinating units already engaged in the all-India coordinated multilocation tests of elite lines. One of the formidable tasks for the DUS testing units would be to characterize the extant (national releases) varieties to develop a database for the reference collection of varieties (RCV). Though strictly only the latest varieties would be tested for DUS, the manpower and finances required for a precise and total characterization would be a limiting factor. As DUS tests would be done on a cost recovery basis, the onus is on the ICAR institutes to maintain the test plots in an excellent condition to prove the distinctiveness of varieties, maintain the database and the relevant records in order.

### *3. Plant breeders' rights*

In order to claim PBR, a variety must be clearly distinguishable for at least one essential character from the varieties commonly known in India and abroad. Such distinctiveness has to be bred into the variety while incorporating other economically important traits. Establishing such distinctive features is likely to be increasingly difficult in future. Initially there may be a rush of varieties for DUS testing, but this is expected to slow down eventually for want of distinctiveness. Further, distinctiveness does not guarantee commercial viability; breeders have to combine both qualities. Unless this is achieved through planned breeding activity, the genotypes developed cannot be commercially exploited fully through PBR.

### *4. Sharing germplasm*

The most important ingredient for a crop improvement program is the availability of genetic diversity. Until recently, germplasm worldwide was considered the heritage of mankind to be shared and used by all. With the new world order that is emerging in the post-WTO era, the availability of germplasm may be restricted. Any breeder trying to develop new varieties should obtain explicit permission to use germplasm or landraces from the region from where they were originally collected. Although Prior Informed Consent (PIC) and Material Transfer Agreements (MTAs) do assure benefit-sharing, the willingness to share germplasm rests with the breeder/farmer and/or the community. Unless the material is available in the National Gene Bank (NGB), from where it can be accessed by signing an MTA, there is no way of getting the material if the party is not willing to share it.

Further, the second step in the development of new varieties is to test elite lines in the All India coordinated research projects (AIC RPs). Breeders nominate the materials in good faith, and further selection would depend on the performance of cultures in the program. Simultaneously, other breeders also nominate the material and are free to use available material in the trial if they wish to do so. Now, in the PPV&FR regime, if a particular line is doing extraordinarily well in station- or state-level testing, the breeder may not be as readily agreeable as in earlier days to part with the line for multilocation trials because his peers may want to identify it for their use or select and modify as an essentially derived variety (EDV). Unless divulged, benefit sharing becomes a bone of contention between breeders and organizations. Thus, the free exchange of germplasm and breeding lines may become the casualty of the PPV&FR Act unless some innovative practices are devised.

### *5. Transgenics and EDVs*

The increasing use of biotechnology in producing transgenic crop varieties and genetically modified organisms (GMOs) also requires the development of biosafety norms to regulate trade in such crops, animals and products. The trade in GMOs will have to be strictly regulated, and that capacity needs to be created urgently. A responsible regulatory system will ensure that we attract investment in this sector. The prior informed consent of farmers must be taken while pursuing on-farm trials of transgenics. Public notice must be given of all such trials and an informed debate generated on the issues involved rather than allow populist propaganda to be disseminated. It must, however, be remembered that much greater environmental damage takes place due to the chemical pesticides currently in use than might possibly be caused by a transgenic pest-tolerant crop.

The concept of EDV was developed to prevent biotechnologically produced varieties from taking away the benefits of conventionally bred varieties by transferring one or a few genes into or from them. However, EDV does not deal with the incorporation of genes from a protected variety into a nonprotected variety. It has to be recognized that it was conventional breeding by farmers or plant breeders that made the expression of a particular critical gene possible. Therefore, the claimant for plant variety protection for a biotechnologically produced variety should disclose the source parents and must agree to contribute part of the gain to the breeders of the source variety.

## 6. Farmers' rights

Provisions of the PPV&FR Act would encourage conservers, farmers and farmer-breeders. Farmers are the custodians of local germplasm. Through pure line selection many of them have developed very important landraces with unique biotic/abiotic stress tolerance or quality attributes or medicinal value. As a result of the PPV&FR Act, such farmers as individuals or as members of a community or through an NGO will be able to claim PBRs or benefits accruable as per clause 26(2) of the Act in respect of any new variety in the development of which local germplasm or a landrace was used.

Other explicit provisions in the Act safeguard the farmers' right to grow seed and preserve produce to grow the next crop and also to share, exchange and sell it without the risk of infringement of PPV&FR. What has been taking place as a traditional practice until now has been codified as a right. Such steps to strengthen local and community seed supply systems are likely to result in stiff competition for public and private seed companies. While public seed companies have so far largely focused on high-volume, low-value crops, private firms have tended to operate the other way round. Although public sector seed corporations played a historic role in the spread of high-yielding varieties (HYVs) during the Green Revolution, they have since then yielded dominance to the private sector. At present, of the total seed business of Rs 4000 crore in India, the private sector garners more than 75%. When farmers take up quality seed production at the community level, or if seed village programs get a shot in the arm, public seed agencies are likely to face a further threat. Perhaps it is time they became more competitive. In this context, the National Seeds Board has a vital role to play in seed program planning, production, supply and quality assurance. Managerial aspects and the freedom to operate need greater attention and not merely technical or regulatory matters for the success of the public sector seed industry.

## Response of Seed Industry to PPV&FR Act

The seed industry feels that the Act is a step in the right direction and strikes a satisfactory equilibrium between plant breeders' rights (PBRs), farmers' rights (FRs) and researchers' rights (RRs). However, its impact will be felt only after its effective implementation. We present here the summary of the seed industry's views and reservations on some specific provisions of the PPV and FR Act 2001.

### *1. Plant breeders' rights*

The process of plant breeding is long and expensive, and requires time, money, skill and labor. Recovery of those expenses is enabled by way of PBRs guaranteed in the PPV&FR Act. However, the farmer too is treated as a breeder, conservator and cultivator. The equal role given to the farmer may in some cases act as a limitation on PBRs.

Apart from this, the farmer is protected against innocent infringement of the Act. It is a well-intended provision, but needs to be drafted so as to be more specific. For instance, nothing is said in the Act about what might constitute a violation of breeders' rights. This is of critical significance since the Act does allow a farmer to sell generic seed of a protected variety. Should a farmer be sued for breach of the breeder's rights, what would constitute proof in a court of law that he was unaware of the existence of such a right? Breeders' rights have been strengthened to the extent that the onus of proving innocence is placed on the alleged violator. However, apart from these limitations in the law, the penalties and offences section of the law is satisfactory.

### *2. Farmer-to-farmer exchange of seeds*

The farmer has the right to sell, sow and exchange seeds of a protected variety, but not under a brand name. This may result in unfair competition between seed traders and farmers and may inflict losses on the seed market. In addition, the farmer is protected against the supply of spurious seed and he has a right to claim compensation in case of crop failure. This provision on farmer-to-farmer exchange of seed can be misused for commercial gains in the guise of seed exchange by corporate farmers. .

### *3. VCU trials*

The Act requires seed producers to state on the seed bag the expected performance of the seed under a set of conditions. The VCU trials are conducted by designated research institutes and state agricultural universities through multilocation testing for a specified number of years or seasons. As per this clause, farmers have to be compensated for the nonperformance of a hybrid or variety. This may give rise to litigation. Nonperformance of a variety may not always be related to the innate potential of a genotype, but may be due to nonstandard cultivation conditions and practices including climatic vagaries.

#### *4. Biodiversity and germplasm exchange*

Breeders wanting to use farmers' varieties for creating EDVs would need the explicit permission of the farmers involved in their conservation. The farmers may not be satisfied with the proceeds due to them and may demand more. Protracted negotiations between farmers and breeders over the use of a particular landrace as an initial variety may hamper research and development.

#### *5. Registration of farmers' varieties*

The PPV&FR Act allows the registration of farmers' varieties and includes them in the ambit of benefit sharing. However, those farmers who lack formal education may find it difficult to get their varieties registered in the National Register of Plant Varieties. While NGOs and communities may help in this matter, it remains to be seen how many farmers' varieties will actually pass the DUS trials. Benefit-sharing might yet remain a mirage for the farmer after all. There is a need for more clarity on the definition of proprietary material to claim ownership/proprietorship.

#### *6. Infrastructure and security for deposited material*

Since it is necessary to generate sufficient resources for the Plant Varieties and Farmers' Rights Protection Authority, the fee for registration and other processes as well as the annual fee for maintenance of plant variety protection should be reasonably fixed, keeping in view the possible commercial value of the crop and the national interest. Resources are needed to equip the Authority with appropriate infrastructure such as a secure system for the storage of reference samples. As things stand, there is no security system in place for the genetic material deposited, especially parental lines. The private sector advocates some kind of a message transfer agent or black box arrangement with a dual lock and key system to prevent misuse of genetic material. The facilities and technical expertise available at the National Bureau of Plant Genetic Resources (NBPGR) need to be strengthened.

It is no mean task to maintain sufficient quantities of material of all the reference varieties across crops. The infrastructure required and the transparency, accountability and efficiency needed for carrying out DUS trials are a bit of a concern at present. User-friendly software tools for statistical analysis of DUS trials are still being worked on.

## Draft Seed Bill and Response of Seed Industry

Based on the recommendations of the Seed Policy Group headed by Dr MV Rao, former vice-chancellor of Acharya NG Ranga Agricultural University (ANGRAU), Rajendranagar, Hyderabad, the Government of India has drafted a new Seed Bill, to regulate the seed business, particularly the registration of seeds of all kinds and varieties, their production, processing, quality control and law enforcement. The bill is aimed at amalgamating the provisions of the Seeds Act, 1966, and the Seeds Control Order, 1983. It will regulate the sale, import and export of seeds, facilitate supply of quality seed to farmers throughout the country, and establish a National Seeds Board to advise the Government on all relevant matters. The detailed provisions of the bill are presented in Appendix I. The response of the seed industry to some of its provisions is summarized below.

### *1. Definitions*

Seed industry representatives feel that the word 'hybrid' should have been included in the definitions section of the draft Seed Bill. Similarly, misbranding, or wrongful sale of seed under the label of popular registered varieties or hybrids, should have been defined as a major offence.

### *2. National Seeds Board*

Seeds being a highly specialized subject, industry spokesmen believe that formulation of policy on important issues such as minimum standards and procedures requires adequate participation by industry experts in the National Seeds Board. At least five experienced and qualified representatives (from different regions of the country) from the seed industry should be involved in this process. This would strengthen the National Seed Programme.

### *3. Constitution of committees*

Similarly, the committees to be constituted under the proposed Seeds Act ought to have 33% representation from seed industry experts. In any of the developed countries, the majority of members of such advisory or regulatory committees are from the industry. This would give a practical orientation to such activities.

#### *4. Central seed testing laboratories*

Industry representatives feel that there should be at least four Central Seed Testing Laboratories (CSTLs) to monitor the working of the notified seed testing laboratories in the country. At present, there is no audit of their working. It has often been observed that seed lots certified as substandard by the notified state seed testing laboratories (SSTLs) have in fact recorded excellent performance in farmers' fields. Therefore, adherence of standard practices and maintenance of the required conditions for germination in the SSTLs needs to be closely monitored. This calls for more central seed testing laboratories.

#### *5. Labelling*

As per the Seeds Act, 1966, the expected performance of seeds (varieties/hybrids) in the given conditions is required to be stated on the labels of seed bags along with other particulars. However, working out a format for giving these particulars has proved to be very difficult. Seed performance depends not only on genetic purity but also on environmental factors such as soil fertility, soil reaction and managerial practices including pest and disease management, as well as climatic factors such as rainfall and temperature, which vary from year to year even within a specific geographical region. This could create miscommunication between seed producers and farmers, and lead to litigation. Therefore, seed industry representatives feel that mandatory statement of the agronomic performance of seed on the labels should be reconsidered and deleted from the Seed Bill.

#### *6. Multilocation testing and value for cultivation and use*

The Seed Bill requires multilocation testing (MLT) data to be submitted for registration of a seed variety. However, data generated by private companies on their own may not have any validity for assessment of agronomic performance. Therefore, ICAR testing for all the varieties to be registered should be made mandatory.

#### *7. Compensation to farmers*

Seed industry spokesmen argue that the compensation system provided for in the Seed Bill can lead to unforeseen and negative consequences. In most cases, the cost of seed supplied by a company varies from 3% to 10% of the



cost of cultivation of a crop. The seed alone could contribute to 20-30% of the yield. Returns on investment, therefore, are high and attractive. The prices of seed of most crops in India are much lower than in neighbouring countries. Given the stiff but healthy competition in the Indian seed industry, placing the burden of compensating farmers on seed companies could result in

- a. Companies increasing prices to hedge for probable compensation payouts;
- b. Companies closing shop to escape the compensation burden; and
- c. Differences over compensation may lead to protracted litigation between farmers and seed producers.

This could culminate in reduced competition, narrowing of options for farmers and high cost of seed. The seed industry wants compensation to be limited to the actual value of the seeds or two times that at most.

Moreover, the seed industry argues that the question of compensation has already been addressed by other legislations such as

- i) Consumer Protection Act, 1986 (Tonapi et al., 2004); and
- ii) Protection of Plant Varieties and Farmers' Rights Act, 2001.

With the proposed Draft seed bill 2004, joining this list, there would be a multiplicity of seed compensation stipulations. This situation calls for vesting powers in a single seeds enactment overriding all others.

## 8. *Transgenic varieties*

The environmental safety of a particular gene or a particular transgenic event involving a gene in a specific crop is thoroughly examined by the regulatory system before it is released (or deregulated) into the environment. Once the specific gene with a specific transformation event is deregulated, there is no real need for the concurrence of the Environment Protection Act (EPA) when releasing subsequent varieties or hybrids carrying the same gene. Therefore, it should be explicitly stated in the Seed Bill that "No seed of any transgenic kind or variety shall be registered unless the (*alien*) gene which it is carrying has been approved by the Environment Protection Act, 1986 (Tonapi et al., 2004)".

There need not be compulsory registration for transgenic varieties as they would be cleared or deregulated by EPA. Registration may only delay the

process of release of transgenic varieties. The environment protection agencies of the USA, Australia and other countries where transgenics are commercially grown have similar provisions. For example, in the USA, the Bt gene Cry 1AC is deregulated, and any seed company can introgress it into their variety by the simple breeding technique of backcrossing and release for commercial cultivation without going to the Environment Protection Agency again.

### **9. Provisional registration**

Provisional registration should be granted to seed companies till the final decision is made rather than for three years as proposed, since the final registration may take longer than three years.

### **10. Powers of the seed inspector**

Since the seed sales of a particular crop take place in a very short period (sometimes ranging from 7 to 15 days in a year), the power to issue a stop sale order for a period of 30 days is too long and can ruin a seed producer. Therefore, this power should be made conditional. The following sentence should be added to the relevant section of the Seed Bill, stating that: *“When the producer has furnished information clarifying objections raised by the Seed Inspector, the detention order should be revoked within 24 hours”*

or,

*“If the reasons are inadequate, notices calling for further information should be served within 24 hours.”*

### **11. Offences and punishments**

The proposed penalties for minor infringements are too high. Seed is a biological product, and germination may at times deteriorate very fast due to the harsh climatic conditions that prevail in India particularly during the kharif (rainy) season. Therefore, the penalties should be minimized. Minor offences should be compoundable by the seed inspector himself to save time and resources for all concerned.

## Integrated and Effective Implementation of PPV&FR Act and New Seed Bill

Various new legislations concerning seed, biodiversity and environment share interfaces in the implementation of certain provisions of each law. The common entity addressed in all of them is seed, and there is a need for their effective and integrated implementation.

Some overlapping issues have been sorted out to bring about harmony between the Seed Bill and the PPV&FR Act. However, much more remains to be done. For example,

- The Seed Bill requires mandatory registration of varieties/seeds, but registration is under the purview of the PPV&FR Act.
- Key differences exist between the Seed Bill and the PPV&FR Act relating to declaring the origin/pedigree (parentage) of a variety, the conditions for multilocation testing, the agency that will conduct these tests, the level of transparency maintained on grant of registration, price control and treatment of farmers' varieties. While the PPV&FR Act requires the declaration of the origin of the variety with pedigree details, the Seed Bill does not.
- As regards testing of new varieties, the PPV&FR Act lays down that the Plant Varieties and Farmers' Rights Protection Authority will conduct the DUS tests. The Seed Bill does not specify who will conduct the tests for establishing the usefulness of the new variety.

Such lacunae can be misused unless the discrepancies are resolved. Farmers have an opportunity to raise objections if they have reason to think that a variety is not what it is claimed to be under the PPV&FR Act. In the case of the Seed Bill, however, the registered varieties will be made known only through periodic notifications. The public has no opportunity to object to a new variety for any reason. This lack of transparency could mean that varieties of poor performance could get registered without giving people a chance to oppose it.

There is every need to look into each and every aspect of the Seed Bill, the PPV&FR Act and the Biodiversity Act, 2002, and harmonize the discrepancies. In the PPV&FR Act, for instance, the breeder applies for registration for a PBR. This right is valid for 15 years for crop varieties and 18 years for tree species. The Seed Bill allows the period of protection to be doubled so that the seed variety can be protected by the seed producer for

30 years for crop species and 36 years for trees. This extension of the seed owner's right, however, is a positive sign for the seed industry.

There are other lacunae too that need to be addressed. The compulsory VCU trials required for registration may delay the release of new hybrids and varieties with superior pedigrees. Any new hybrid or variety is identified after several years of breeding and testing. To impose additional testing would mean that the benefits of the value-added cultivars would not reach farmers for another two or three years. This is a loss not only to the seed industry, but also to farmers and the nation as a whole. It is not clear how the proposed National Seeds Board will manage the testing of several thousand new varieties and hybrids at loosely networked institutes and research centers. The existing manpower and infrastructure might not be equal to the mammoth task. The mandatory VCU trials could be reduced to one year, which would reduce the lock-in period for new hybrids and varieties.

On the positive side for the seed industry, accreditation of organisations for certification and private organizations for conducting agronomic trials would be welcomed. It is also indirectly stated in the Seed Bill that dealers cannot sell seed of local nonregistered varieties. This is good for the seed industry because of the proprietary nature of their products. The stipulated stock display system by dealers and distributors is a new measure to ensure good quality seed. Involving representatives from the seed industry in the National Seeds Board (NSB) too is another encouraging development.

## Benefits from PPV&FR Act and Seed Bill

The Plant Variety Protection and Farmers' Rights (PPV&FR) Act is unique in the sense that it is the first time anywhere in the world that the rights of both breeders and farmers have received integrated attention. Farmers and breeders are allies in the struggle for sustainable food security and hence their rights should be mutually reinforcing and not antagonistic. The Act adopts this approach. Under the legislation, plant breeders will have the right "to produce, sell, market, distribute, import, or export a variety; in short, full control over production and commercialisation of seeds". Genetically modified (GM) varieties are encouraged by a provision in the Act for creating a separate fast track for approving "essentially derived varieties that are identical to the parent variety except for change in a single character." Most GM varieties belong to this category, and any variety can be registered if it is "novel, distinctive, uniform and stable." The only stipulation that breeders

are required to declare is that the parental material used for breeding was lawfully acquired and their new variety “does not contain any gene or gene sequence involving terminator technology.” Violation of breeders’ rights and using a similar name or packaging to that of the breeder will invite fines up to Rs 1 million and a stringent jail term. Simultaneously, the Act recognizes the right of India’s 50 million farmers to save and sell seeds produced in their farms “including seeds of a variety protected under this Act,” provided they are not sold under brand names (the breeder’s registered name). India is heavily reliant on localized farming; about 87% of the seeds sown are currently produced and sold by farmers themselves. The breeder is rewarded for his innovation by having control of the commercial market place, but without being able to threaten farmers’ livelihoods.

Farmers and local communities also stand to gain from a National Gene Fund, whose proceeds would go toward farmers’ welfare, maintenance of community gene banks or compensation for crop failure, etc. Breeders must pay a royalty into the fund when farmers’ varieties (germplasm) or landraces (original traditional varieties that have not undergone changes) are used for breeding new varieties. The industry seems positive about the legislation. There was a long-standing demand from the seed industry for a law that would safeguard the gains made through the creative efforts of its plant breeders. The PPV&FR Act will therefore encourage higher investment in research and development in India and transfer of advanced technologies from abroad. Companies need not worry unnecessarily over the right given to farmers to sell seed of protected varieties. What is intended under the Act is the freedom of farmers to keep seeds of such varieties and enter into limited sale in their neighbourhood, and this will be possible only in the case of self-pollinated crops. In the case of hybrids, farmers will have to buy seeds every year like they do already.

In the PPV&FR Act and the draft Seed Bill, there is a recognition that farmers who want to propagate their own seed should be allowed to do so. Through the payment of royalties from breeders into a National Gene Fund, there is acknowledgment of the debt owed by those who improve plants in the modern age to their predecessors who developed indigenous and farmers’ varieties. These legislations recognize that companies that spend money making beneficial improvements to crops need some reward. The Indian Plant Variety Protection and Farmers’ Rights Act could be a model solution, one that other developing nations might follow.

## Scope and Future Challenges

### *1. R&D investment*

By introducing the PPV&FR Act, India is fulfilling its obligations as a member of the World Trade Organisation (WTO) to provide protection to new varieties developed by breeders. The Indian Government opted for this legislation, rather than protecting new plant varieties by patents, after a sustained antipatent campaign by NGOs, which fear that a patent regime would end up making farmers prisoners of multinational companies. India has framed the law so as to protect the rights of farmers. The next step for India is to decide how it will interact with other nations; at present, the only international forum set up to globally recognize plant breeders' rights is the intergovernmental organization, the Union for the Protection of New Plant Varieties (UPOV), Geneva. Since it was strengthened in 1991, it does not allow farmers to save seed and is therefore incompatible with the Indian legislation. But UPOV should not have objections since the responsibility of recognizing farmers' rights has been left to national governments.

It is generally agreed that IPR promotes innovation, increases return from investment and boosts investment in R&D. In the Indian scenario, varietal improvement was hitherto largely undertaken by the public sector research system with very little involvement from the private sector. The impact of the PPV&FR Act on public sector research and private research could possibly be different. The liberal farmers' and researchers' rights provided in the Act may restrict research investment from the private sector in self-pollinated and vegetatively propagated crop plants, but the public sector is expected to continue its predominant role and the interests of farmers are expected to be protected as per the policy of the Government of India. Also, the private sector's interest in those self-pollinated crops with high-volume seed trade is likely to continue to supplement public sector efforts. Thus, private investment in varietal improvement under this legislative regime is expected to increase in selective sectors, such as hybrid varieties of commercially attractive crop species and self- or vegetatively propagated crop species offering high-volume annual seed sale. Consequently, public sector research is expected to face stiff competition in these sectors from the private sector.

It is estimated that currently more than 400 private firms are involved in the Indian seed sector. Out of these, only a very few have their own R&D

capability on varietal improvement. In other words, these firms have been staying in the seed business with the help of varieties and hybrids freely available from the public sector. Under the emerging regime, the viability of such firms with little R&D backup may become increasingly difficult. Accordingly, the Indian private seed industry has also been changing with its lead players acquiring foreign tie-ups. Such tie-ups are likely to lead to acquisitions and mergers to eventually create a few private majors with increased compatibility and monopolistic control on varietal improvement and seed trade.

## *2. Biodiversity, material transfer and varietal protection*

Indian agriculture has wide crop diversity and various practices in crop diversification by farmers. With several crop species not offering a commercially attractive scale of operation for the private sector, state-funded research may be required to continue giving its attention to varietal improvement of these crop species without the least competition from the private sector.

Varietal protection may influence public research priorities too. While it may be possible that all varieties of crop plants bred by public research may not be protected or that all protected varieties may not be licensed out, all competitive varieties of major crop plants are expected to be protected and licensed for a consideration. Such flow of returns may provide an incentive to the breeders concerned and encourage their competitiveness and bring about general improvement in competitiveness across the public system.

The public sector can be as successful as the private sector in acquiring new genetic diversity from elsewhere through material transfer agreements. Public research can match the private sector by streamlining its research management to enhance efficiency, speed and competitiveness. Such a change may also encourage private-public collaboration to take advantage of the impressive infrastructure and human resources available with the public sector in diverse areas of crop improvement.

## *3. Public sector research*

Public sector research has a lesson to learn from the European experience in the context of varietal protection. Within a decade of introduction of such protection in Europe, much of its public research ceased to operate with reputed research institutions selling out to the private sector. While such changes are not likely to happen so speedily in India, the possibility in the

long run cannot be ruled out. Considering the necessity for a public R&D system, as well as a general realization that it must be further strengthened, it is expected that the PPV&FR Act will bring advantageous changes in crop improvement and variety development efforts to fulfil the all-round interests of Indian agriculture. The DAC of the Government of India with expert consultation and advice from ICAR has embarked on various issues for successful implementation of these legislations.

To sum up, WTO and other provisions in the Agreement on Agriculture need not always be viewed as deterring factors. The TRIPS agreement and the PPV&FR Act in the long run would act as catalysts for enhancing agricultural production and productivity in the country. We are moving from a green revolution to a gene revolution with strategic integration of biotechnology tools into Indian agricultural systems. It is time to strengthen and support agricultural systems through better funding, and scientists too should learn to adapt to the IPR regime. It is said: “the best way to learn to compete is to compete”; the right way to do this is through the right type of deliverables and innovative policies, especially on human resource development.

## Towards a Sound Policy Framework for Sustainable Seed Systems

Production and distribution of quality seed in India involves the participation of central and state governments, state agricultural universities (SAUs), and public, cooperative and private sector institutions. The seed sector in India consists of two national-level corporations (Neyveli Lignite Corporation and State Farms Corporation of India), 13 state seed development corporations, 24 multinational joint venture seed companies and a large number of private sector seed companies. Today, the Indian seed program boasts one of the biggest seed markets in the world, with annual sales at around US \$920 million. Of this, domestic offtake accounts for US \$900 million and sales in the global market account for the remaining US \$20 million. There are about 19 state seed certification agencies and 90 state seed testing laboratories in the country. The public sector’s seed requirement accounts for less than 15%. More than 85% of this requirement is met from farmer-saved seed and private seed companies. Farmers save seed of local varieties/straight varieties and use this continuously for about 3-4 years. However, they are compelled to purchase hybrid seed every year, because the hybrid vigor of  $F_1$  hybrid seed degenerates in  $F_2$ . The ideal seed supply system is depicted in Figure 7.1.



# Seed supply functions and organizations

## Rules and Regulations

## Research and Development

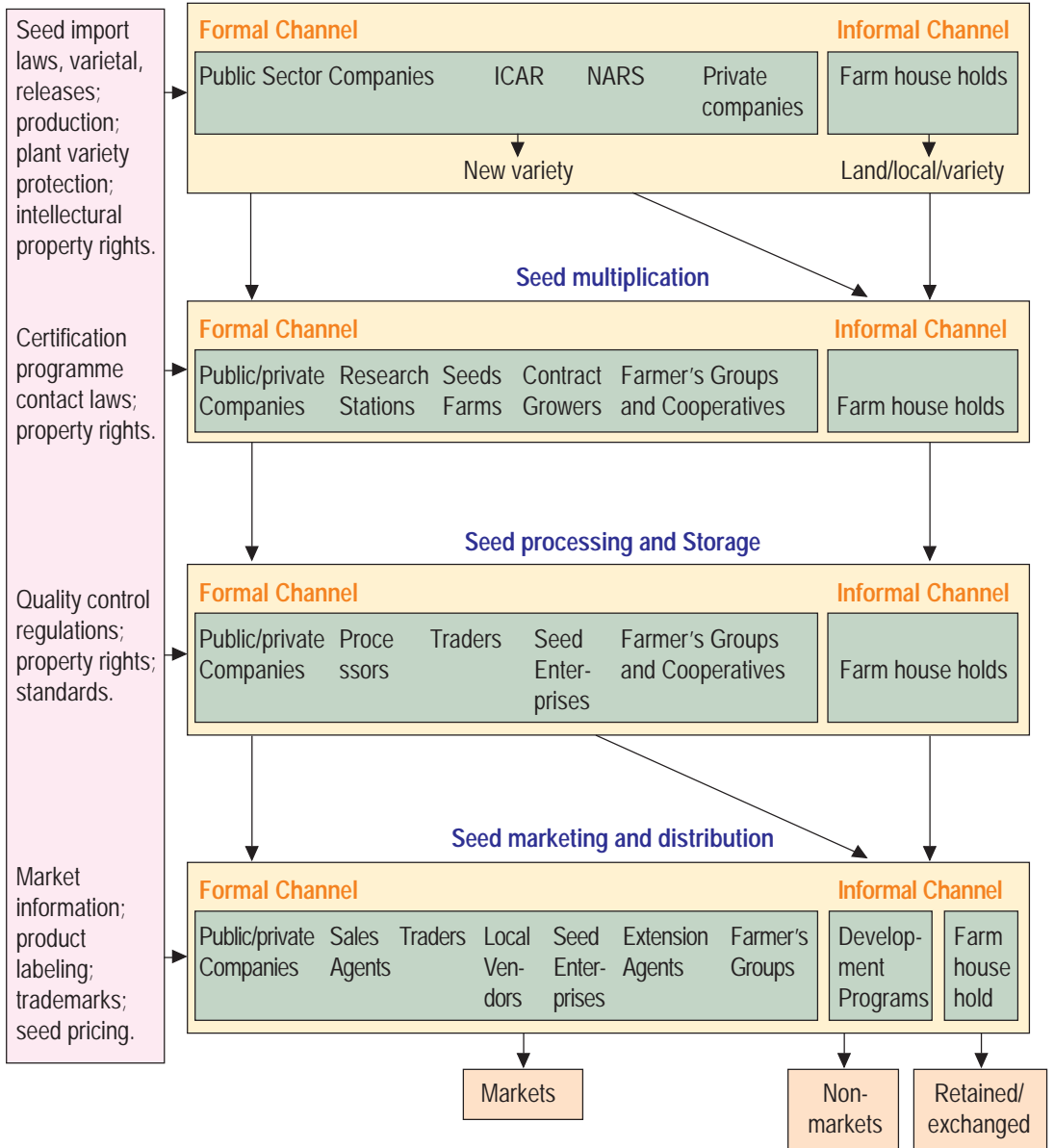


Figure 7.1. Seed system: an organizational and institutional framework.

More than 85% of the total seed sown in India is produced by farmers themselves. Moreover, the proportion of quality seed available is only 12% of the total seed used for sowing each year. Hence, large areas under food grain cultivation are still sown with seeds saved by farmers. Experimental evidence shows that cereal crops give 10–20% less yield per hectare when farmers use their own seed. Use of quality seed of improved varieties and hybrids would add about 20-30 million t to the country's annual food grain production.

In spite of the fact that India was first in the world to develop hybrids in a number of crops, the area coverage under hybrids is quite low. The proportion of hybrids in the total seed produced is not very satisfactory: cotton 23.0%; maize 59.6%; sorghum 77.6%; castor 75.0%; pearl millet 60.0%; and sunflower 29.6%. Ideally, what is needed to boost production is to increase the area under quality seed up to 100% if possible, preferably under hybrids where hybrids are available. In nonhybrid crops, the replacement rate of quality seed should ideally be 33% in self-pollinated and 50% in cross-pollinated crops. Our efforts in innovations in seed systems and seed legislation must be directed toward that end.



## About ICRISAT®



The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a nonprofit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Future Harvest Centers of the Consultative Group on International Agricultural Research (CGIAR).

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