

Seed System: The Key for a Sustainable Pulse Agriculture for Smallholder Farmers in the Dryland Tropics¹

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Seed is the fundamental life-blood of agriculture and the foundation of a successful farming for smallholder farmers in the dryland tropics. The farmer does make arrangements for many farm inputs but the seed is the primary input. Good quality seeds, which have genetic and physical purity; health standards; high germination and moisture percentage, can increase farmer's production by about 20-30%.

The Green Revolution (GR) program has influenced seed system in the 70's in vegetables and cereals but not in pulses, which is mainly grown in the dryland tropics. The procedures, through which a cultivar is bred, produced, certified, stored, marketed and used which includes all the channels through which farmers acquire genetic materials and in interaction with the commercial seed industry is known as seed system. The current seed flow in pulses reveals that marketing and usage from a system of free access and/or exchange is limited to seed growers or seed producers, traders (middlemen) and agricultural government agencies. The flow of planting materials is more on the farming community as farmer seed exchanges and barter is preferred than acquiring seeds by cash. Most often the cultivars promoted are the registered seeds or good seeds, limiting the diversity in farmers' fields.

What are the Three Types of Seed System?

Seed systems vary widely on locality, market availability, and farmer knowledge, and can be informal, formal, or a combination of the two. However, seed system in pulses is currently not well established which has led to poor seed supply, pushing the smallholder farmers to save their own seeds year-after-year or obtain from other farmers.

A. **Informal Seed Systems** are characterized by a lack of functional specialization. These systems are traditional and informal, operating mainly at the community level through exchange mechanisms. These systems have been variously called farmer-managed seed systems, informal seed systems, traditional systems or local seed systems. They are semi-structured, 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.

In the informal seed system, approximately 80-90% of all seeds used is largely sourced from

¹ Paper presented during the 23rd PHILARM National Convention, Villa Caceres Hotel, Naga City, Camarines Sur, Philippines, 16-18 April, 2013

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farmers' own-saved seed which involve saving seed from own harvest, and using seed for re-sowing, sharing, exchanging, bartering and selling. Farmers save seed and use this continuously for 3-4 years with low (2-3%) seed replacement ratio because the proportion of quality seed available each year is only 10-12%. The varieties used are mostly local landraces, and awareness about improved varieties, seed availability and seed access is very poor. Seed is procured off-farm (local markets, from other villages, relatives, other farmers and government relief agencies) only when necessary or as when own seed is not available due to drought, poverty or seed pests and diseases. However, these statements about the predominance of the informal sector cover significant differences between crops, villages, farmer groups and their socio-economic conditions. Traditional seed systems are location-specific and vary greatly within farmer communities.

In all pulse producing countries, farmers have traditionally relied on seed saving as their primary method of seed access. For pigeonpea, farmers cultivate local varieties and would trade seed amongst themselves or between villages when their seed became unviable after 3-4 years of successive cultivation (Figure 1). The trade between farmers first and then with neighboring villages helped to give new exposure to existing cultivars in the village. When some new seed is cultivated then new genetic material enters the cycle because of natural outcrossing.

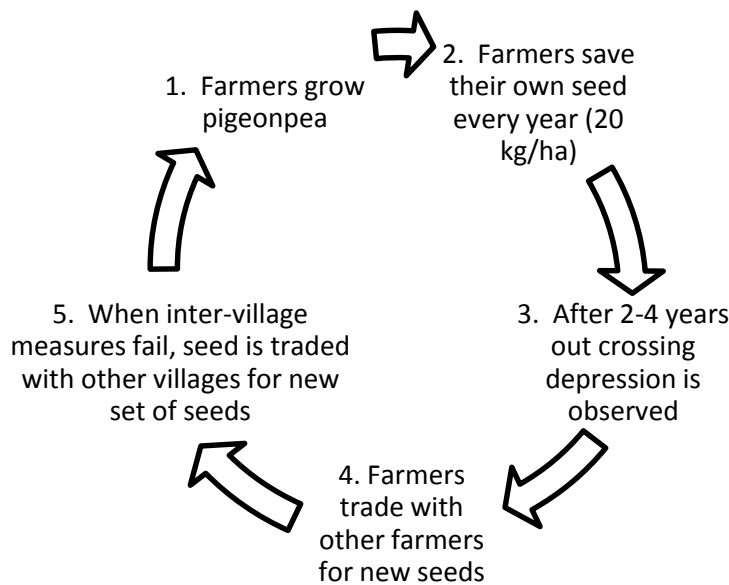


Figure 1. Dominant seed system of smallholder farmers in pulses.

B. Formal Seed System. The formal seed sector can offer only a limited range of cultivars and operates within specified quality standards. Although, the private sector is increasing its pulse share in the market, it is the farmers sector which produces 70-80% of the quality seed. Private companies mainly respond to commercial incentives on hybrids of high-value seeds but very little in pulses. In practice, these may constrain its ability to meet the diverse needs of farmers. Formal seed systems consist of seed production of agencies namely: state government agencies;

government-assisted and other cooperatives; multinational corporations (MNCs) or transnational corporations (TNCs); domestic private sector companies with their own research and development (R&D) or without their own R&D; and Joint venture companies between MNC and domestic private company or between two domestic companies, etc. (Figure 2).

There are serious concerns over the appropriateness of the cultivars available in the formal seed sector, the quantity and quality of seed delivered, seed production costs and prices and timeliness of supply. Explicitly, rigid government policies and regulations, poor organizational linkages and inadequate infrastructure contribute to the problems of the formal system. 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. Hence, 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 in seed production.

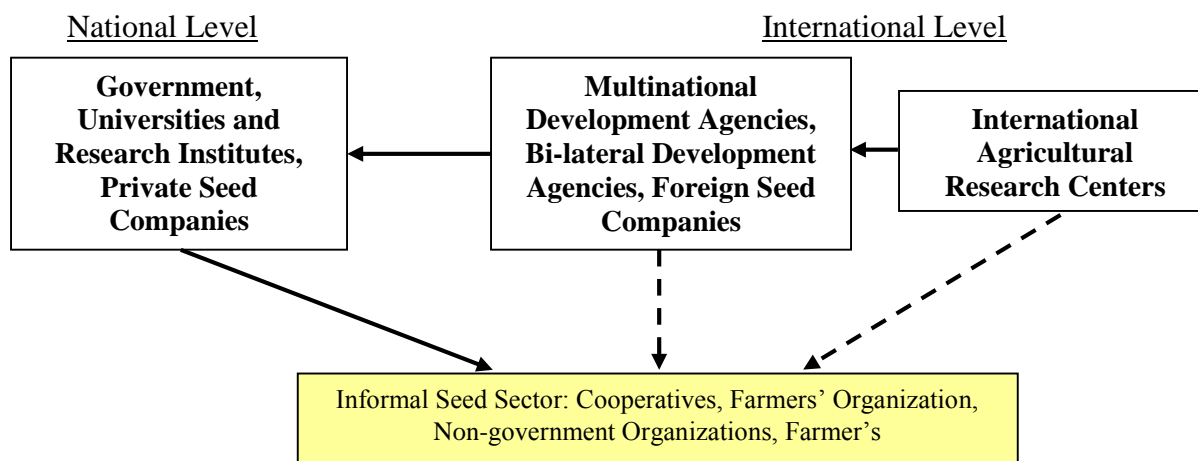


Figure 2. Framework of Formal Seed System.

C. **Integrated Seed Systems** which combine methods from both the formal and informal sectors including local seed supply systems are mechanisms to supply seed of new varieties to farmers (Figure 3). The cultivar developed and used; seed produced and stored 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 pulses for smallholder farmers in the dryland tropics. The integrated approach that takes into understanding the formal and informal seed sector in breeding, seed production and distribution has shown to have promising potential for improving seed supply to smallholder farmers.

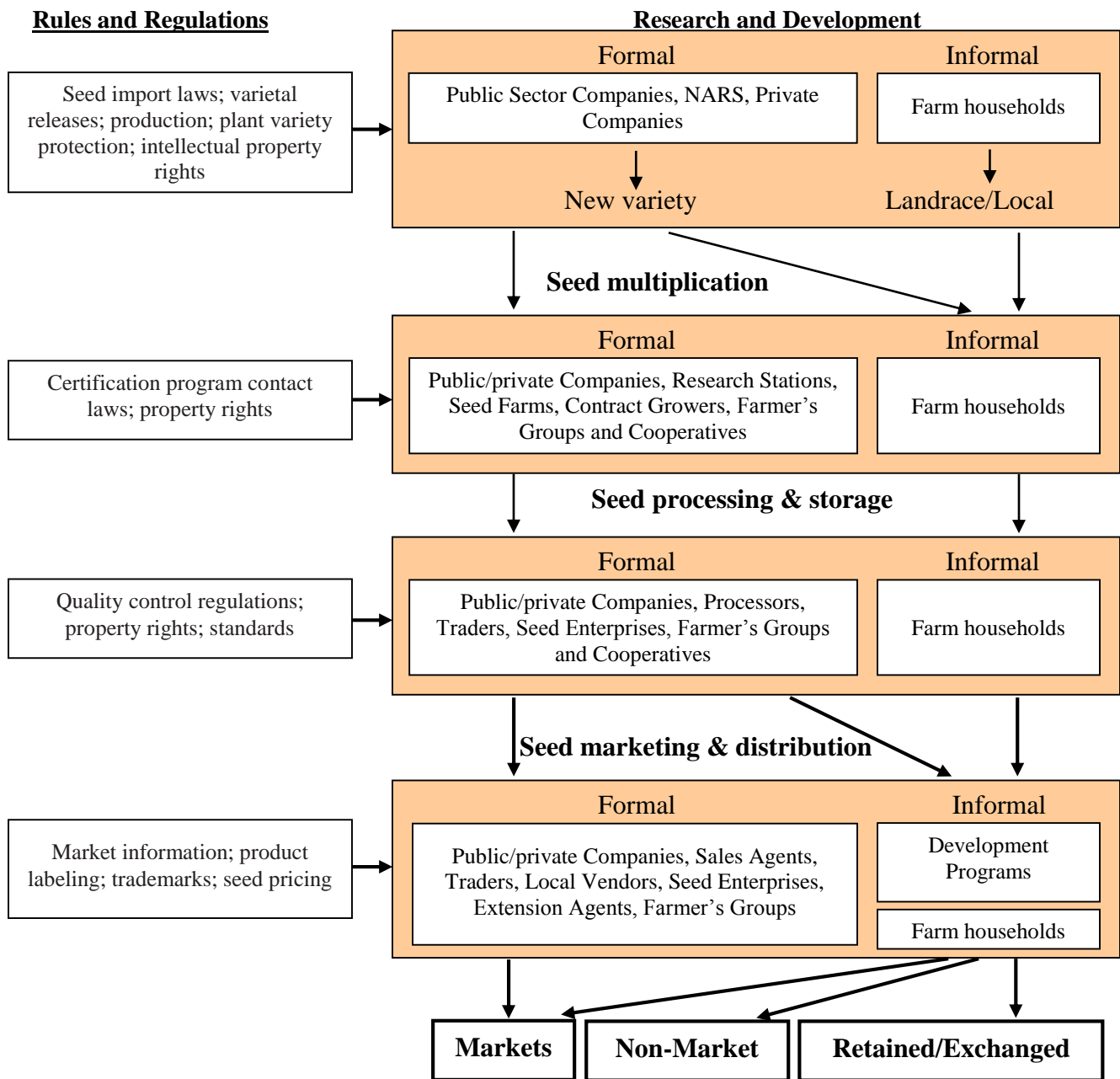


Figure 3. Integrated Seed System Organizational and Institutional Schema.

Awareness on the importance in the seed system of the farming community should be increased. The farmers' roles in the seed system need to be strengthened especially in widening of the genetic diversity in their fields as they become involved not just in seed exchange but also in the improvement and use of their seeds. The system of free access and exchange should be further emphasized to give the farmers full rein on the local seed delivery system.

Strategies for effective and efficient seed system for the smallholder farmers

In the farmer participatory seed production system, there are two models which can be promoted depending upon the clients' needs and local situation:

1. **Community-based seed production model** of seed production system where seed sufficiency depicts the farmers to save their own seeds. This model is effective for farmers to maintain and produce own quality seeds. The new cultivars (i.e. groundnut) for seed production start with a 2 kg seed to cover 0.01 hectare (Stage 1). The multiplied seeds from Stage 1 will be used to cover 0.10 hectares (Stage 2). The harvested seeds from Stage 2 will now be utilized to cover 1 hectare of land (Stage 3) for commercial purpose. Moreover, in the stage III, the farmer has to set aside 2 kg of seeds from selected plants to start Stage I (Figure 4).

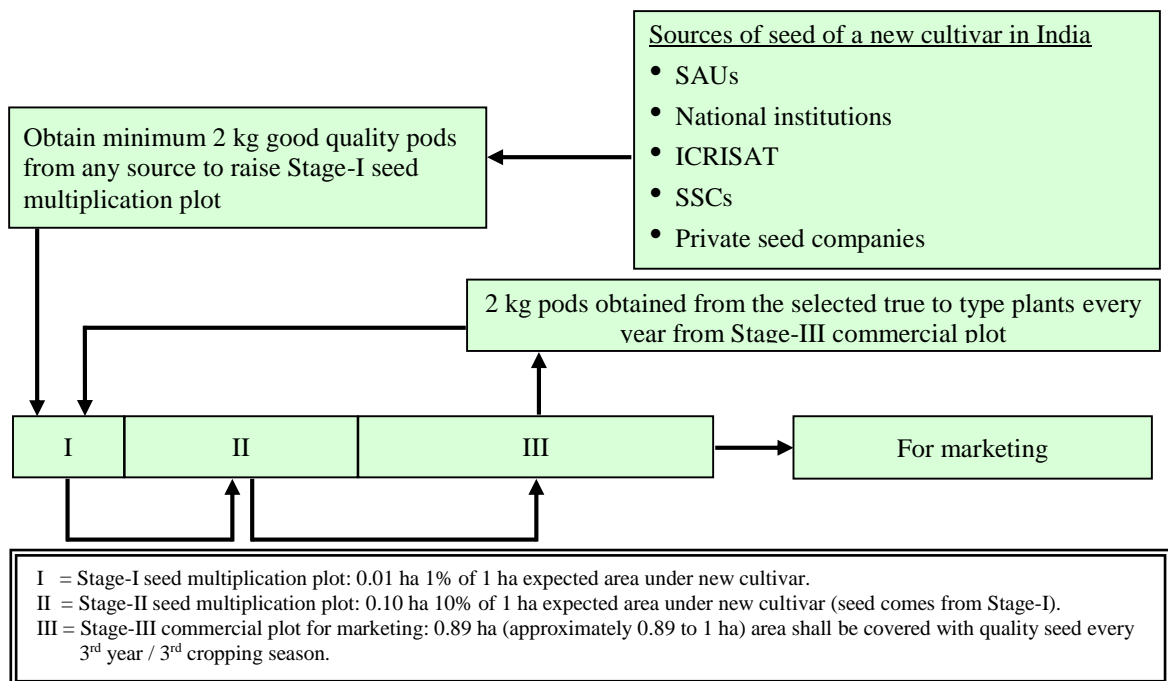


Figure 4. Community based seed system model in Tamil Nadu and Karnataka, India.

2. The **'One Variety One Village'** concept where seed is available at the local level through which quality good seeds for open pollinated crops (i.e. pigeonpea) are produce by progressive farmers, NGOs, SHGs and farmers' cooperatives. In order to avoid high levels of outcrossing and maintain seed purity from season to season, a certain isolation distance should be guaranteed in the process of cultivation. Because the minimum distance to maintain this purity is roughly 300 meters, a farmer would need to own close to 50 hectares in order to produce half hectare of good quality seed which is not possible in India. An alternative to creating isolation is to encourage the majority of neighbor farmers to cultivate the same variety of seed, thus eliminating the danger of outcrossing

with other varieties. If an entire village or a large section of a village can be motivated through extension education and community organization to plant the same variety, yields will be maintained from season to season and the number of year's seed can be repetitively saved for re-cultivation without loss of desirable characteristics. Intensive community organization is needed to reap these highly desirable benefits. Seeds can then be sourced according to the community's preference from a variety of suppliers (Figure 5).

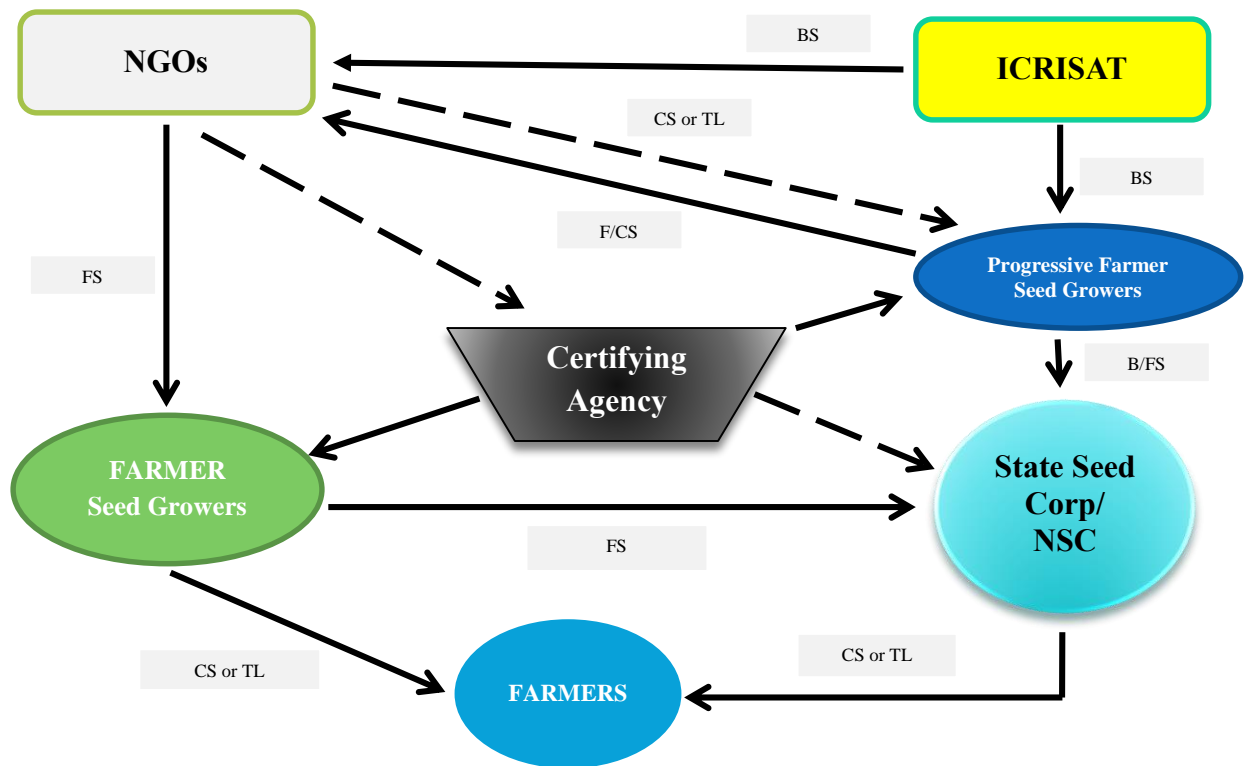


Figure 5. 'One Village One Variety' seed system model in Odisha, India.

- B. The **Integrated Seed Systems** model where combine methods from both the formal and informal sectors including local seed supply systems strengths and weaknesses are complementary (Figure 6).

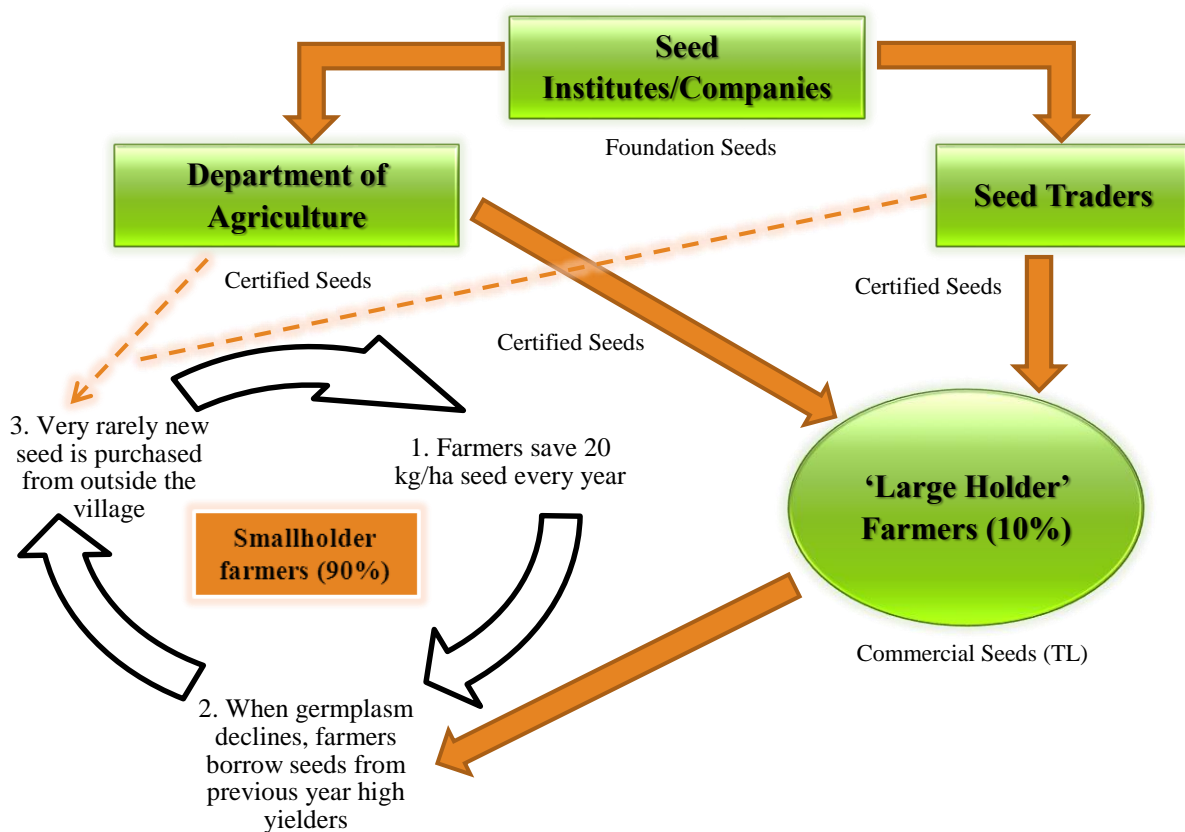


Figure 6. Integrated seed system model in Andhra Pradesh, India.

The kind and success of any intervention will depend much on the framework within which it is implemented (bio-physical suitability), present institutional arrangements, and related policies. The following have been identified as possible intervention strategies that would help improve smallholder farmers with the best quality seed at the right time, place and price.

- Instead of going through a cycle of producing foundation and certified seeds, to getting this tested and certified in some far-off place, and selling this back to the same place, strategies should be formulated to produce, test and certify within the same locale.
- Developing contractual agreements with farmers to produce pulse seeds together with the establishment of seed associations/cooperatives.
- Transferring improved pulse seed production technologies to resource-poor farmers. The benefits of improved cultivars and production technology are harnessed for the resource-poor farmers.
- Designing, developing and testing site specific alternative seed system models for improving and sustaining local seed supply based on geographic and ethnic as well as administrative boundaries.

- Implementing farmer seed self-reliance programs through community or village seed bank program or facilitating decentralized seed production and distribution system.
- Promoting community-based evaluation, characterization and multiplication of “at-risk” varieties of pulses.
- Practicing of farmer participatory varietal selection, seed production and monitoring. On-farm demonstration trials, on-station seed selection, and distribution of seed to private suppliers.
- Facilitating community-devised and generated marketing and credit support systems.
- Collecting and characterizing indigenous grain varieties and establishment of *in situ* seed conservation centers to reduce the risk of local varieties disappearing.
- Capacity building of self-help groups to facilitate community seed banks and provide incentives to farmers who grow indigenous cultivars and seed conservation efforts.
- Introducing controlled conditions to effectively produce nuclei seed; facilities for seed storage, processing, and packaging and strengthening the public-private sector partnerships for seed distribution.
- Identifying opportunities continuously for mutual learning by farmers and scientists to help improve the effectiveness of seed supply to local communities.

Hence, any seed system requires a regulatory framework as well as a seed policy that considers regulations of an expanding and diversifying seed sector for the benefit of the smallholder farmers engaged in the seed production system.

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