

# **Strategies to Build Viable Community Seed System in Dry Land Ecosystems for Sustainable Seed and Food Security in India**

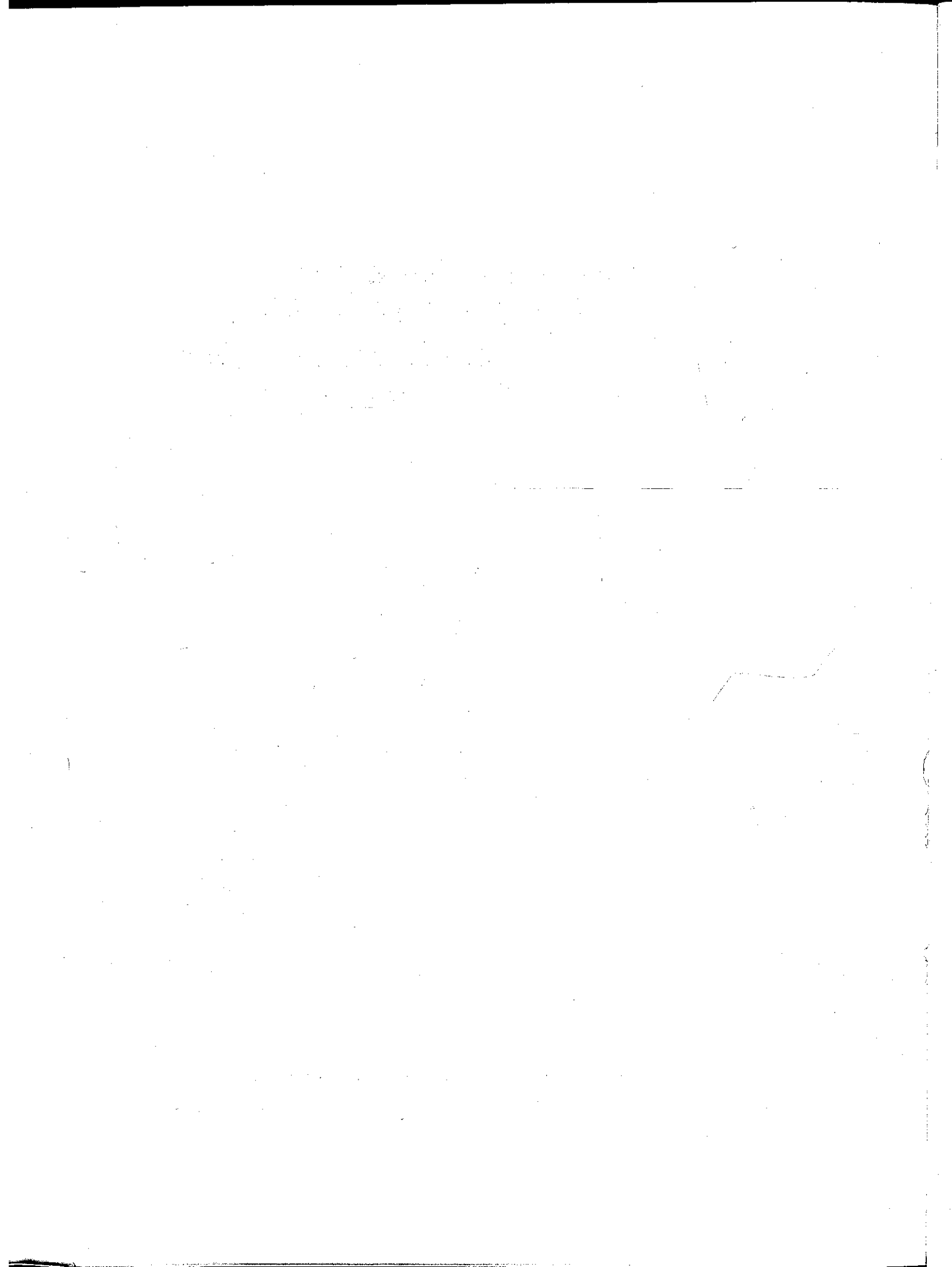


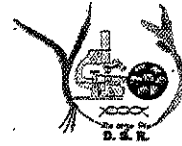
Vilas A Tonapi, Ch Ravinder Reddy, S Rajendra Prasad,  
BS Tomar, Sanjay Singh, Sushil Pandey, S Natarajan and Sandeep K. Lal

**Directorate of Seed Research**

बीज अनुसंधान निदेशालय

Indian Council of Agricultural Research  
Kushmaur, Mau 275101 (UP)





# Strategies to Build Viable Community Seed System in Dry Land Ecosystems for Sustainable Seed and Food Security in India



हर कदम, हर उमर  
किसानों का हमसाफर  
भारतीय कृषि अनुसंधान परिषद

*Agrisearch with a human touch*

Vilas A Tonapi, Ch Ravinder Reddy, S Rajendra Prasad,  
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**About the authors**

- Vilas A Tonapi, Head, Division of Seed Science and Technology, Indian Agricultural Research Institute, New Delhi -110012, India
- Ch Ravinder Reddy, Senior Scientist (Technology Exchange), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, 502 324, AP, India.
- S Rajendra Prasad, Project Director, Directorate of Seed Research, Post Bag No. 11, Village : Kushmaur, PO : Kaithauli, Mau 275 101 (UP), India
- BS Tomar, Senior Scientist, Division of Seed Science and Technology, Indian Agricultural Research Institute, New Delhi -110012, India
- Sanjay Singh, Senior Scientist, Division of Seed Science and Technology, Indian Agricultural Research Institute, New Delhi -110012, India
- Sushil Pandey, Senior Scientist, National Bureau of Plant Genetic Resources, Pusa, , New Delhi -110 012, India
- S Natarajan, Senior Scientist, Directorate of Seed Research, Post Bag No. 11, Village : Kushmaur, PO : Kaithauli, Mau 275 101 (UP), India
- Sandeep K. Lal, Senior Scientist, Division of Seed Science and Technology, Indian Agricultural Research Institute, New Delhi -110 012, India

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**S Rajendra Prasad**  
Project Director

**Directorate of Seed Research**

Post Bag No. 11, Village : Kushmaur,  
PO : Kaithauli, Mau 275 101 (UP), INDIA.  
Phone: 0547-2530325/ 2530326  
Fax: 0547-2530325  
E-mail: pd\_dsr2005@yahoo.co.in  
Website: <http://www.dsr.org.in>

## Abstract

To make available and affordable good quality seed at the right time requires a well functioning seed supply system. This in turn will help to ensure seed security and enhancing productivity in dryland areas. Given the critical role that improved varieties can potentially play in increasing the production of conventional cropping systems, developing an integrated and effective seed system capable of generating and delivering improved seed varieties in a cost-effective ways is a challenge. Farmers' seed systems in agrarian communities have stood the test of time to enable evolution of modern agriculture. Thus the informal seed sector has ensured conservation of agro-bio-diversity, at the gene, ecosystem, and farmer levels to ensure food security. A relatively recent analysis has led to an understanding of the crucial role that women have played in sustaining the informal seed sector, and more widely, in ensuring food security. However, this sector is solely dependent on local resources and inputs, and seed supply is highly vulnerable to disaster and socio-political disruptions. Sowing the seeds of innovation therefore assumes great urgency if one is to strengthen local seed systems. While the hybrid seed industry led by the private sector in formal seed systems has focused on profit-making species and crops, the informal sector has concentrated on those crops and seed systems which underpin local food production, mainly those predominantly self pollinating and open pollinated. Given this scenario, national seed policies must devote more effort to sustaining and strengthening the informal seed sector. Most of the international support to strengthening seed systems focuses on the formal seed sector; the time has come for matching support to the informal sector.



**डा. एस. अय्यप्पन**

सचिव एवं महानिदेशक

**Dr. S. AYYAPPAN**

SECRETARY & DIRECTOR GENERAL



भारत सरकार

कृषि अनुसंधान और शिक्षा विभाग एवं

भारतीय कृषि अनुसंधान परिषद

कृषि मंत्रालय, कृषि भवन, नई दिल्ली 110 114

GOVERNMENT OF INDIA

DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION

AND

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

MINISTRY OF AGRICULTURE, KRISHI BHAVAN, NEW DELHI 110 114

Tel.: 23382629; 23386711 Fax: 91-11-23384773

E-mail: dg.icar@nic.in

## FOREWORD

The dry land agro-ecosystems encompass crops ranging from cereals like rice and wheat to, coarse millets like maize, and sorghum, minor millets, pulses and oilseeds, fiber and many underutilized crops. When cropping systems are characterized by subsistence farming, most of the crops grown are for self consumption, where farm saved seeds provides the bulk of the seed requirements in these areas. The issue is Cultivar Replacement Rate (CRR) is very poor, old obsolete varieties and in most cases the land races are still prominent and popular among the farmers. Therefore, Seed Replacement Rate (SRR) is far below the state and national average. In such a scenario, designing appropriate seed systems to meet the specific challenges demands clear identification of needs and strategies.

Although the seed sector provides a dynamic and flexible system of seed supply, usage, handling, trade and exchange, continuous use of untested seed inevitably leads to degeneration of seed quality. Though farm-saved seeds promote the use of local or traditional varieties to some extent thus conserving the land races, over time it doesn't provide adequate choices to the farmers to diversify their portfolio and thus improving productivity. One of the most pressing concerns related to seed supply of modern varieties is how to establish sustainable seed provision systems for commodities that cannot be economically supplied through a centralized, formal seed industry.

Despite the penetration of markets in the local economy, traditional coping strategies based on local processes of seed exchange are still important. Any successful developmental intervention aimed at increasing the resilience of seed systems should take into account these traditional exchange practices. For example, a better strategy for improving local institutions and seed exchange networks could be aimed at increasing production and multiplication of seeds at the local level and facilitate movement of people between the two areas, rather than distributing seeds from outside to farmers. Development projects should be innovative and poverty-focused. It is crucial to reduce the poor man's vulnerability by increasing farmers' access to money and other valuable assets, which in turn are important for establishing and maintaining social relations that will help to evolve seed and food security in the long run. The bulletin "Strategies to Build Viable Community Seed Systems in Dry Land Ecosystems for Sustainable Seed and Food Security in India" is an attempt to analyze seed multiplication and delivery systems while analyzing the problems associated with different seed systems. This publication makes a strong case for strengthening alternative seed systems and seed delivery models that address the needs and vulnerabilities of small farmers, given the constantly changing dynamics on the national, international, political, and socio-economic fronts and will prove to be a handy source for all those working on community seed systems.

9<sup>th</sup> April, 2012  
New Delhi

  
(S. Ayyappan)

## Contents

Seed production and supply spectrum across dry land ecosystems	1
Sustaining viability of informal systems with Innovative seed delivery models	9
Developing a community based seed system	17
The alternative integrated seed system model	25
Need for a policy framework to build a viable local seed system	32
References	41



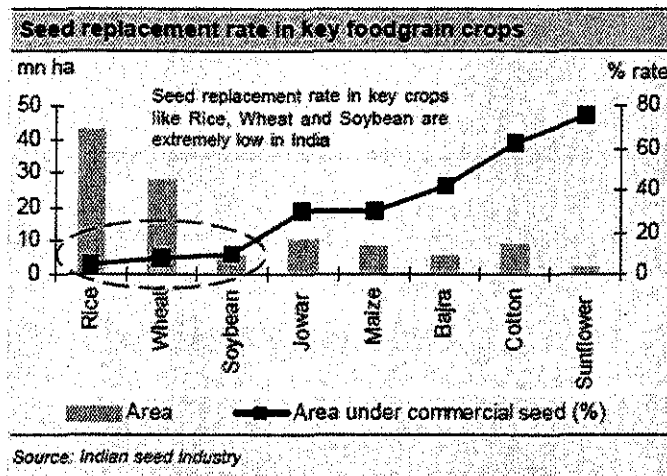


## Seed production and supply spectrum across dry land ecosystems

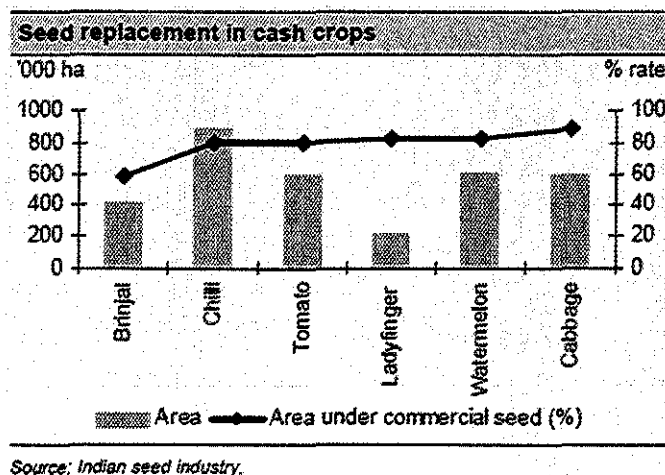
### Preamble

It has been estimated that over 90% of the crops in developing countries are still planted with farmers' varieties and farm-saved seed (Almekinders *et al.*, 1994; Almekinders and Louwaars, 1999; Maredia *et al.*, 1999; World Bank, 1998). The formal seed sector focus on high value and hybrid crops and most favorable agro-ecosystems as trading in these crops and areas is most profitable. Thus open pollinated varieties and self-pollinating crops are left to the mercy of small scale unorganized seed companies and public sector seed companies and the informal seed systems. As the access to quality seed becomes acute, the smallholder farmers depend for their seed security by saving their own seeds required for the next season, thus reducing opportunities for seed replacement with new varieties. With privatization or commercialization of public sector seed activities, the formal public-sector seed activities have tended to focus on a narrow range of crops grown by larger farmers, in this way, reducing supplies of seed of new varieties of subsistence crops to smallholder farmers even further (Bengtsson, 2007). Nevertheless, there are a number of examples throughout the world where seeds of cultivars are supplied by successful small- to medium-scale seed enterprises or farmer organizations. Some of them may have succeeded in creating a vibrant seed business able to respond to the demand for quality seeds. Identifying these and determining the key factors leading to their success will contribute to efforts to replicate the innovations in similar agro ecological regions or conditions.

The existing seed systems involve the formal seed sector, which is an official or private control of seed monitored through the entire process of breeding, multiplication, processing and storage, leading to the final product. The informal seed sector is simply the farmers themselves that provide each other and themselves with seed for sowing. This seed may be cleaned manually, but is otherwise untreated and thus a potential carrier of various diseases. Therefore, strengthening of the seed system at community level should involve all possible aspects of modern seed activities. In industrialized countries the formal seed sector provides the vast majority of seed to farmers, while both seed systems are present in developing countries. Despite large investments in formal seed systems in developing countries over the past 30 years, the seed demands of about 90–95% of smallholder farmers are still met by informal sources at the farm and community levels.



Although the informal seed sector provides a dynamic and flexible system of seed supply, usage, handling, trade and exchange, continuous use of untested seed inevitably leads to degeneration of seed quality. Farmers depend on their own seed for sowing, not only because of inadequate access to seed from the formal seed sector, but also because the formal seed sector more often provides seeds of a limited range of cultivars and varieties of food and fodder crops, which do not always fulfill the needs of farmers. On-farm growing and maintenance of locally adapted landraces, cultivars and wild species help the farmer decrease the impact of a series of production constraints like drought, flooding, heat, cold, pests and diseases. In many developing countries, problems created by seed-borne diseases are ignored and control measures unknown or inadequate. The consequence is often poor seed quality, dissemination and build-up of seed-borne diseases and yields far below potential. The quality of the seed must be known before it is sown. A farmer using healthy seed will be able to increase yield of his harvest dramatically. However, the health and quality of seed is not always apparent to the naked eye. Seed supply from both formal and informal systems suffers from a series of problems due to the lack of economic resources for education, research and quality control.



## **Overview of seed systems**

Seed systems can be grouped into two types: 1. Formal seed systems and 2. Informal seed systems. Informal systems are also referred to as local, traditional or farmer seed systems. Both systems have their own limitations.

### **i) Formal seed systems**

Formal seed systems are easier to characterize as they are deliberately constructed, involving a chain of activities leading to clear products – certified seed of verified varieties (Louwaars 1994). The chain usually starts with plant breeding and selection, resulting in different varieties, hybrid parents including hybrids and materials leading to formal cultivar release and maintenance. In practice, these systems may be constrained in their capacity to meet the diverse needs of farmers in developing countries. The framework for a performance analysis of a formal seed sector has been discussed by several authors (Pray and Ramaswami 1991; Cromwell *et al.* 1992; Friis-Hansen 1992). The guiding principles in the formal system are maintenance of varietal identity, genetic purity and production of seed with optimal physical, physiological and sanitary quality. The central premise of the formal system is that there is a clear distinction between seed and grain. This distinction is less clear in informal seed systems.

### **Limitations of formal seed systems**

- The varieties developed are often not adopted by small farmers due to complex environment stresses and low input conditions.
- The formal seed sector has difficulty in addressing the varied needs of small farmers in marginal areas.
- They offer only a limited range of varieties
- The formal seed sector is reluctant to produce and market varieties of the major millets, pigeon pea and groundnut because they may not be commercially feasible. Even if it does produce such varieties, they may not reach small farmers in remote rural areas.
- The interest of the private sector may cease to be served once the varieties are sold to farmers because the latter tend to save their own seed for the next season and hence will not buy again.
- Prohibitive seed prices are a limitation for resource-poor farmers.
- Poor logistics in seed diffusion and high seed demand constrain formal seed programs.
- Formal seed systems are sensitive to natural disasters and political or other turmoil.

### **ii) Informal seed systems**

Village seed systems or farmers' seed systems or local seed systems are different names for the informal seed system, in which farmers procure seed by different methods and practices

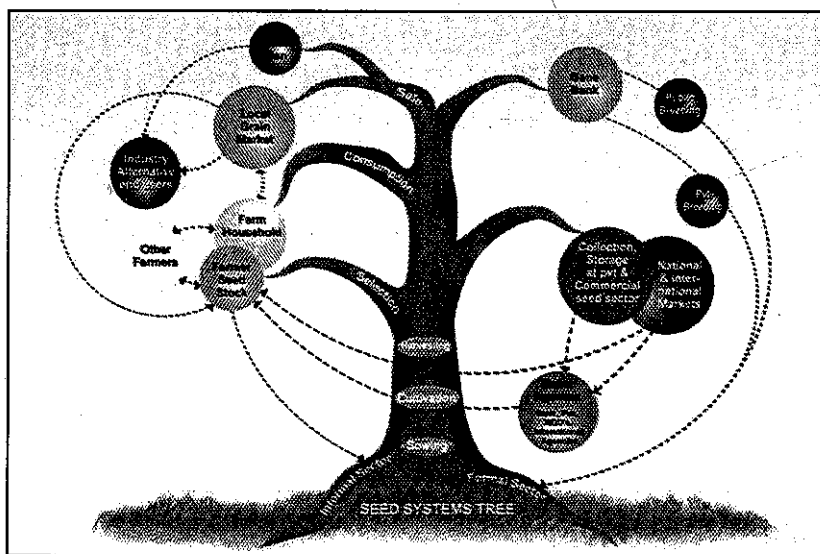
depending on the situation and location. In an informal seed system, farmers themselves produce, disseminate and access seed directly from their own harvest, through exchange and barter among friends, neighbours and relatives; and through local grain markets. Encompassing a wide range of variations, local systems are characterized by their flexibility. The varieties disseminated may be landraces or mixed races and may be heterogeneous. In addition, the seed is of variable quality in terms of purity and physical and physiological parameters. While some farmers treat seed specially, there is not always a distinction between seed and grain.

### Limitations of informal seed systems

- The seed quality is often suboptimal due to biotic stresses and storage problems.
- Seed exchange is limited to a geographical area and governed by cultural barriers
- Crop failures or low yields have a tremendous effect on the availability of seed and local prices.
- When a local seed system collapses, it is not easy to restore it in a short time. In such a situation, local varieties (land races) are easily lost and replaced by relief-supplied seeds.

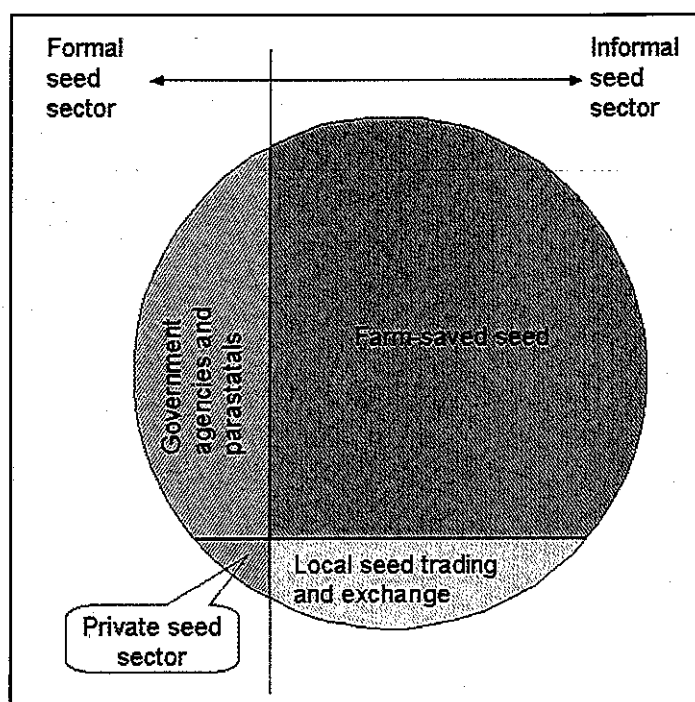
### Seed sources for informal and formal seed systems

In fact seed systems in dry land ecosystems are basically influenced by their pace of seed replacement, seed-to-grain price ratios, distance to seed sources and the quantity of seed traded by formal and informal means. The richness of materials grown at the household and community levels is in general positively affected by the quantities of seed sold by dealers and in local weekly open-air markets, as well as the rate of seed replacement. Distances to different seed sources also influence the diversity of crops and varieties in these communities. In the marginal environments, crop and variety use decisions, and the crop biodiversity levels that result, take place within the context of local seed markets and the national seed industry.



The Seed System tree

Usually, formal channels for seed transactions encompass traders in the district market yards, seed exchanges through private dealers and distributors, and seeds marketed by private companies, which are branded, the transactions are monetized, and those engaged in the business are usually full-time traders. In contrast, traders operating in weekly village markets are part-time traders and seeds traded here are not branded, since they originate from farmers from surrounding villages or communities. To some extent, the seeds are identified by their village name or, in some cases, for e.g. by the farmer's name (if the farmer is reputed in the locality for the quality of seeds). The seed exchanges are monetized but the prices are not based on 'the existing market prices', nor are they 'fixed' – they vary according to the demand and quality (physical purity) of the seeds. Seed dealers/distributors in the formal seed supply chain are a vital link between the formal seed producing firms and farming communities.



Traditional seed supply scenario in dry land ecosystems

### Challenges for seed sector in marginal environments

The major challenges the seed sector faces in the marginal environments of India are:

1. The extent and persistence of farm-saved seeds.
2. Variation in R&D investment across seasons, dry land crops; and
3. Seed sector regulations, in particular the enactment of recent plant variety protection and farmers' rights legislation in India.

The extent and continued use of farm-saved seeds in dry land crops, which constitute mainly the varieties, on the one hand discourages the entry of commercial sector in developing new

research products and also from the perspective of public sector to add any kind of incentives for their already existing research. Though farm-saved seeds promote the use of local or traditional varieties to some extent thus conserving the land races, over time it doesn't provide adequate choices to the farmers to diversify their portfolio and thus improving productivity. One of the most pressing concerns related to seed supply of modern varieties is how to establish sustainable seed provision systems for commodities that cannot be economically supplied through a centralized, formal seed industry. The seed supply bottleneck primarily affects self-pollinating crops seeds saved and sown year after year in the local systems.

### Indian Scenario

A robust seed system guarantees the sustainability of its agriculture to ensure that the products of modern plant breeding and local farmer ingenuity are widely available. National seed systems usually include several elements. A commercial seed sector is necessary to ensure efficient seed

Quality Seed Requirement & Gap in Demand

Crop	Seed Requirement (Lakh qtl.)	Seed Distributed (Lakh qtl.)	Gap (SRR: 25%)	Gap (SRR:33%)	Gap (SRR:100%)
<b>Cereals</b>	<b>735.32</b>	<b>147.43</b>	<b>36.40</b>	<b>97.68</b>	<b>587.89</b>
<b>Paddy</b>	323.79	58.18	22.77	49.75	265.61
<b>Wheat</b>	367.71	74.83	17.10	47.76	292.88
<b>Maize</b>	18.77	7.94	-3.25	-1.68	10.83
<b>Pearl Millet</b>	4.93	2.20	-0.97	-0.56	2.73
<b>Pulses</b>	<b>82.67</b>	<b>12.88</b>	<b>7.79</b>	<b>14.68</b>	<b>69.79</b>
<b>Oilseeds</b>	<b>142.07</b>	<b>39.49</b>	<b>-3.97</b>	<b>7.87</b>	<b>102.58</b>
<b>Sunflower</b>	1.12	0.80	-0.52	-0.43	0.32
<b>Repeseed/ Mustard</b>	3.81	1.63	-0.68	-0.36	2.18
<b>Groundnut</b>	64.02	15.90	0.10	5.44	48.12
<b>Soybean</b>	71.29	20.89	-3.07	2.87	50.40
<b>Fibres</b>	<b>60.83</b>	<b>2.55</b>	<b>12.66</b>	<b>17.73</b>	<b>58.28</b>
<b>Cotton</b>	3.65	2.27	-1.36	-1.05	1.38
<b>Jute</b>	57.17	0.28	14.01	18.78	56.89

Source: Harbir Singh & Ramesh Chand, 2011

supply. Both public and private seed systems are relatively well developed in India; hence the possibilities of delivering plant-breeding innovations to farmers are better. An unanswered question however is: how do resource-poor farmers react to a complex commercial seed provision system? Recent innovations in adaptive and participatory research go a long way in addressing the first concern, but much remains to be done regarding seed system diagnosis. Even in a relatively mature seed system such as the Indian one, the movement of information between farmers and seed providers leaves much room for improvement. Seed secure farmers tend to maintain their own varieties with limited influx of new varieties. In addition, awareness about variety selection is not always well developed in traditional farming communities. It may also reflect the fact that in traditional self-contained seed systems, the same genetic material may be easily available from neighbors, thus reducing the risk of seed procurement and accesses. The Farmers source seed off-farm from other farmers and often farmer communities identify certain individual farmers as reliable sources of good quality seed. The proportion of farming community involved as seed producers cum distributors is very small. Furthermore, it is often difficult to establish whether these local seed suppliers are making a conscious effort to produce high quality seed, or if they are simply well endowed farmers, they always have surplus grain to sell the grain as "seed" during the next planting season. Seed sources have been related to wealth status, with rich farmers maintaining their own seed stocks but poor farmers required to buy or borrow seed every year. Fodder is less susceptible to drought than grain production as some fodder can be harvested even in years when grain production fails. This undoubtedly influences the choice of crops and varieties and is well illustrated by the farmers in the project areas where our interventions took place.

### **Barriers to seed dissemination and socio-economic constraints**

Poor distribution of inputs and produce in a region results from poor infrastructure. Farmers have little access to seed of improved varieties. The key to overcoming this problem is to make available a range of modern varieties to farmers and train them on how to efficiently produce seeds of selected varieties, using modern technologies. In fact seed and product markets should target national and regional markets. More than 60% of farmers purchase seed from the market through cash and credit. Thus there is a need to link farmers to credit institutions. Information on seed supply and demand across has to be disseminated across countries. The approach is to maintain an inventory of variety traits, growing varieties with preferred traits for evaluation and selection by farmers, and producing breeder and foundation seed of newly released varieties and those in advanced stages of testing. These are some of the ways of establishing sustainable seed systems. Besides, organizing field days and variety demonstrations at the community level, monitoring the adoption of improved varieties, identifying constraints to broaden adoption, and developing a community-based seed production system form an integral part of the strategy. Despite the penetration of markets in the local economy, traditional coping strategies based on local processes of seed exchange are still important. Any successful developmental intervention

aimed at increasing the resilience of seed systems should take into account these traditional exchange practices. For example, a better strategy for improving local institutions and seed exchange networks could be aimed at increasing production and multiplication of seeds at the local level and facilitate movement of people between the two areas, rather than distributing seeds from outside to farmers. Development projects should be innovative and poverty-focused. It is crucial to reduce the poor man's vulnerability by increasing farmers' access to credit and other valuable production assets, which in turn are important for establishing and maintaining social relations that will help to evolve seed and food security in the long run.

**Informal seed systems: most suitable for dry land ecosystems**

The informal seed systems are the best, where the formal sector finds seed distribution difficult and farmers can't reach seed markets easily. They may also be appropriate in smaller, limited agro-ecological zones, where the formal seed market is disinterested or unable to cater because of limited markets for specific varieties or because widely marketed varieties may not suit that region or another important reason is an economic consideration, as profit margins are lower. They are also suitable in cases where the crops involved have a high seed rate and are bulky in nature for example, groundnut pod, which translates into higher transportation costs and low profits.



## **Sustaining viability of informal systems with Innovative seed delivery models**

The main purpose of alternative seed delivery system is to address the seed availability problems of smallholder farmers. In this chapter we discuss on the ways of strengthening seed systems that could potentially address the needs and counter the vulnerabilities of smallholder farmers in these areas using specific seed delivery models.

### **Introduction**

Most of the community-based seed production models/schemes are initiated because farmers are concerned about the non-availability of quality seed at planting time. Many farmers don't have access to improved varieties; and wouldn't be able to afford them even if they were. So introduction of alternative seed systems models must impact farmers' access to seeds of improved varieties at affordable cost. The quality of seed produced by community-based system or farmer seed systems is guaranteed only by its seller or village seed committee, because they are not processed and are uncertified seed. The seed so produced is low priced, and available at farmers' doorsteps at the right time, and provides access to all farmer groups in the village.

The regulatory and legal framework of national seed rules and regulations in many countries hampers the development of informal seed systems. National seed regulations are mostly based on international standards, which are often incompatible or irrelevant to the realities of farmers' seed systems. The restrictions imposed by national seed authorities on free exchange and marketing of seed, especially compulsory variety registration and seed certification, as practiced by many developed and developing countries are constraints on the efficient functioning of the formal seed sector and on the development of alternative seed systems (Annette von Lossau 2000). On the other hand regulatory frameworks are crucial for the development of a national seed system (Tripp 2003).

The major source of seed for small-scale farmers comes from their own on-farm savings, seed exchange, borrowings and local traders. Nevertheless, farmer's community systems of seed supply are under pressure due to recurring natural calamities such as drought, crop failure, storage problems and poverty. In the drought situations farmers depend on subsidized seed supply by government agencies, which meets only 30–40% seed requirement of smallholder farmers (Ravinder Reddy 2005). In order to strengthen the seed delivery system, interventions are required to strengthen informal seed supply systems, such as establishing village-based seed

banks as alternative seed systems for seed security. The alternate village based seed delivery models that may enable sustainability of community seed systems in the dry land ecosystems have following objectives:

1. To improve seed availability and access to improved varieties of seed to small and resource-poor farmers
2. Build capacity of stakeholders at the community level to enhance sustainable supply of good quality seed, and timely supply at affordable price.

### Alternate village based seed delivery models

#### Model 1 : Individual farmer as seed bank

This model (Figure 1) can be developed as a local seed system for different crops. Most effectively this seed system will benefit farmers for crops that require high seed rate, which are bulky in nature, or crops that involve high transport and package costs, for example groundnut pod. This model involves training a couple of farmers in each village in seed production technology and supporting them by supplying breeder seed and technology backstopping.

#### The pros and cons of the model

- This model can be tried even in remote areas where NGO are unwilling to take up operations.
- External finance is not required as all the costs are usually met by the farmer/seed producer.
- Effective and provides wider scope for dissemination and adoption of improved varieties through informal seed channels.
- Technical institutional services not justifiable for individual farmers.
- Farmers are still unwilling to save seed because of storage pests and other financial debts.
- Procurement of breeder seed is difficult at the farmer level once the project is completed.
- There is no control on the selling price of seed.
- There is no control on seed distribution to different communities in the village.
- Seed distribution is limited to select groups.

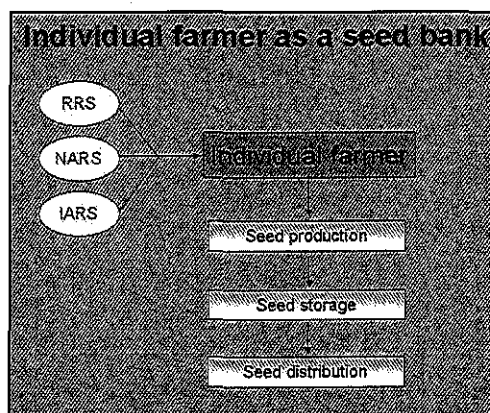


Figure 1. Model 1: Individual farmer as seed bank

## Model 2 : Village based seed banks

The concept of 'seed bank' (Figure 2), which advocates village self-sufficiency in production and distribution of quality seeds, is fast gaining ground. Seed villages or village seed banks operate with utmost transparency, mutual trust and social responsibility. Though this is not an entirely new concept, it is being promoted to reduce farmers' dependence on external inputs.

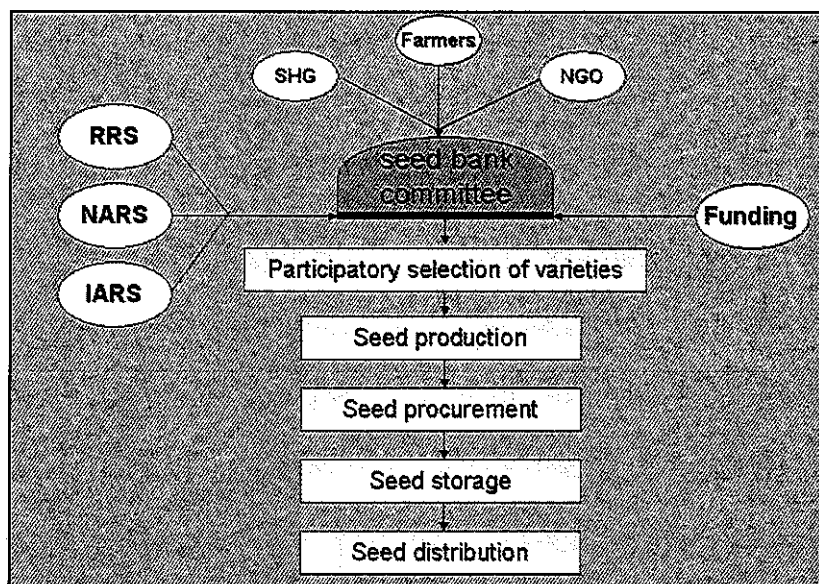


Figure 2. Model 2: Village based seed banks

### Advantages of village based seed banks

- Availability of improved varieties in sufficient quantity within the village
- Assured and timely supply of seed
- Decentralized seed production
- Availability of improved variety seed at a low price
- Improved seed delivery system to resource-poor farmers
- Reduced dependence on external seed sources and hence an effective measure to curb spurious seed trade
- Encourages village level trade and improves village economy
- Social responsibility of the seed production and delivery system
- A step ahead towards sustainable crop production
- Avoidance of diseases carried through seed (seed-borne pathogens) that have been produced and imported from different agro-ecoregions
- Scope for farmers' participatory varietal selection
- Availability of true-to-type varieties and healthy seed.

## Constraints

- Reluctance of farmers when it comes to adopting quality seed production practices
- Additional investment for inputs in seed production
- Lack of buy-back assurance to farmers from SHGs/NGOs
- Proper seed storage facilities and management in villages
- Lack of funds with SHGs/NGOs for seed procurement, packaging, storage and transportation
- Fixing of a minimum support price for seed procurement
- Technical support for seed production and its monitoring
- Responsibility of quality control aspects and monitoring of seed production
- Regular availability, accesses, and procurement of breeder seed for seed production
- Willingness of farmers to participate in seed bank activities

## Small-scale seed enterprises models

### Model 3 : SHG-mediated system

In this model, SHG is empowered to take up the task of seed production (figure 3.). Members, however, need to develop skills in planning and seed production techniques as well as support in terms of storage. Alternatively arrangements may be worked out with nearest market yard or state godowns to have the seed storage facility. The most critical aspect in this model is technical support and supply of breeder seed. Given the proper support, this model could provide significant benefits to farmers as it ensures the opportunity for all members and groups to share the profits of seed production. This model performs two tasks: meeting seed requirements of farmers as well as conserves a wide range of crop genetic diversity.

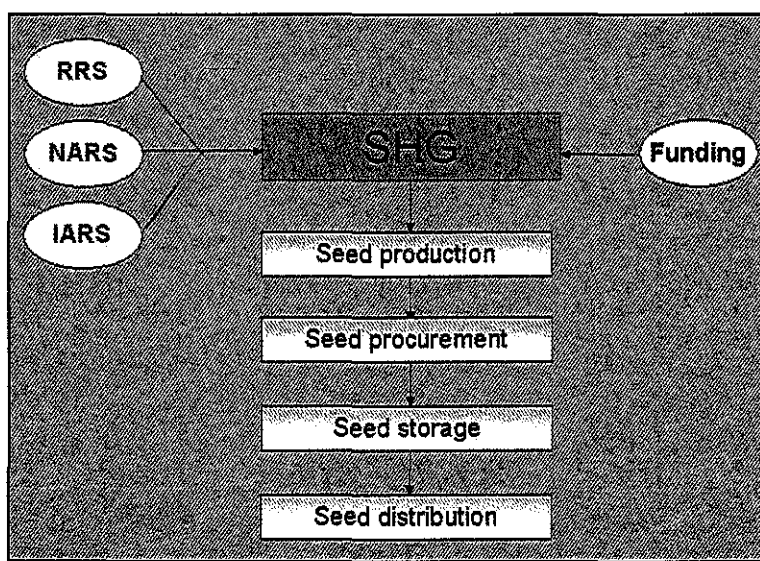


Figure 3. Model 3: SHG – mediated system

In most developing countries, the formal sector is far smaller than the informal seed sector. The latter is the major source of planting material for smallholder farmers, contributing 80–90% of the seed requirement of smallholder farmers (Monyo *et al.* 2003; Ravinder Reddy 2004b). Strategies to improve quality of seed, access and availability of improved varieties, multiplication and dissemination, availability of seed on time at affordable prices to resource-poor smallholder farmers can bring about changes in the food security in developing countries. Support from state/national governments, and international organizations or any other funding agencies should be targeted at improving the efficiency of these investments by strengthening technical capabilities of SHGs, NGOs, farmer cooperatives, CBO's, KVK's and schemes to improve or develop village based seed programs through seed multiplication, quality control and marketing activities.

#### ***Pros and cons***

- Improved availability and access to improved varieties by all groups of farmers.
- Minimum overheads.
- Seed is stored in the village.
- Seed available at reasonable price and at the right time.
- Control on fixing procurement and selling price of seed.
- Priority for farmers' preferred varieties.
- Need for institutional support for technical backstopping and supply of breeder seed.
- Fund for procurement of seed.

#### **Model 4: NGO-mediated system**

**Non-Governmental Organizations (NGOs):** In this model (figure 4), an NGO may be given the responsibility for a cluster of villages. These organizations select and engage farmers in seed production on a contract basis and preference is given to crops and varieties that are in demand in particular area. Basically NGOs are involved in mobilizing farmers/seed producers, planning seed multiplication, training, procuring, processing and marketing seed. Similar to other models, NGOs has to depend on other institutions for procuring foundation/basic seed stocks for multiplication.

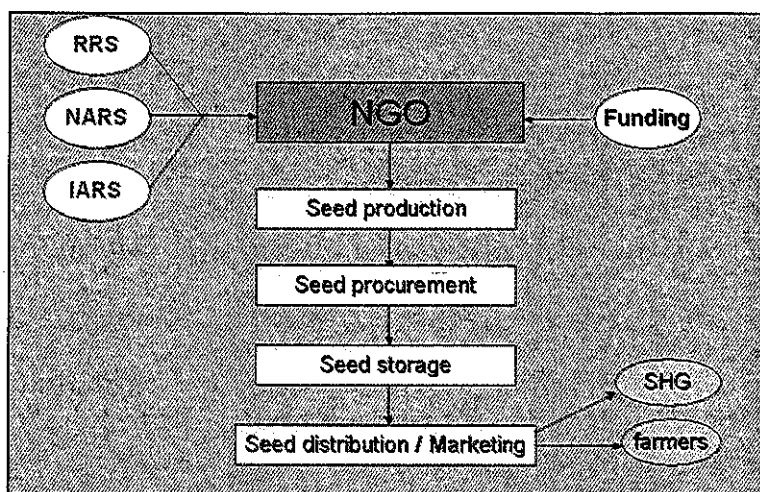


Figure 4. Model 4: NGO– mediated system

#### **Pros and cons**

- Operates in couple of villages.
- Seed production operations in couple of villages (3-5).
- Storage of seed within the village.
- Seed distribution within the operational areas.
- Selling price can be fixed by discussions with farmers.
- Improved seed availability and access for all groups of farmers.
- Minimum overhead costs.
- Need institutional support for technical backstopping and supply of breeder seed.
- Fund required for seed procurement

#### **Model 5: KVK-mediated system**

In this model (figure 5) KVK's are given the responsibility to implement the model.

#### **Pros and cons**

- Targets, large operational area (many villages).
- Centralized production; needs large storage place (such as godowns)
- Comparatively greater overhead costs
- Involves more than one crop and variety in production
- Less scope for farmers' participation and their choice of varieties
- More inclined towards commercial seed trade

- No scope for involving farmers in fixing procurement and selling prices
- Model needs infrastructure
- Usually KVKs has fairly good technical capabilities
- Generally institution funds are available to some extent.

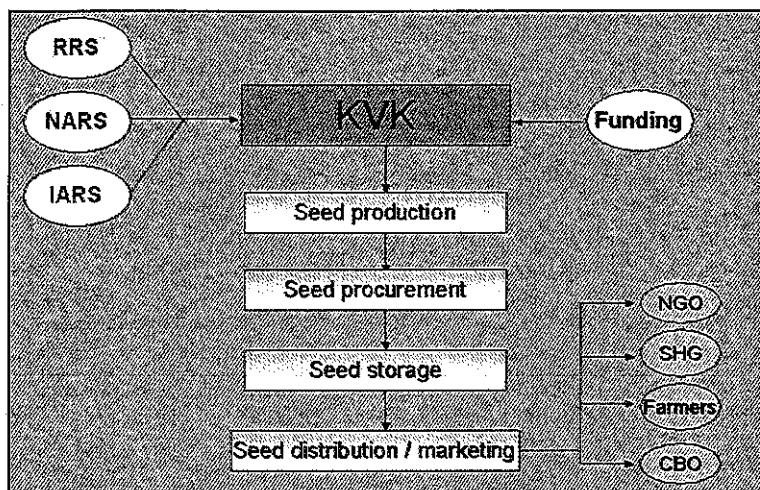


Figure 5. Model 5: KVK– mediated system

Each of five models tested can be harbingers of seed system sustainability upon implementation based on the environments and regions they operate. The comparative statement comparing all the five models across each component working towards seed system sustainability is given in Table 1.

**Table 1. Comparative chart of different seed systems models**

Components	Models				
	Model 1	Model 2	Model 3	Model 4	Model 5
Organization/community involved	Individual farmer	VBSB	SHG	NGO	KVK
Breeder seed source	Research institute or project scientist	Research institute or project scientist	Research institute or project scientist	Research institute or project scientist	Self or research institutions
Responsibility for transport of source seed	Research institute or project scientist	Research institute or project scientist	Research institute or project scientist	Research institute or project scientist	Self
Sourcing of other inputs	Farmer	Seed bank committee/farmers	Farmers	Farmers/NGO	Farmers/KVK
Choice of crop/variety	Farmers	Farmers	Farmers	NGO/farmer	KVK
Training in seed production	Project scientist(PS)	Farmers	Farmers	NGO	KVK
Seed production monitoring	Project scientist	PS, NGO, VSBC members	PS, SHG	PS, NGO.	PS, KVK
Seed quality assurance	Farmer	VSBC	SHG	NGO	KVK
Cleaning, packing and transportation	Farmer	Farmers	Farmers	NGO	KVK
Marketing	Farmer	VSBC	SHG	NGO	KVK
Fixing procurement and selling price	Farmer	VSBC	SHG	NGO	KVK
Funding for seed production	Farmer	Farmers	Farmers	Farmers/NGO	Farmers/KVK
Funding for seed procurement	Farmer	VO/SBC	VO, self	VO, self, other org.	Self, other org.
Sustainability issues	Technical support, supply of breeder seed	Technical support, supply of breeder seed, funding, takes over of role once project completed Incentives for farmers for maintaining quality.	Incentives for farmers for maintaining quality, technical support, breeder seed supply, funding for seed procurement	Farmer produce fetch low price because there is no external quality control, certification. Supply of breeder seed, funding	Marketing, cost of seed, selection of varieties, Incentives for farmers for maintaining seed quality, certification



## **Developing a Community based seed system**

For centuries, farmers all over the world have selected and saved seeds to grow in the next season. But the lack of basic knowledge on scientific seed production, quality control, and innovative interventions has resulted in inferior seed quality and resultant low yields. This chapter is synthesis of knowledge that needs to be imparted to community seed systems to produce, process, treat, test, store, trade, and barter and re-sow the seeds for food, feed, fodder and livelihood security. The mechanisms of training and creating seed growers associations to sustain further their seed growing activities are also detailed here.

### **Introduction**

Farmers have also cross-pollinated plants by hand, or by mixing varieties within the same field, to maintain and adapt their crops. As a result of this relationship between the farmer and plant, these locally adapted crops are able to withstand changing growing conditions. Some varieties may be resistant to certain pests, while others may be more tolerant of salinity or drought. Some varieties may be planted or harvested earlier or later in the season. In this way, farmers have been able to maintain a mix of crops suitably adapted to their own local needs.

Traditional crops are crops that have a long history in a region and are adapted to local conditions, especially in times of stress or hardship where resources like water and nutrients are a limitation. They also provide a wide range of nutrients to the diet. Some people may think that they do not have a wide variety of traditional crops or they may think that crops from other countries are better than their own. The seeds of traditional crops and the knowledge about their growth and use are important resources and should be conserved and used.

Farmer saved seed quality is always constrained by poor harvests, inadequate on farm storage facilities (Meena Kumari 2006), insufficient means to multiply quality seed, and poor seed distribution systems. There is thus a need to strengthen local capacity to produce, store and distribute seed of many crop varieties, including some landraces/farmers' varieties, that are useful for diverse and evolving farming systems.

### **Steps for strengthening community seed production, seed saving and storage**

- (a) Appropriate policies for seed production, and seed distribution, to help focus efforts of government supported initiatives on the varietal needs of resource poor farmers in particular, with attention, where necessary, on the needs of women farmers, and minor crops that are inadequately covered by the private sector.
- (b) Provide, and promote small-scale seed enterprises and strengthen linkages between gene banks, plant breeding organizations, seed producers, and small-scale seed production and

distribution enterprises;

- (d) Strengthen seed quality control schemes for small scale enterprises and provide appropriate incentives, credit schemes, etc., to facilitate the emergence of seed enterprises, paying attention to the needs of the small farming sector, of women and of vulnerable or marginalized groups;
- (c) Provide support and strengthen farmers' organizations in order that they can more effectively express demand for their seed requirements, paying particular attention to the needs of women and of vulnerable or marginalized groups;
- (d) Provide training and infrastructural support to farmers in seed technology, in order to improve the physical and genetic quality of farmer saved seed.
- (e) Develop approaches to support small-scale, farmer level seed distribution, learning from the experiences of community and small-scale seed enterprises already underway in some countries.
- (f) Seed Quality of Farm Processed Seed can be as good as and often better than Certified Seed if farmers takes the first step by selecting the right variety, controlling purity with good rotation, and follow standard agronomic practices' to achieve disease and weed control. They can choose a Mobile Seed Processor that can offer the equipment, management and expertise to achieve the standard you require.

#### **a. Seed Production**

- The plants grown from the seeds will have similar characteristics to the parent plants, unless the parent plants come from F<sub>1</sub> hybrid seeds. Seeds should be selected from strong and healthy plants to harvest and save.
- It is very important to remove unhealthy or diseased plants from the field as soon as they are seen. Also try to remove plants with undesirable characteristics from the field before they flower and pollinate other plants, but make sure that there is a diversity of characteristics in the field.
- If a farmer wants to develop or introduce specific characteristics in a plant, they can do this by controlling the pollination of plants for seed production. To combine desirable characteristics in plants, the farmer can transfer the pollen from a chosen individual plant to fertilize another chosen plant. For plants such as maize, which are usually wind pollinated, the farmer can shake the male flower over the female flower to transfer the pollen.
- If plants are being cross-pollinated for particular characteristics, the farmer must stop the flowers being pollinated by pollen from plants with other characteristics. This can be done by isolating the plants.
- Provide prescribed isolation for crops as prescribed.
- Seeds must be dried to prescribed levels before storing them to improve their storage life.

This is because moisture in the seed may encourage mould, bacteria or other pests and diseases affect seed viability.

- Seeds should not be dried too much or too rapidly as they may crack or lose their ability to germinate. They can be dried outside in the morning sun or partial-shade, but should not be left in strong sunlight.
- To dry seeds, spread them out thinly on paper, cloth, flat basket or plate in a warm place off the ground. They should not be dried on metal as this may become too hot. Turn them over several times a day to ensure that they dry evenly. When the seeds do not feel damp or stick together they are likely to be ready for storage.
- Any seeds that are immature, broken, diseased or infested with pests should be taken out. Stones, dirt and seeds from other plants should also be removed.
- Winnowing can remove smaller light contaminants such as dust, weed seeds and dry leaves. To winnow the seeds, place them in a large flat container and toss them into the air when there is a gentle wind, then catch them in the container. The light contaminants will be blown away by the wind.

#### **b. Seed Certification**

- To encourage decentralized seed production, the "truthfully labeled" designation could be used as an alternative to the existing system of centralized public certification. In this case, no field inspection is made, producers are wholly responsible for seed quality and are required to describe certain quality aspects on the label (Tripp and Van der Burg, 1997). However, under such a system there is a need to develop enforcement mechanisms that might operate by involving individuals (possibly extension agents) who have been trained by the public certification agency in field inspections for artisan quality seed, or by shifting the responsibility for quality control to an autonomous or local level public institution, including seed certification agencies. In both cases, producers should pay for field inspection services.

#### **c. Seed Storage**

- Seeds must be stored in a way that prevents them from being attacked by pests or diseases, and that maintains their quality. Some seeds can be stored for a long time without losing their germination rate, and others can only be stored for a few months. This depends on the type of seed, the moisture content of the seed and the storage conditions. Good storage conditions for seeds are: Low moisture, Low temperature, Low light, Protection against rodents, Protection against insect pests and diseases.
- High temperatures can encourage biological activity in the seeds and shorten their storage life, particularly if there is any moisture in the seeds. Bright light can also be damaging to stored seeds. Seed containers should be kept in a cool area and out of direct sunlight.
- To keep rodents such as rats and mice away from seeds, they should be stored in a clean hygienic area. The floor should be swept so there are no scraps of food that may attract

rodents. Seed containers should be well sealed and if possible kept off the ground so that rodents cannot get in. Sometimes seeds are stored in specially built huts that are raised off the ground.

- Storage weevils, fungi and bacteria can infest seeds when in storage and damage them. Only seeds that are free of pests should be stored. Weevils, fungi and bacteria start to multiply in warm and moist conditions. To prevent this from happening, the seeds should be kept dry and cool. Appropriate pesticides/substances may be mixed with the seeds to help prevent pests and diseases. Mixing the seeds with clean, dry sand and filling the container will prevent weevils moving around.
- The quality of the seeds affects how well they will store and their ability to germinate and grow well in the field. Testing the seed before storage ensures that only good quality seeds are stored. A germination test gives an idea of the proportion of plants that are likely to grow from a certain quantity of seed, and will show how many seeds must be sown in order to obtain the desired number of plants. Use between 10 and 100 seeds, depending on how many seeds there are.
- To test the germination rate, place the seeds some distance apart on a clean damp cloth or paper towel. For large seeds it is better to use sterilized soil. Soil can be sterilized by pouring boiling water over the soil to kill germs. The seeds should be placed somewhere warm, but out of direct sunlight. Keep the seeds damp, but not too wet, by sprinkling with water or covering with a clean damp cloth or paper towel.
- If none of the seeds have germinated it may be necessary to leave them for more time, keeping them warm and damp. If most of the seeds have germinated and have healthy looking roots and shoots, the rest of the seeds from that harvest should be viable and suitable for storage and planting. If less than half of the seeds have germinated, or if many of them are unhealthy, the rest of the seeds from that harvest are probably also unhealthy with low germination rate. The farmer may decide not to store these seeds. If seed is in short supply, these seeds may still be stored and planted, but a note should be made that they are not good quality seeds. It may be useful to test the quality of seeds before storage, and to test home saved seeds and seeds that have been bought or exchanged, before planting them.

#### **Developing a community seed program**

- The level of response from farmers to development initiatives varies from one place to another. While farmers do become self-reliant within a few seasons: some of the factors motivating them as seed growers include a good harvest and increased incomes from sale of seed. A poor harvest in the first season though can discourage farmers and lead to them giving up.
- A minimum of 5 years is required to develop a sustainable community seed program. The first three years should focus on capacity building; such as technical training in seed production, business skills, group dynamics, leadership and getting farmers to understand the seed

production process.

- The last two years should concentrate on exit strategies or final handing over of the management of seed production to the community. Some of the important activities during this last stage include taking farmers on an orientation visit to places such as research stations and gene-banks (for seed sources) and the State Seed Certification Agencies (SSSCA). This acquaints farmers with certification procedures and expenses. In addition seed producers should visit seed companies and other service providers (e.g. NGOs) as potential market outlets. A study visit to other more experienced seed growers associations would be of benefit to new seed growers.

### **Steps in developing a community seed system module**

A basic model for developing a community seed program detailed below is the principal model has universality in developing community seed systems in semi arid tropics. Even otherwise a model developed for a specific area/village/region may not yield the same result (Sreenath Dixit 2005) because variation in willingness of stakeholders, crops and varieties grown, climatic conditions, socio-economic and may be biotic factors.

#### **A. Reconnaissance survey**

After identifying areas of operation, the Non Governmental Organization (NGO) or Project Implementing Agency (PIA) should carry out Reconnaissance survey on Seed Needs Assessment (SNA) (Ravinder Reddy *et al.* 2006). This is done as a series of participatory dialogue to engage communities in the problem diagnosis on all matters relating to seed and to achieve the community's commitment to act and develop own solutions. The SNA will also identify knowledge gaps that can be corrected during training. Still more the SNA should assist communities in developing an action plan on what needs to be done, while remembering the role of the NGO is only to facilitate this process.

#### **B. Participatory selection of crops/varieties**

It is the role of the communities themselves to decide on the crops and varieties to be multiplied. There is a tendency for farmers to select only improved varieties at the expense of other important local varieties. Facilitators should check that this pattern does not persist. Farmers should be encouraged to select a good mix of crop types (crop diversity). Locally adapted varieties would be ideal in the first year. These tend to increase chances of success since farmers already have adequate experience growing them. The NGO should be pro-active in promoting farmers participatory selection of varieties/crops for a particular area/ region/village with desirable characters (Sreenath Dixit 2005).

#### **C. Selection of seed growers**

Once crops for multiplication have been identified through farmers participatory selection and agreed upon, then communities can select individuals who they feel should become their seed growers. Since food legumes are known to be conserved and multiplied mostly by women, it

is only appropriate and advantageous that seed production of such crops be done by them. To help farmers carefully select their local seed growers, the NGOs can help facilitate a process developing criteria for selecting seed growers. Some suggested criteria are:

- Should be resident of the village
- Should be a farmer with land holding
- Must be trustworthy
- Willing to attend training programs without fail
- He should be friendly in nature and approachable by others
- Inclination to put sincere efforts
- Must be willing to work in a team
- Experienced in growing one or more crops intended for multiplication
- Must be honest and willing to repay seed loans.

Having a set of criteria helps farmers to choose farmers correctly and reduces bias. Experience has shown that where an NGO decides to interpose and select farmer seed growers, others farmers have had to secure seed for them instead.

#### **D. Capacity building**

After seed growers have been identified, technical training should follow. The seed growers are trained in basic seed production techniques including rules and regulations including seed certification methods, seed health management, and seed storage management. Training is enhanced when followed by an educational tour to areas where similar programs exist. This is farmer-to-farmer learning. Farmers must be trained in business skills and some basic group dynamics and leadership.

As with all farmers training, the trainer should be conversant with principles of adult learning and facilitation skills. Training can be conducted by a competent extension officer so long as they fully understand the basic seed production standards and the seeds Act.

#### **E. Procurement of basic seed and distribution**

The NGO or farmers need to secure Basic Seed (foundation seed) for their seed production activities (Ravinder Reddy *et al.* 2006). Basic Seed can be difficult to secure. Therefore, start searching for a proper seed source much before start of season. However, where poor weather has affected the growing season, it would be advisable to provide seed for the following season. It is advisable to subcontract breeders recognized by government authorities or research organizations to produce Basic Seed in specified quantities as a means of ensuring seed supply for farmers. Contact arrangements may be worked out.

In the absence of Basic Seed, a seed grower can plant certified seed but only for one season. Thereafter farmers must secure Basic Seed for quality seed and long-term benefits.

## **F. Formation of seed growers association**

Some seed growers certainly prefer to work as individuals but in seed growing, the formation of an association has the following advantages:

- Registration is cheaper for a group than for individuals, or self help groups can take this activity right away without any registration.
- It is cost effective to work as a team when procuring Basic Seed and, selling seed: There is the benefit of bulk buying and selling
- Group contributions can be used for paying for activities such as crop inspections, seed sampling and testing
- During the early years of seed growing the team is important for providing mutual support, encouragement and a collective voice.
- However for farmers to work effectively as a group, needs assessment can determine whether they need to be trained in group dynamics, leadership, record keeping, conflict management and business skills.
- The seed grower association would be required, in the longer term, to mobilize funds to sustain their seed growing activities.

## **G. Seed marketing**

- The success of a community seed project lies in the ability of the seed growers to sell their seed. Some farmers have used field days, weekly village markets, village local market days, as a way of advertising available seed to fellow farmers. Others have used public meetings and ceremonies in their villages to sell the seed. Seed growers should be innovative in adopting ideas that are workable within their rural setup. Seed growers, however, should be careful not to price their seed beyond other local farmer's willingness to pay.
- Wherever possible help establish a credit scheme such as a revolving fund. This will enable community-based organizations to buy up seed from seed growers that will then generate new loans for resource poor farmers. Some farmers do loan seed to others farmers, to be repaid later in the form of grain, labour or livestock.
- After selling off their produce, farmers should be encouraged to save some of the income for purchasing new seed, and covering other overheads with the next growing season.
- Many development projects have used community-level seed production as the starting point for commercial seed development. Results have been disappointing with little commercial sustainability. Reasons for lack of success are twofold: inattentiveness to transaction costs (for making contracts for source seed, ensuring quality control, and obtaining information) and a lack of experience and resources for marketing. Community-level seed projects need more appropriate goals to be successful, such as testing and disseminating new varieties, developing farmers' experimentation capacities, and forming better links between farmers and researchers.

## The alternative integrated seed system model

The alternative seed system model envisages integration of formal and informal seed systems to achieve the objective of providing quality seed of self pollinated crop (improved varieties) at the right time and at reasonable prices to small-scale farmers. The model can be implemented in two steps.

### Step 1

This involves farmer-participatory selection of improved varieties (Fig. 1). Interested and resourceful farmers should be identified in the project villages to take up demonstration of improved varieties under the guidance of scientific staff enabled by consortium institutions.

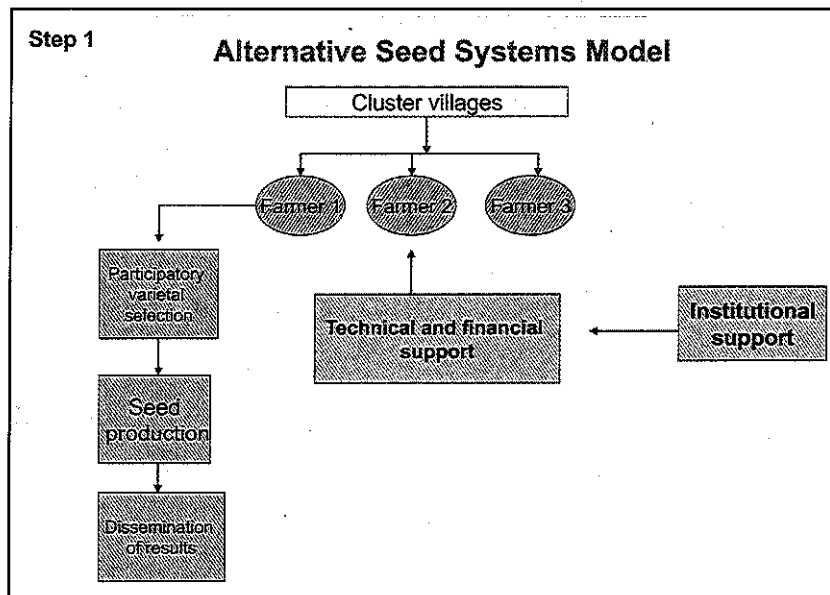


Figure 1. Step 1 for the alternative seed system model.

The assumptions for step 1 are: (i) Resourceful farmers are capable of imbibing technology faster – along with the capacity to absorb shocks, if any – than small-scale farmers; (ii) External finance is not required, and resourceful farmers can absorb expenses pertaining to seed production; (iii) Resourceful farmers can afford to take a risk in conducting the trials; (iv) The general tendency of small farmers is to follow examples set by big farmers and village leaders; and (v) The word of resourceful farmers on improved varieties and yields spreads easily in the village, and hence dissemination of results is faster and more effective.



## **Step 2**

The experience gained in Step 1 relating to the performance of improved varieties is discussed in village assemblies (grama sabhas). The activities to be carried out in Step 2 should be discussed in focus group meetings in all the nucleus villages. Seed produced in the previous season (Step 1) then be distributed to other interested farmers to grow in the next season on the principles of the village seed bank concept, (Step 2; Fig. 2). Village seed bank committees (VSBCs) should select seed growers (farmers) for the next season in the nucleus villages.

After the focus group meetings, stakeholders in the village belonging to VSBCs will be invited to invest in the VSBs as a micro seed enterprise for procuring seed produced in the village and storing it in the village seed bank for sale next season. This will help to derive two-pronged benefits to the communities in the form of dividend for the SHGs and good quality seed supply to farmers.

### **c) Sensitizing stakeholders**

The concept of village seed banks is to have discussion elaborately in grama sabhas to sensitize the stakeholders. Farmers need to be convinced about self funding for procurement of seed and storage of seed as it needs investment.

### **d) Formation of village seed bank committees**

The main function of these committees is to help reduce costs on seed production and delivery of seed and at the same time help farmers reduce their individual cost of production, processing and marketing.

Once they become self-reliant, the associations serve as useful mechanisms to broaden the outreach of development programs at little or no additional cost. They help build rural social capital by establishing self-help linkages and encouraging broad based collective action on village level seed enterprises. The following guidelines may be used for developing and strengthening seed bank committees:

- Make farmers understand the advantages of associations.
- Allow all sections of the farm community to join the project.
- Understand small farmers' strengths, potentials and weaknesses in procuring seed.
- Empower women farmers (SHGs) to join the association to increase their potential in organizing and investing in developing micro seed enterprises.
- Link farmers' associations to research institutions/organizations for procuring foundation seed for seed production.
- Build capacities of farmers in crop production, production of quality seed and scientific storage methods.

The concept of village seed banks (VSBs) when taken by enthusiasm by the self-help groups (SHGs), village organizations (VOs) and farmer groups, the proposal for constituting a village committee to manage the seed bank can be taken forward by the village sarpanch (village head) by conducting a grama sabha for electing the seed bank office-bearers and members. Presidents of SHGs become members of the village seed bank committees (VSBCs) with 30% representation

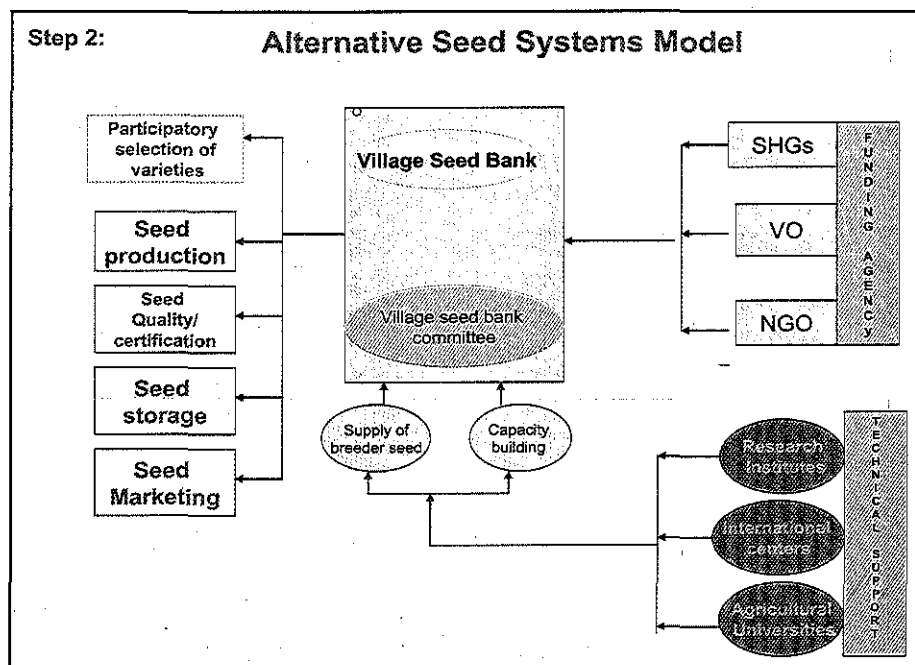


Figure 2. Flow diagram showing the organization of a village seed bank.

and participate in the selection of the other members and office-bearers. The committee members then need to be trained in various activities of cooperative societies (such as rules and regulations, book-keeping, accounts, audit, electing the executive body and tenure of the committee, etc). The roles and responsibilities of the VSBCs need to be charted out during the gram sabhas, like: (1) Selecting seed producers; (2) Procurement of seed from seed producers; (3) Selecting proper storage space in the village; (4) Fixing the procurement and selling prices of seed; and (5) Mobilizing funds by promoting memberships and investment in the VSBs. The VSBC can then pass a resolution to ensure the quality of seed and redistribution of procured seed to the village member farmers. Their responsibilities also include decisions regarding allocation of seed quantities to each farmer in the nucleus village and satellite villages in the cluster.

#### e) Farmer-participatory selection of varieties

To promote uptake of improved varieties having farmer-preferred characters and market traits, foundation seed of selected varieties could be procured from various research institutions (consortium partner institutions) and seed provided at subsidized rates to selected farmers to take up on-farm trials in comparison with their local varieties with the assistance of the village and cluster representative. These varieties need to be evaluated along with the local variety in

farmers' fields in the nucleus villages. Seed thus produced shall be shared with other interested farmers for sowing in the forthcoming season.

At the end of the season, VSBCs, VOs and the farmers need to be involved in the evaluation of the varieties based on yield, fodder value, tolerance to moisture stress and other varietal characters like tolerance to pests and diseases. These trials provide an opportunity for the selected farmers to evaluate the varieties under their management conditions and to make a selection using criteria determined on the basis of their preference for specific traits. Regular monitoring visits have to be undertaken to the trial sites during the cropping season and off-type plants have to be removed before harvest. Farmers will then observe different varietal characteristics (genetic and morphological) expressed by the varieties grown in their fields. On-field meetings need to be conducted at the end of the cropping season to document the traits preferred by the farmers.

Demonstrations, field visits and field days shall be used to provide extension advice and training in pre-harvest crop management to the collaborating farmers and the CBOs. Farmer-participatory selection of varieties shall then be conducted during farmers' field days where men and women farmers will be grouped separately and their preferences documented. The criteria used by the farmers for the selection of varieties based on a combination of the attributes should also be documented.

#### **f) Capacity building**

Imparting training to stakeholders is a part of each activity to strengthen farmers' capabilities to tackle the situation technically and manage through appropriate decisions. A number of training programs need to be conducted on improved production techniques such as method of sowing, sowing by seed cum fertilizer drill, intercultural operations, optimum plant population, spacing, seed storage technology, and IPM, etc in the project villages to enhance production. On-farm training programs also need to be organized for focus groups in the cluster villages during field visits. A lot of emphasis shall be given to educate farmers and develop awareness on improved method of cultivation. Young educated farmers be given printed technical information (bulletins, flyers and posters) on improved cultivation practices, seed production and certification, integrated pest and disease management (IPDM), grain storage methods and management.

#### **g) Institutional linkages**

The pre-project studies (baseline survey) need to be conducted to have overall dimension of productivity constraints related to

- Farmers' institutions
- Improved production technologies
- Access to improved-cultivar seeds
- Access to institutions

The interactions with farmers and the project team's previous experiences, will help us to decide whether farmers' associations are viable platforms to bring farmers together, build their capacities and enable them to gain access to resources, inputs (seed) and markets. This would directly help them in cutting uncertainty and transaction costs, and empower them to make choices relating to the feasibility, productivity and profitability of village-level seed enterprises. It would also help to pinpoint asymmetric access rules, and allow farmers to raise their voice and have it heard.

Evidently, improvement of farmers' livelihoods depends on the strength of their coming together. Access to resources is influenced by the extent to which farmers are organized and the institutional arrangements available, and finally the contextual social and political structure that prevails. Farmers' organizations, therefore, would have a vital role to play in rural change. Thus we shall have enabled system to help increase farmers' access to improved varieties and availability of seed and improved production technology that can improve farm productivity. This role was in the past held by agricultural extension services and research institutions. Now public spending on extension and research is shrinking, and institutional changes, such as privatization of farm services, have thrown it open to many new actors.

Rural communities are often heterogeneous in their technical demands – apart from the fact that many local decision-making systems are not well-organized, or are dominated by elites of the local area. Farmers' associations appear as an attractive approach for articulating such demands. Few areas that need to be identified encompass for immediate collaboration in developing a common understanding of the issues of seed availability and technology development for enhancing productivity as they relate to the needs of the rural poor. For instance, sharing of experiences between scientists and farmers, higher levels of coordination with various research institutes, NGOs, KVKs, for ongoing field operations and support for initiative-linked activity, focusing on the involvement of various institutions to interact with farmers' associations and linking them to development of farmers' learning platforms. Village seed bank committee members thus trained and linked with various institutions like Regional Agricultural Research Stations (RARS) and local NGOs for supply of breeder seed and technical backstopping. For procedural and legal advice on farmers' associations they can be linked with Cooperative Societies to ensure administrative sustainability.

#### **h) Funding**

To sustain the VSBs, regular inflow of finance is essential for procurement of seed from seed producers and storage in godowns till the next crop season and to meet interest on the capital raised. VSBs need to be strengthened in managing seed banks as a micro seed enterprise through investments from seed bank members, committee office-bearers, and SHGs. A micro seed enterprise business model can be developed (Fig. 3) to attract investors in the village, especially SHGs. These SHGs can get loans from scheduled banks at a low interest rate (0.25%) and they can invest in VSBs as a profitable venture. Apart from this, SHG members who are also

the members and office-bearers of seed bank committees are responsible for managing VSB activities by involving themselves from the beginning of the venture. This addresses the sustainability of VSBs by involving farmers in production, procurement, storage and distribution of seed. Variation in the procurement price and selling price of seed in the market has a wide gap because production, grading, transportation and storage take a major chunk of the selling price because of the bulkiness the seed that farmer produces. No private seed company may show interest in trading bulky seed, as profit margins are very low. Taking the advantage of this factor, seed production, grading and storing of seed within the village by farmers has a major sliding advantage in this model. Hence it may be profitable as a micro rural seed enterprise.

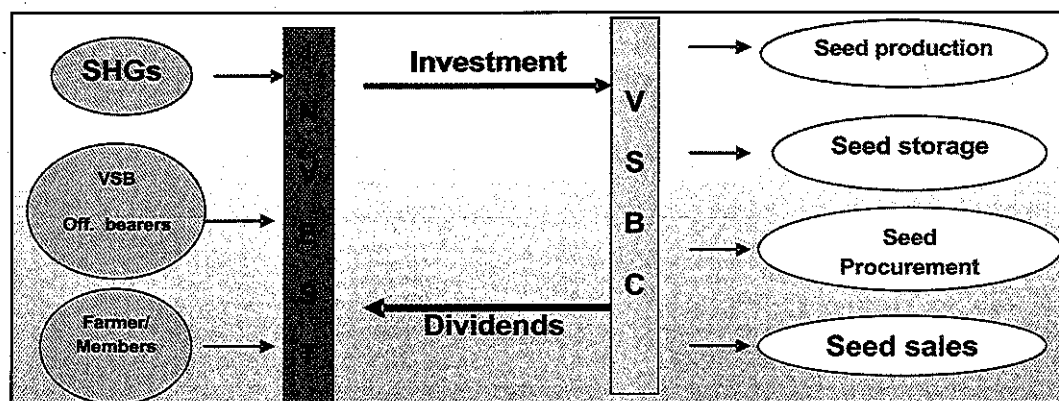


Figure 3. Fund flow diagram.

### Advantages of village seed banks

- Availability of seed of improved varieties in sufficient quantities within the village
- Assured and timely supply of seed material to farmers
- Decentralized seed production
- Availability of improved-variety seed at lower prices
- Improved seed delivery to resource-poor farmers
- Reduced dependence on external seed sources and effective curbs on spurious seed trade
- Good opportunity for SHGs to invest and develop a village seed enterprise
- Encourages village-level trade and improves village economy
- Social responsibility of seed production and delivery system
- A step toward sustainable crop production
- Avoid introduction of diseases carried through seed (seed-borne pathogens) produced and imported from other agroeco regions

- Scope for farmer-participatory varietal selection and feedback to the scientific community on the performance of cultivars
- Availability of true-to-type varieties and healthy seed within the reach of farmers at affordable prices
- The probability of sustainability is high because involving farmers from the beginning of VSB establishment, seed production, storage and marketing through their own investment and sharing the benefits

#### **Constraints of village seed banks**

- Willingness of farmers to adopt quality seed production practices
- Additional investment for inputs in seed production
- Buy-back assurance to farmers from FA/SHGs/NGOs
- Proper seed storage facilities and management at village level
- Availability of funds with FA/SHGs/NGOs for seed procurement, packing, storage and transportation
- Fixing minimum support price for seed procurement
- Technical support for seed production and its monitoring
- Responsibility of quality control aspects and monitoring of seed production
- Availability, access and procurement of breeder seed from research institutes for seed production at regular intervals

## **Need for a policy framework to build a viable local seed system**

The dryland agriculture in India encompass wide diversity of crops from cereals to coarse millets, minor millets, pulses, seeds, fiber and many underutilized crops cultivated subsistence farming, which are grown for self consumption. As the farm saved seed constitute bulk of the seed requirements in these areas, the cultivar and seed Replacement Rate (CRR and SRR) is extremely poor, and old obsolete varieties and land races still rule the roost among the farmers. Thus new varieties evolved by public and private institutions have not reached these areas. The formal sector either produce very little or none of the seeds and varieties preferred by the farmers in the dry regions. Private seed industry's domain is hybrids and high value crops that provide higher profits to them, since seeds of these preferred crop varieties are seldom produced by them, as the poor purchasing power of the growers does not attract them either. Hence choice of the local varieties preferred by the farmers are seldom available. The main reasons that limit the supply of quality seeds in dryland ecosystems (Anonymous, 2011) are:

- Smaller holdings, subsistence nature, low external input use and poor investments are the key issues restricting the seed production program;
- Area restrictions imposed by the seed certification agencies and the seed production organizations do not permit the small holders to get into the seed production program;
- Seed quality assurance other than official certification standards are not in vogue, truthfully labeled seeds are not encouraged;
- These areas frequently suffer drought or some other natural vagaries which de-motivates growers, seed production agencies are averse to entering such high risk areas and normally prefer to work on the peripheries where they find better production conditions;
- Contingencies in the traditional farming systems and the cropping systems were not just to maintain the extra buffer stock, but the contingent crops, varieties besides the contingent extra buffer stock;
- Therefore, there is a need for good contingency plan to ensure seed of various crops for different sowing situation and should ensure the availability of same for the next year;
- Subsidies are only allowed on the larger formal recommendation domain, new and notified varieties, released by the government either state or central - hence most of the farmer preferred varieties remain out of the realm of the subsidies;

Traditional/community system of addressing contingency situation is fast disappearing. Community participation in Government system of contingency planning and its implementation is missing. According to Proceedings and recommendations of the workshop on “Evolving an Alternative Paradigm for Seeds Systems for Rainfed Agriculture: Revitalizing Rainfed Agriculture (RRA) network”, held between 27<sup>th</sup> – 28<sup>th</sup>, January 2011, at ICECD Campus, Ahmedabad, organized by Satvik : Promoting Ecological Farming, Bhuj - Kutch (Gujarat) the issues that need to be addressed by the policy makers are:

- How rainfed farmers are presently handling contingency situation?
- In the absence of appropriate system of handling contingency situation, what kind of loss farmers are facing?
- What improvement in existing system is required?
- What should be the scale of contingency plan – community or state? or upto certain scale activity can be handled by Community and after that State may have active role?
- Who will help community to evolve and implement appropriate contingency plan and required preparations?
- How community itself can ensure the seed material for contingency situation?
- Who will produce seed? Who will store it? What about viability of seed?
- What roles can the organized private and public sector systems can play? The general situation today is that seeds are being produced from various sources including – farmers / ICAR / SAUs / KVKs / State government / Private industry and to a certain extent by NGOs – SHGs or CBOs or institutions set up by them. One of the most critical gaps that is being felt is that how we are going to address needs of a large variety of varied eco systems that are not being addressed – especially those that may be considered as harsh or less fertile areas?

#### **The Role NARS has to play in strengthening the community seed systems**

1. There should be survey of each agro ecosystem to develop a detailed report and atlas of available seeds on one hand and on the other hand an assessment of the seed and varietal requirements from each area need to be compiled.
2. The ICAR / SAU system produces satisfactory source material in the form of breeder seeds, but the outreach and extension programmes are non-existent or very weak. There is no real participation of farmers in the selection of varieties that are taken up for production and correction is needed at this level.
3. The current system of seed production is heavily weighed in favour of hybrid seeds. There needs to be a definite shift of emphasis so that our traditional varieties are produced without mis-matches.



4. The informal seed system which still caters to a large section of local needs, needs to be recognized by the policy makers with active intervention and support to provide access and availability of local and traditional varieties through multiplication and distribution to have better seed replacement rate.
5. The research must also actively consider and include the extant local varieties, the role that can be played by them and how they can be improved.
6. Specifically in the case of cotton it was mentioned that there is an alarming decline in the indigenous varieties that are cultivated and even those that have to be cultivated as a legal requirement accompanying GM crops is not being met. There is a need to specifically nurture and encourage indigenous varieties.
7. It is to be noted that there is nothing in the policy framework that is actually stopping anyone from taking up work on community seed systems. However, it is also a fact that these are not considered and recognized as fashionable / hot favorite areas to work on, as a result this kind of work does not lead to publications and recognition by way of promotions.

#### **The role of the state and the central agencies**

The ICAR - Agricultural Universities – KVK system has the responsibility to select the seeds and produce them at the level of nucleus and breeder seeds. After this, the responsibility of large-scale multiplication, production and distribution at farmer's level rests with the state government. The systemic flaws at the level of the basic seed at ICAR – SAU – KVK needs to be improved with the involvement of farmers to meet the varietal requirement.

#### **The role of Public Private Partnership in local seed availability**

There is a greater need to usher in public private partnership to strengthen the community seed systems through popularization of farmer bred varieties through seed savers groups. There is a need of having community varietal testing plots, multiplication and promotion through seed banks in collaboration with research and development institutions. In fact network of community seed banks, documentation on seeds, participatory plant breeding, varietal production and marketing through seed co-operatives, convergence with research and development organizations with establishment of cluster level seed banks through federation of SHGs in the management aspects with research and development organizations will go a long way in making available the choicest of the varieties to the communities in dry areas. In fact linking them with credit organizations for financial needs in the initial stage and with certification agencies and NARS for quality control will help in assuring access to quality seeds.

#### **Identification of the components for village-based or community seed production systems**

- Some major factors to be taken into consideration when developing village-based seed banks system for use by smallholders include issues such as need assessment, policy issues, market issues, appropriate technology required, seed system studies, inputs, capacity building and funding.

- Plant breeding stands at the head of a long series of steps in seed provision. In order for the products of plant breeding to be delivered to farmers there must be: (i) adequate, direct interaction between plant breeders and farmers and (ii) careful attention to the co-ordination of all of the intermediate steps of seed provision.
- The nature of seed demanded by farmers differs. Large and medium-scale farmers use markets to purchase uniform genetic materials that are highly responsive to chemical inputs and embody specific characteristics (eg, color and uniformity of grain size) rewarded by the market. By contrast, more subsistence-oriented smallholders may value characteristics such as drought tolerance, early maturity or good storage characteristics more than fertilizer responsiveness. Because of the small size of their landholdings, mixed cropping practices, and strategy of minimizing production risks by diversifying the variety base, smallholders also demand relatively small quantities of seed, but for a number of varieties of the same crop, and recycle seed over more seasons than large commercial farmers.
- Strategies to improve seed quality must begin with strengthening the public agricultural R&D sector on a long-term, sustainable basis. It will be especially important to build the capacity to move from homogeneous seed recommendations to the development and dissemination of varieties targeted to specific agro-ecological zones and the needs of different groups of farmers. To facilitate this process, target groups of farmers should be defined more precisely, zoning of breeding plots and field trials can be improved, and management incentive systems should be developed to reward researchers and extension agents when new technology is adopted by target groups.
- Strengthening public and private extension programs to increase farmer knowledge about the benefits of using new seed and transmitting information about farmer preferences to researchers will also help increase the demand for new seed. Initiatives that improve postharvest product utilization expand output markets, and lower production risks are also important: seed users will be willing to pay more for new seed if their expected returns from planting the seed are increased by either lowering risks or increasing their revenues. Thus, measures to strengthen the downstream sectors of the economy are as important as strengthening the seed system itself.
- Farmers need to be better integrated in every aspect of the seed system:
  - ◆ As active participants in seed research and release processes,
  - ◆ As vital links in seed production and distribution through farmer-to-farmer seed exchange networks,
  - ◆ As independent seed entrepreneurs producing seed for the local market, and
  - ◆ As contract seed producers and informed agents/seed traders linked with other private and public seed companies.

- The government now has a critical but different role to play in:
  - ◆ Providing public goods that promote efficient seed sector performance
  - ◆ Developing and enforcing regulations for a heterogeneous seed sector
  - ◆ In the short- and medium-term, facilitating linkages between formal and informal sector seed suppliers as the seed system matures; and
  - ◆ Direct distribution of seed or seed vouchers following disasters.
- Public research and extension agencies also need to consider how farmers who may be unable to purchase seed through the market but could benefit significantly from access to varieties with improved drought and disease resistance. For crops/regions where there is currently no commercial seed market, disseminating seed directly to farmers so that they are absorbed into the traditional system of seed supply may be a more effective strategy than trying to supply it through the higher-cost market channels, if potential users are unlikely to be able to afford them.
- More recently, NGOs have also played a role in strengthening the informal seed system, providing a technical liaison with national and international research systems, educating farmers on better seed selection, storage and processing, and providing technical and financial assistance to rural seed enterprises. This support has increased farmer access to improved varieties following the contraction of government-sponsored research and seed supply services. Two cautions are necessary, however. First, because NGO programs are temporary, instead of relying on them to link smallholders and research organizations, creating incentives and funding for research and extension systems to link with smallholder organizations directly would be better. Second, a more careful analysis of the economics and sustainability of the smallholder seed firms being promoted by NGOs are needed.
- Farmers irrespective of landholding have draught and milch animals. Awareness about breeds and fodder is quite satisfactory due to presence of milk co-operative societies. Small- and medium-scale farmers prefer local varieties for food and feed. As there is a need for creating awareness and capacity building with regard to improved varieties of food-feed crops such as sorghum, pigeonpea and other forage crops (stylo, para grass and napier grass). Large- and medium-scale farmers are aware of maize hybrids and their cultivation practices. Farmers are tending towards cultivation of maize hybrids, because of high returns per unit area. Sorghum and pigeonpea crops are sown with own-saved seed by a majority of farmers across all groups. Some farmers are using F<sub>2</sub> generation (own-saved seed) maize hybrids with 20–30% less yield.
- The commercial demand and cultivation of fodder/forage crops in many watershed villages is weak because of a poorly developed livestock sector in which animals are kept mainly on subsistence. The demand for fodder/forage seed will depend on the development of the

livestock sector in that particular village and value added industry to livestock products. However, if the livestock sector develops, particularly in terms of value added industries, it is expected that demand for intensive fodder cultivation will increase. This will translate into a “derived demand” for seed, in order to meet the fodder crop requirements. The concept of “derived demand” is useful, as it helps to explain (1) the interrelationships between livestock development, fodder promotion and seed production; and (2) how these factors could be used as integral components of policies supporting livestock.

### **Strengthening stakeholders of community seed systems**

Specifically rural community seed programs should be provided with technical backstopping by international, national and or state research institutes to strengthen the stakeholders, and render them self-sufficient. Measures could include:

- Farmers' participatory evaluation of genotypes suitable for a particular agro-eco-region.
- Maintenance of farmer-preferred varieties (landraces) currently being grown, as well as modern selected genotypes.
- Capacity building of stakeholders in seed production technologies, seed health and storage management and in general, integrated pest and disease management strategies.
- Creating awareness of improved agricultural practices and information on improved seed material suitable for their agro-ecological region is important to bring about greater food security.
- Training farmers in better selection, treatment and storage practices of seed produced from their own farms, as 80% of seed used by smallholder farmers comes from their own-saved seed or local seed systems in developing countries. Training would help increase production through better use of own genetic resources, indirectly conserving crop biodiversity in the region.
- Training farmers in seed health management and seed storage methods, which is important to preserve the viability of seed until the next season. Seed-borne microorganisms and storage insects can make seed unproductive during storage – a major problem that smallholder farmers face. This is even more pronounced in leguminous seed and control is particularly difficult.
- Training in selection and timely harvesting of a crop as well as postharvest precautions essential for good harvests.
- Making varieties developed by national, international and state research centers available to smallholder farmers. These modern varieties must be multiplied and disseminated through formal and informal seed delivery channels at affordable prices. Several strategies were implemented by ICRISAT and partners in Tanzania (Rohrbach *et al.* 2002) and in Zimbabwe (Monyo *et al.* 2003).

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- Ensuring that village seed committee members undertake the responsibility of producing quality seed. Low costs of seed can be maintained only if locally produced seed stays unprocessed and uncertified. The statutory standards of commercial seed are too expensive for the informal sector. Evolving a policy to certify village/community-based seed production without taxing smallholder farmers, would offer greater scope for production of quality seed to improve the informal system.

### **Interventions required for developing informal seed systems**

In order to ensure that quality seeds of preferred varieties are accessible to poor resources farmers, a systematic pathway combining a set of activities starting from the identification of preferred genotypes to variety demand stimulation and seed accessibility must be established from the beginning. It is very clear the crop breeding pattern and the seed system arrangement have influence on the availability and seed accessibility to farmers mostly the poor and marginalized. Therefore imposing a generic formal seed or private sector led seed systems may not be the best solution (Zerbe; 2001). In order to accelerate the use of improved varieties, some major steps are important and required:

- Farmer-to-farmer seed exchange and local seed markets function throughout the dry regions but are not adequately linked into systems for improved seed. Locally operating institutions such as NGOs, extension services, KVKs, social organizations, farmers' associations, could play an important role in improving farmers' access to quality seed. If given an appropriate enabling legal framework, such organizations could help link farmers to other seed producers, research institutions and importantly small commercial seed companies working in similar agro-ecosystems locally and regionally.
- Traditional seed systems do not fully cater to current farmer needs. Even traditional crops and varieties benefit from maintenance of source quality seed (with varietal purity and seed health). For improved or national varieties, links between farmer seed producers and sources of foundation seed are important. Even more critical are linkages that allow seed producers access to new varieties, which is not available in the informal sector.
- Farmer seed producers can be efficient and at least some have the potential to expand as specialized, small or medium sized local seed enterprises. Farmer associations, SHGs, NGOs, KVKs and social organizations have a potential role in promoting improvement in production, marketing and distribution systems for traditional farmer seed producers. This may involve linkages between research organizations for technical backstopping and the formal seed

sector for improved varieties. For these interventions to be sustainable, they must be based on training and market development and not on direct government subsidies.

- Sustainable, competitive seed systems require substantial re-orientation of government policies and programs involving seed distribution. Rather than attempting to directly supply seed to farmers, government programs will need to provide support services that allow development of formal and informal seed enterprises to respond to market demand for seed. This essentially seeks to offer farmers a great range of choice in terms of varieties and source of seed. Indirect subsidies may still be important for competitiveness among enterprises.
- Government programs may focus on the development of informal seed sector linking NGOs, KVKs and farmer seed producers to sources of improved foundation seed and helping to expand marketing systems for farmer-produced seed. Programs will need to be vigilant in eliminating subsidized seed distribution that restricts development of sustainable local seed sector. Key to success in strengthening informal seed systems will be improving farmer and seed producer access to information on product and seed prices and market options.
- Development of alternative seed systems is eminent. The formal seed sector has shown little or no interest in seed multiplication for crops with high seeding rate and low multiplication rates. Transportation, processing, bagging, and certification costs make the seed expensive for the farmers to buy. Community-based or village-based seed production and distribution schemes may have impact on small holder livelihoods. Including local crops in the PDS – may have a positive chain reaction;
- Develop separate and more localized and diversified seed standards, alternate seed certification like Growers Group Certification (GGC) with Internal Control System, Participatory Guarantee System (similar to the organic certification)
- Create local professionals and pool of local human resources, create better infrastructure and logistical support, Special attention to micro – stock – hypothecation, to remunerate for seed stock retention period;
- Economy of scale and proliferation of activities as farmer collectives, create, nurture the viable institutions;
- Pushing National Food Security Mission (NFSM), Rashtriya Krishi Vigyan Yojana (RKVY), Agriculture Technology Management Agency (ATMA), National Rainfed Area Authority (NRAA) to include rainfed seed systems development in their programmatic intervention, repackage “Seed Village Concept” of NSC and GOI;
- Set research and development priorities with farmers and other stakeholders, and engage farmers and traders in the varietal testing system and their conditions
- Avail regularly foundation seeds of preferred varieties to both formal and local seed production;

- Engage farmers, farmers' organizations, extension services and development organization in the intervention so that early information and awareness about promising genotypes is raised and demand is stimulated for effective scaling up
- The farmers' seed producer organizations need to be incorporated in the rainfed areas, the poor and small – marginal farmers may become the shareholders. These organizations should be encouraged to produce the seeds of the farmer preferred crops, varieties;
- Bench marking the SRR for farmer preferred crops should be undertaken.
- Develop partnership with other services providers include traders and development partners so that various seed related activities are shared among partners
- Encourage complementarity among formal and informal seed sector and more importantly sharing of seeds horizontally (farmer-to-farmer)
- In order to improve the quantity produced to meet the demand and increase local stock of the varieties, other yield enhancing technologies are also required, therefore the interventions should go beyond the seed aspects and other non seed technologies (agronomic practices);
- In local decentralized seed systems, the grain/seed merchants are key stakeholders in the seed dissemination and outlets for seed producers, thus their engagement and linkages to seed producers will pay a great dividend. Facilitating linkages between farmers and a range of other actors providing seed systems-related services is another tool to improving seed system effectiveness.

## **Conclusion**

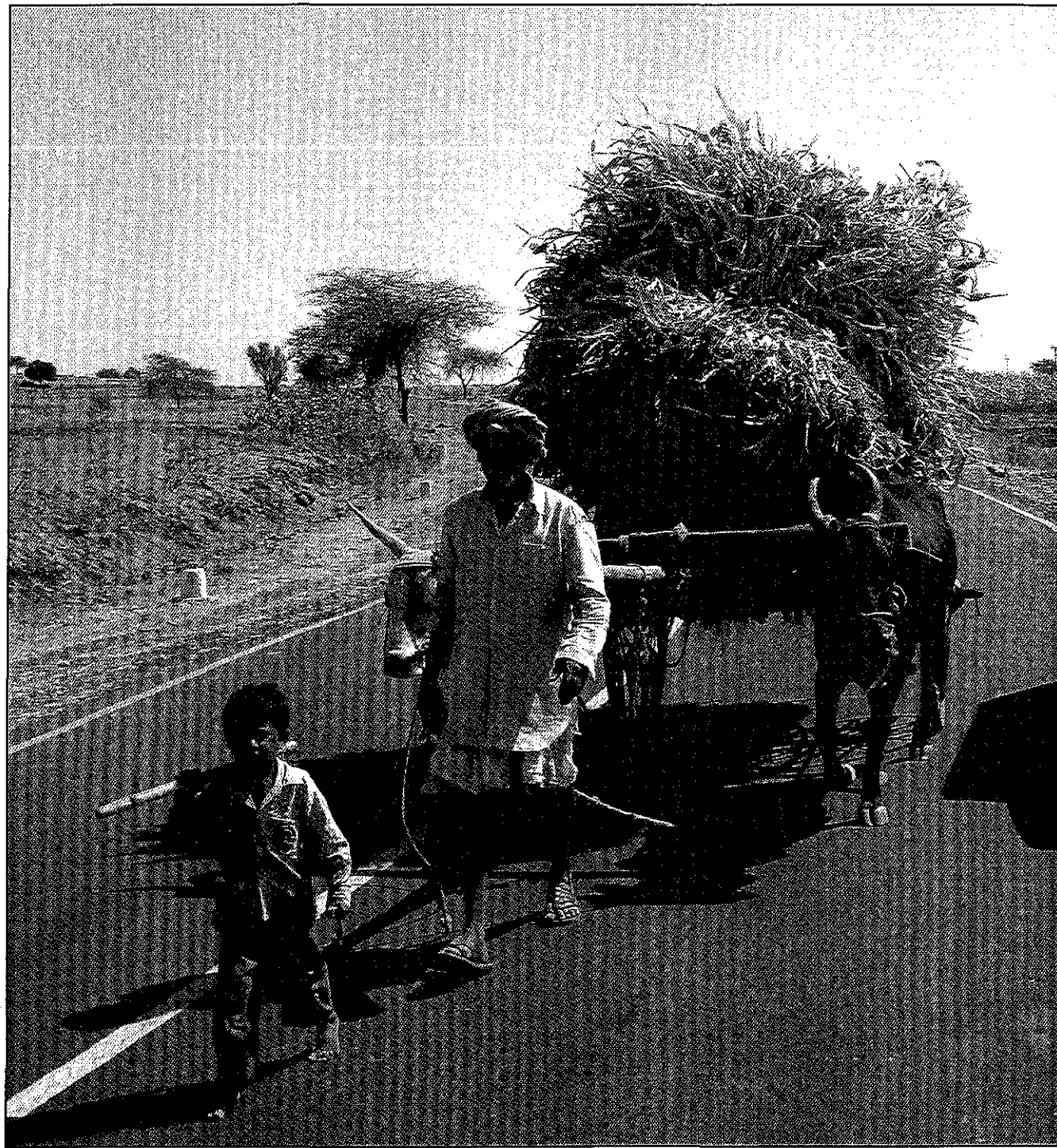
An effective means of improved seed distribution is farmer-to-farmer seed exchange. This may be primed to a limited extent by the supplies of improved seed from public agencies, agricultural research stations and non-governmental organizations to farmers in easily accessible villages. However, such a system is very slow. To speed up the flow of seed of adapted, acceptable, improved varieties to farmers, there is a need to form a network between research institutes, agencies involved in quality control and various non-governmental organizations, community-based organizations (SHGs, farmer schools, farmer youth clubs, farmer associations) interested in various aspects of seed production and utilization. For high volume low value crops, the basic farmer demand is for quality seed of improved varieties. The most economical way would be to produce seed at the village level through community-based seed systems and sell it to local communities without incurring the extra costs of processing and certification. Village-based seed banks provide an alternative solution to this problem and help farmers become self-reliant. This initiative needs organized communities, institutional technical backstopping and continued interaction between various institutions, policymakers and stakeholders to strengthen local seed systems to enhance seed productivity in the dry lands. Therefore, VSB is an efficient and sustainable model that can be out scaled to other crops and other areas.

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**DIRECTORATE OF SEED RESEARCH**

(Indian Council of Agricultural Research)

Post Bag No. 11, Village: Kushmaur

PO: Kaithauli, Mau 275101 (UP), INDIA

E mail: pd\_dsr2005@yahoo.co.in Website: <http://www.dsr.org.in>