

# **SOUVENIR**

**XII National Seed Seminar**  
on  
**"Prosperity Through Quality Seed"**  
24th - 26th February, 2006



**Indian Society of Seed Technology**  
New Delhi



**Acharya N.G. Ranga Agricultural University**  
Rajendranagar, Hyderabad

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# INNOVATIVE SEED SYSTEMS AND SEED DELIVERY MODELS FOR FOOD-FEED-FODDER SECURITY IN SEMI-ARID TROPICS OF ANDHRA PRADESH

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## Summary

Seed is the most important input component for productive agriculture. A well-functioning seed system is defined as one that uses the appropriate combination of formal, informal, market and non-market channels to efficiently meet farmers' demand for quality seeds. The fact that a bulk of rural livelihoods are drawn from crop-livestock sector and that crop residues are the main stay for animal feeding reflect the importance of crop agriculture not only from food production point of view but poverty reduction as well. A majority of livestock kept by rural households is well integrated into the prevailing crop systems. In low rainfall dry land agriculture areas, food feed cereal, millet and legume crops are the main sources of income and food for farmers besides fodder for their animals. Farmers' demand for seeds, particularly those of poor farmers therefore depend on multiple criteria. Given the critical role that improved varieties play in increasing the conventional crop production, a key question is how to facilitate the development of an integrated seed system that is capable of generating, producing and distributing improved seed varieties that meet the needs of resource and resource-poor farmers in a cost-effective way. The study is an attempt to review and document the existing seed multiplication and delivery systems in four dry land agriculture districts of Andhra Pradesh namely Anantapur, Kurnool, Mahbubnagar and Nalgonda, representing typical characteristics of semiarid tropics in India. Analyzing the problems associated with different seed systems in the Districts, the paper makes a case for alternative seed systems that address the needs and vulnerabilities of small farmers.

## Introduction

Every country needs a robust seed system to guarantee the sustainability of its agriculture and to ensure that the products of modern plant breeding and local farmer ingenuity are widely available. Agriculture in India is over 5000 years old. Farmers have been breeding, selecting and collecting enough seeds all along to meet their requirement. The very survival of Indian agriculture for centuries is a testimony to the sound wisdom on seed production and storage the agrarian community has been nurturing over time.

About 70 percent of rural households keep cattle, which are well integrated into the cropping system. Mixed crop-livestock systems support majority of livelihoods in the countryside. Farmers requirement of seeds depend on the agro ecological features of the area they live in and the accessibility or otherwise for supplementary water for irrigation. Generally better-off farmers go by the sale value of the grain and resort to cropping systems accordingly. However, the poor farmers and other small producers give weightage to the



straw yields and quality of straw from the grain crops. Diversifying resource base through crop livestock systems spread the risk for small farmers on the one hand and gives an opportunity to utilize their family based resources more efficiently on the other. Also the mixed cropping, inter cropping practices of farmers dictate the type of cultivars and the level of biodiversity to be maintained and supported through seed production systems. The complexity and vulnerability of small farmer/poor farmer systems demand seed production and delivery systems that are consistent with their needs and demands. More than 80% of crops in developing countries are sown from seed stocks selected and saved by farmers (Delouche, 1982; Osborne and Faye, 1991; Jaffe and Srivastava, 1992; Almekinders et al., 1994). These systems have been variously called a farmer-managed seed system (Bal and Douglas, 1992); Informal seed system (Cromwell, 1992), traditional seed system (Linnemann and de Bruijn, 1987) and local seed system (Almekinders et al., 1994).

The past four decades have witnessed some drastic changes in ways farmers manage their seed requirement. The decentralized seed production and distribution system practiced over centuries has seen major reversal in terms of production and supply. With the advent of hybrid technology, the farmers require to replenish their seeds every season from external sources (such as public sector research institutions and private seed producers) to harness the hybrid vigor. This has, no doubt, helped increase the production manifold. At the same time, it has also increased farmers' dependence on external agencies. As a result, the once informal and decentralized village seed industry has attained a highly centralized status. It is almost impossible for the organized seed sector to meet farmers' demand in terms of several crops and varieties cultivated across country. Besides, the huge demand outstripping the limited supply has lead to a serious problem of spurious seeds finding their way into the markets and farms with the attendant ills and consequences.

This paper is an attempt to review the seed production and delivery systems in four districts of Andhra Pradesh, representing semi arid tropics in India, with the ultimate objective of suggesting alternative seed systems and seed delivery models that are supportive of livelihoods of poor livestock keepers in mixed cropping systems.

### **Food, feed and fodder seed systems in Andhra Pradesh**

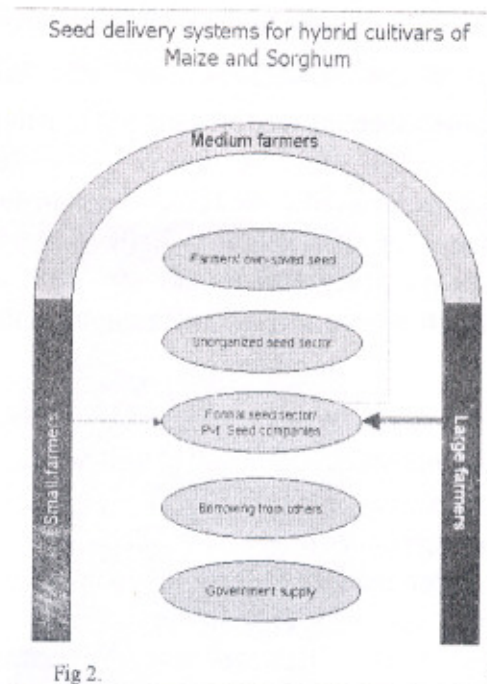
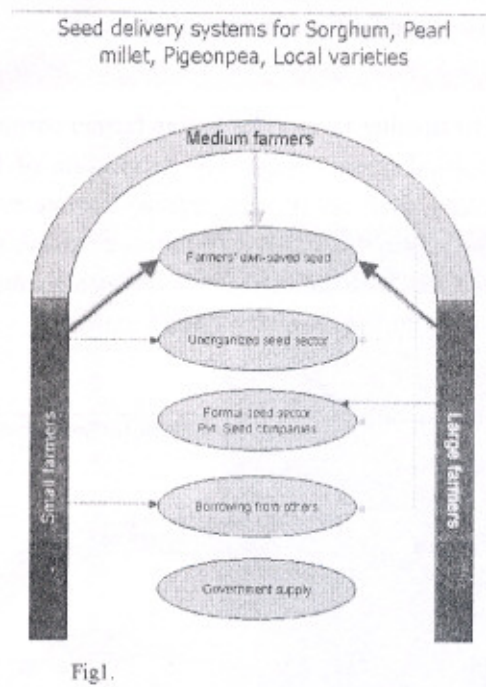
Seed systems in Andhra Pradesh, like the rest of the country, consist of public, private and civil sectors. While the private sector is increasing its share in the market, it is the civil sector (farmer's own-saved seed and exchange) that produces most seed for the majority of staple food crops in Semi-Arid tropics of the State. An inventory in India (Turner, 1994) concludes that there are only a few major crops where more than 10% of the demand is supplied by formal seed sector.

The existing seed systems of food-feed and fodder crops in four districts namely Mahbubnagar, Nalgonda, Kurnool, and Anantapur districts which typically represent the semi-arid tropics (SAT) of Andhra Pradesh state, were studied during 2004 (Ravinder Reddy, 2004b) using the informal participatory techniques and tools. Focus group discussions (FGD) with homogenous groups of farmers like small farmers, medium farmers and large farmers were separately held in eight representative villages across the districts. Informal, open ended styles of discussions were adopted where farmers were facilitated to take a lead in explaining their viewpoint. A 3-member group facilitated and documented the FGD. The overall seed systems prevailing in the four Districts are presented in figure 8.



## Sources of seed and seed delivery systems

**Food-feed crops:** Survey of project area reveals that traditional seed systems are location specific and also varies greatly within farmers' communities. Approximately 80-90% of all planting material except groundnut seed, used by the farmers in the project villages is, by and large, farmers' own saved seed (Fig 1).



However, the afore-mentioned statement regarding the seed source masks significant differences between crops, villages, and socioeconomic conditions and farmer groups. Food feed crops and often major staple crops like sorghum, pearl millet, korra and pigeonpea are generally derived from home-saved seed for reasons of cost and convenience. On other hand, in crops like maize and sorghum where hybrid varieties are used, usually by some farmers from large and medium groups, the seed is obtained almost entirely from private seed companies (Fig 2.). In some cases farmers have discovered that such hybrid seed can meet their needs for one or two further multiplications before replaced it is by fresh seed.

A detailed overview of farmers seed sources and seed distribution channels is often relatively complex with farmer groups obtaining seeds of different crops and varieties from different sources at different times, however, it is possible to identify three main groups of farmers with regard to seed sourcing behavior.

- Seed secure that can fulfill their own seed needs
- Source seed off-farm from time to time out of choice
- Source seed off-farm from time to time out of necessity

Seed secure farmers will tend to maintain their own varieties with limited influx of new varieties. Curiously, most of the Mahaboobnagar area farmers growing sorghum did not express any particular



preference for improved varieties with white seed coat, because of insecurity of yield, low preference for food, highly susceptible for climatic vagaries, biotic and abiotic stresses. On the other hand the farmers of Nalgonda area have shown some positive reaction for adopting improved varieties of sorghum and maize. This would suggest that variety awareness is not always as well developed in traditional farming communities (Table 2). 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.

Farmers sourcing seed off-farm will usually obtain seed 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, this type of activity is more evident in distribution of groundnut seed in Ananthapur district. 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 who always have surplus grain to sell 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 needing to buy or borrow seed every year. Groundnut seed systems operating in Kurnool villages are somewhat different from that of Ananthapur area in seed storage and distribution. The cropping system, soils, and climatic pattern are also differing between these two districts of Rayalaseema region (Table 1). Majority of large and a few medium farmers of Kurnool save their own seed and lend the surplus seed to small farmers with an understanding that one and half times the quantity of seed borrowed will be returned. Whereas in Ananthapur area storage of farm saved seed and borrowing of groundnut seed is vanishing due to continuous drought, poverty, problems with storage pest like groundnut bruchid (*Carydon serratus*), and a sense of insecurity among seed lenders due to occurrence of frequent droughts in the area. Hence, farmers in Ananthapur district, irrespective of their land holding sizes, are increasingly depending on government subsidized seed supply (Ravinder Reddy 2004a). About 60- 70% of farming community in the District depend on government seed supply, which hardly meet 30-40% of their total seed requirement (Fig 6&7). Hence, farmers look to other sources like oil mill companies, local groundnut traders, or purchase with in the village from big farmers to fully meet their seed requirement (Fig 3).

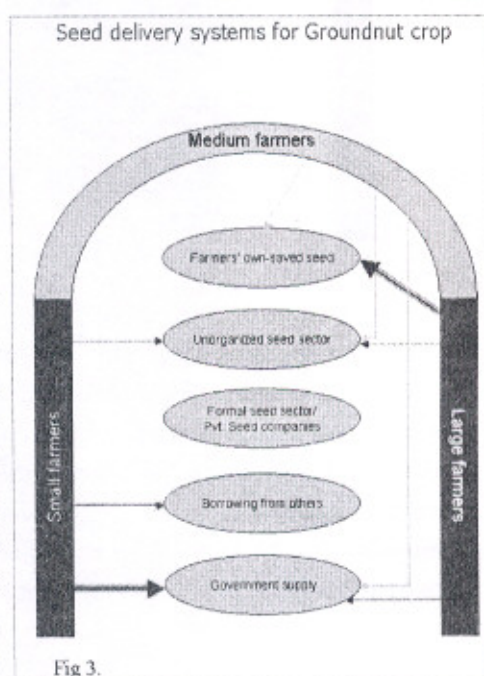


Fig 3.

Groundnut seed distribution by government plays an important role during drought years. A.P. State Seed Development Corporation (APSSDC) also plays a major role in groundnut seed multiplication and distribution in the state. The process adopted by the government for seed distribution, is by calling tenders from seed traders for supplying groundnut seed in a particular area and lowest bidder will get the tender to supply seed. The important aspect here is to note that there is no specification of variety to be supplied to a



particular agro-climatic zone. The bidder procures seed from the unorganized markets, oil mill companies, or groundnut traders. Seed is cleaned, graded, packed and supplied to farmers without any tag of variety name. This system of seed distribution clearly indicates that the farmers often sow mixtures of varieties and the cycle continues every year. Frequent occurrence of droughts during the last ten years, and the resultant government-organized seed supply lead to mixture of different varieties of seed delivered to farmers. This is particularly so in Ananthapur district in the case of groundnut, which is the major crop. Groundnut seed supply in Kurnool district is represented diagrammatically in Fig 6. About 40% of farming community avail subsidized government seed supply. The formal seed sector of groundnut is from government and seed Development Corporation. Informal sector comes from own-saved seed, borrowings from others and the local seed trade occupies a major share (about 60%) in the District (Ravinder Reddy, 2004b).

### **Constraints of groundnut seed systems**

#### **Own- saved seed**

- Seed availability has become a serious issue because during the last 10 years farmers could raise one good crop only once in every three-years.
- Farmers feel storage is a serious problem because of pod borer. Hence many small farmers feel it is safer to dispose all pods and depend on government supply for seed.
- Farmers also have other financial and debt servicing pressures which also contribute to distress- disposal of the produce
- Farmers believe in not using their seed again and again or their belief that seed brought from outside is better than their own was one of the reasons for not saving the seed
- That farmers are aware of the opportunity cost of money and therefore would not like store some thing in November which they require only after 7-8 months later was also advocated as a reason for seed disposal at a time when rates are competitive.
- Small farmers feel hard pressed to buy seed paying hard cash. It is the medium and large farmers who, by default use their own-saved seed. Also when small farmers depend on large farmers for seed, the latter take advantage of the situation and the deal turns out exploitative.
- Incidence of drought influences the demand for seed in the subsequent year also because during drought farmers might realize some yield but the dry and shriveled kernel may not serve as seed for the next season.

#### **Government seed supply**

- There is a restriction of 120kg seed per farmer irrespective of extent of land holding beyond which government will not issue subsidized seed
- Government has not been able to procure beyond 35-40% of the total requirement of seed.
- Government procurement does not differentiate between varieties. It is likely that the seed supplied could be a mix of different varieties.
- Given the bulky nature of pods logistics are expensive and difficult to organize. Accordingly the quantities supplied to different parts of the district do not always match with the local demand
- Given the high costs and other overheads, government supply is not sustainable

### Other issues of seed

- Middlemen resort to unscrupulous practices like faulty weighing of seed and as a result farmers end up in paying more
- Government has setup vigilance teams to check the unscrupulous practices of middlemen in seed weighments, but in practice they have not been effective.
- Not all watershed/village associations are able to combat/deal the middlemen in buying seed.
- In some villages the middlemen are hand-in-glove with large farmers in exploiting the poor
- Market yards in Ananthapur have not been working properly.
- A limited seed is produced and supplied by the only organized seed sector like AP state seed development corporation

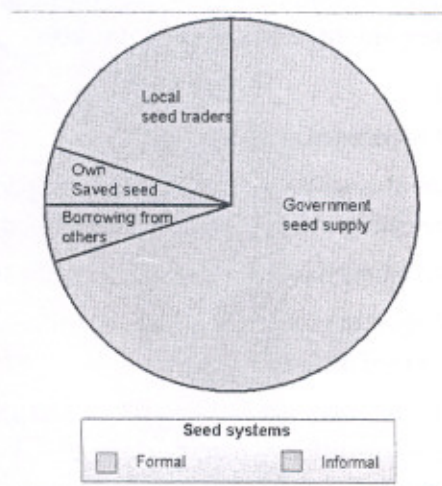
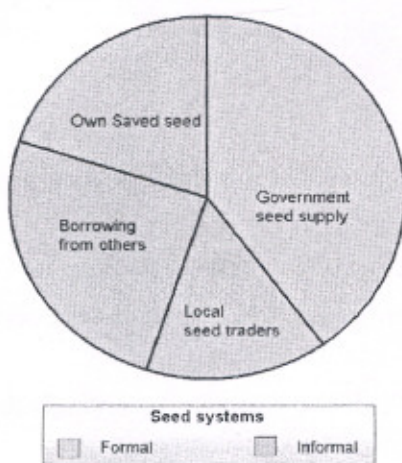
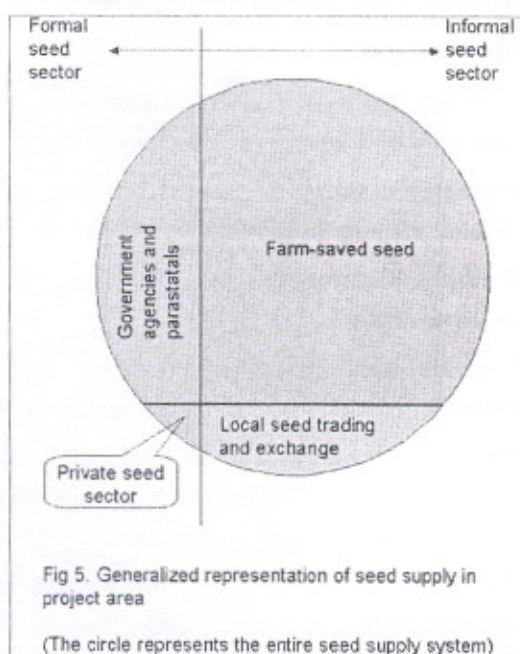
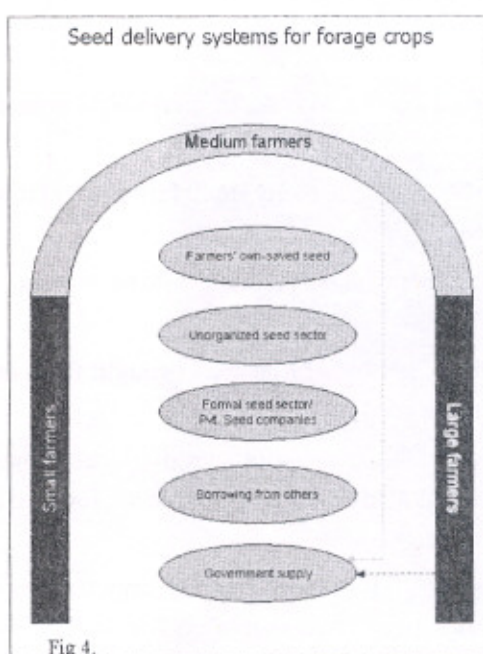


Figure 6&7: Generalized representation of groundnut seed supply in Kurnool and Anantapur districts respectively



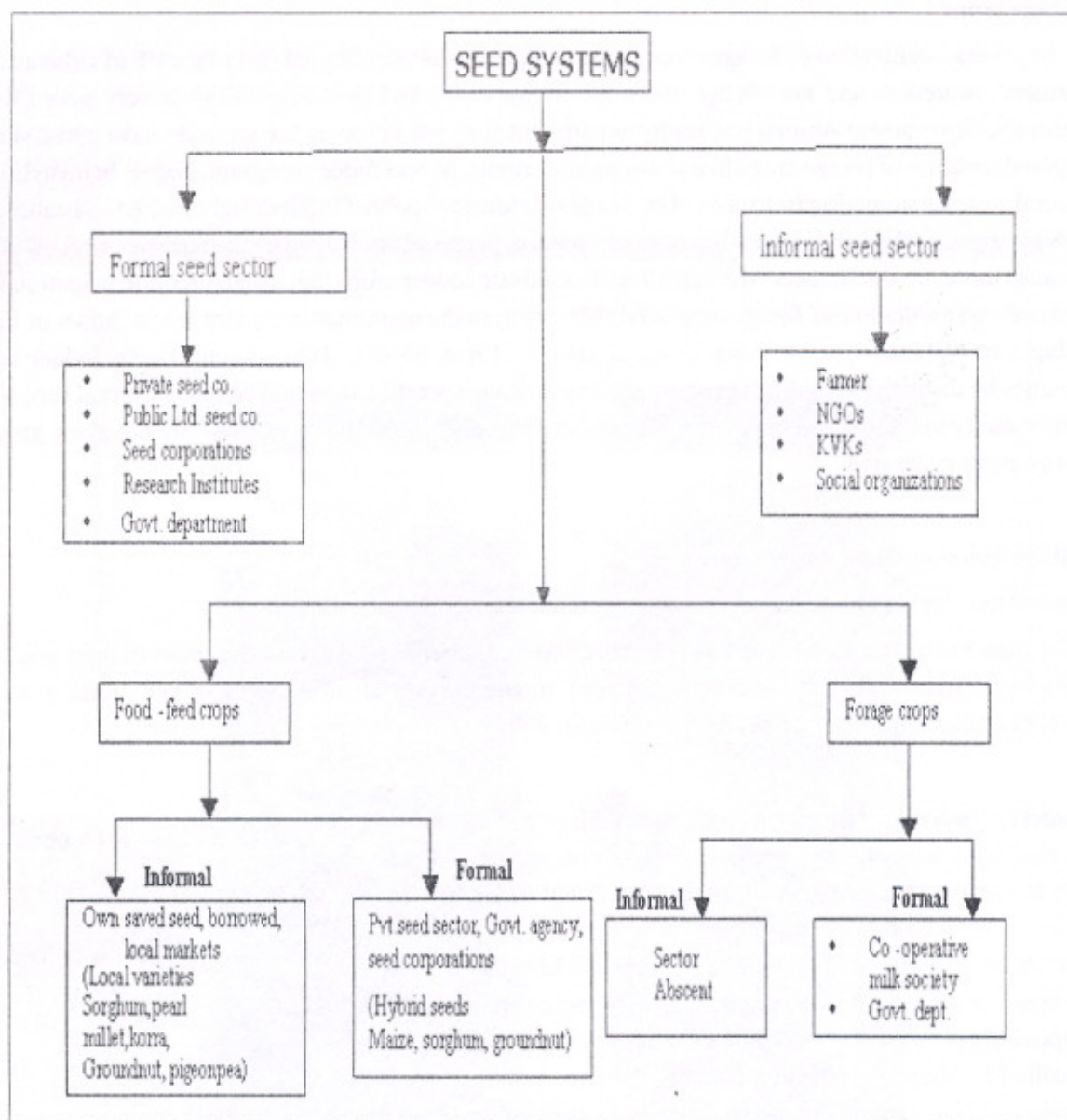


Fig.8: Seed systems and their components

The organized (or formal) seed sector has made some progress in certain crops, notably with hybrids of maize varieties in some villages of Nalgonda district but very little in other cases, where the traditional (informal) system remains largely intact. These terms 'formal' and 'informal' to describe the seed sectors have come into common usage in recent years but the meaning attached to them vary. The most practical usage is to consider the organized/ commercial seed supply as comprising the formal seed sector while all other supply for any channels comprising the informal sector. Thus the total seed supply in project area can be partitioned between these two supply mechanisms represented diagrammatically in Fig 5. The features of formal sector are planned seed production, defined named varieties, officially tested and registered, processed to improve quality, and assurance of quality often by certification. In contrast, the informal sector generally lacks these 'seed-specific' procedures and makes less distinction between grain and seed.

## Forage crops

In general, cultivation of forage crops in the project area is very limited (may be <1% of cultivated area). Farmers' awareness and knowledge about the forage crops and seed availability is very poor (Table 3). Recently, Government Animal husbandry department and milk co-operative societies have initiated activity in popularization of forage crops like *stylosanthes hemata*, hybrid fodder sorghum, Napier bajra hybrid grass in rural areas by supplying free seeds of stylo and subsidized supply of fodder sorghum seed and cuttings/slips of Napier grass. Most of the subsidies of government department are availed by the farmers of better-off group because those are the farmers who can afford to cultivate fodder crops that usually require irrigation facility. General representation of forage crop seed delivery systems operating in project area is shown in Fig 4. In villages of Nalgonda, farmers whose major source of livelihood is dairy are cultivating fodder sorghum varieties by using the subsidized seed supplied by milk co-operative society. The role of formal seed sector in forage seed production and distribution in project area is negligible because, there are not many growers of forage crops in the area.

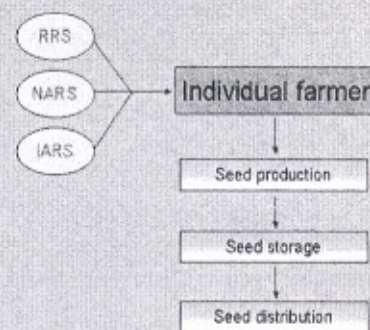
## Village based seed delivery models

Aims of developing village based seed delivery models are:

1. To improve seed availability and accesses to improved varieties seed to resource poor farmers and
2. Build capacity of stakeholders at the community level to enhance sustainable supply of good quality seed, and timely supply at affordable price (Ravinder Reddy, 2005)

**Model 1: Individual farmer as seed bank:** Since generations in developing countries local seed systems are very strong and can able to meet seed requirements of farmer with out depending on formal seed sector. Own-saved seed or borrowings from others contribute 80-90% of their seed requirement. Invariably large farmers in a village used to store seed for future use as grain or seed purpose depending upon situation, the grain may turn out to seed. Smallholder farmers depend upon big farmers for their seed requirements in various situations, they barrow the seed and repay in kind @ 1:1.5 or some times in cash as the case may be. However, every farmer behaves like a seed bank by producing and saving his own seed and reuse for sowing. Some farmers in a village play a role of seed bank by virtue of landholding and financial status produce seed either for his own use or to lend surplus seed to other farmers in the village, but not with an intention to produce for seed purpose. This model mostly operates in small scale and limit to that particular village.

### Individual farmer as a seed bank



This particular practice can be developed as local seed system for different crops grown in a particular village. Most effectively this seed system will benefit farmers for crops require high seed rate, bulky in nature, involves high transport and package cost example, groundnut pod. Involving individual farmers, mostly big and well to do farmers in a village to produce improved varieties seed and sell them to farmers of the same village may be enhancing the smallholder farmers access to improved varieties at affordable cost. This model

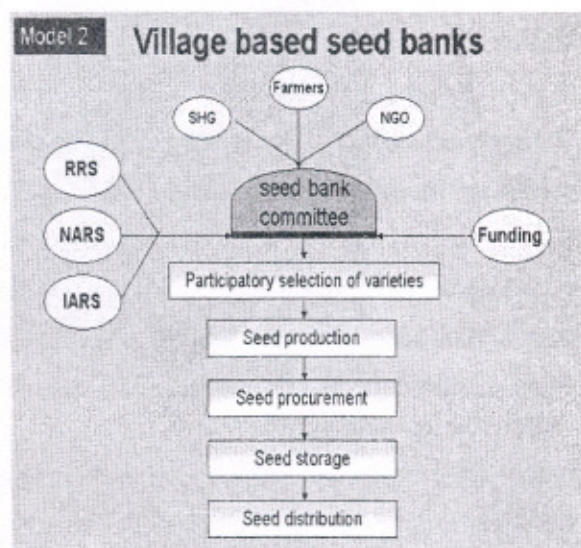


needs to train couple of farmers in each village in seed production technology and support them by supplying breeder seed and other logistics in capacity building. The pros and cons of this model are as follows.

- This model can be tried where NGO are not willing to take-up operations in remote villages
- Poor willingness of the farmers for saving seed due to problems of storage pest and other financial debts
- First step for village based seed bank or small scale seed enterprise
- External finance not required, as all the inputs required for seed production to marketing is usually met by the farmer
- Technical institutional services not justifiable for individual farmers
- No control on fixing selling price of seed
- No control on seed distribution to different communities in the village
- Seed distribution is limited and selected groups
- Effective and wider scope for adaptation and disseminating improved varieties into informal seed channels
- Seed quality (purity, germination, seed-borne pests and diseases etc.,) may be variable as compared to formal sector seed

**Model 2: Village based seed banks:** Farmers need seed because without viable seed the survival of their household is endangered. In fact, the ways that farmers obtain seed are as old as agriculture, and most small-scale farmers in developing countries routinely save their seed from one harvest to the next. Nowadays, some 60-70 per cent of seed used by these farmers is still saved on-farm. Most of the remaining seed is obtained off-farm, from local sources. This seed is usually stored in some form of seed bank, providing seed storage for farmers, and in many case in situ conservation of plant genetic resources. Nevertheless, these community systems of seed supply are increasingly coming under pressure. In the first instance, factors such as droughts, crop failure, conflict, difficult storage conditions, and poverty are eroding both the quantity of seed, and number of plant varieties available to farmers. Second, as a result of agricultural modernization, farmers are increasingly purchasing more of their seed requirements. Not only does this mean that local seed storage could become less important, but as this bought-in seed replaces older, local varieties, these varieties become increasingly unavailable in many communities and especially small group farmers.

In consequence, interventions to strengthen informal seed supply systems, such as establishing village based seed banks, and seed breeding and multiplication are gaining popularity among NGOs and public sector institutions engaged in the area of seed supply. A study was conducted to examine the existing local



seed systems operating in the project villages in Andhra Pradesh and how the farmers respond to the village based seed bank concept. A pilot village was selected with special emphasis placed on farmers operating in areas of comparatively low agricultural potential, with less fertile soils and lower and more variable rainfall, commonly known as complex, diverse and risky (CDR) areas. These farming households are likely to have limited land (of reasonable potential), limited capital resources (Ravinder Reddy, 2004b).

In this context, the concept of 'seed village', which advocates village self-sufficiency in production and distribution of quality seeds, is fast gaining ground. Many attempts are on to revive the age old concept of seed self sufficiency. Seed villages or village seed banks operate with utmost transparency, mutual trust and social responsibility of the seed farmer towards his fellow farmers, and under peer supervision. Though this is not an entirely new concept to villagers, it is being promoted to reduce their dependence on external inputs. In this background, an attempt was made to promote the concept of village seed banks by ICRISAT in its projects (Ravinder Reddy, 2004a). Successful Community initiatives were first documented by an in depth study of the seed villages in ADB and TATA-ICRISAT sites of Vidisha and Guna districts, Madhya Pradesh (Sreenath Dixit et al., 2005). This provided the project with an insight into the concept and helped identify gaps so that the concept could be refined and implemented in APRLP project sites in Karivemula and Devanakonda villages of Kurnool district in Andhra Pradesh (Ravinder Reddy et al., 2004a).

#### **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 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 seed production and delivery system
- ❖ A step ahead towards sustainable crop production
- ❖ Avoid introduction of diseases carried through seed (seed-borne pathogens) produced and imported from different agro-ecoregions
- ❖ Scope for farmers participatory varietal selection
- ❖ Availability of true-to-type varieties and healthy seed within the reach of the farmer at affordable price.

#### **Constraints**

- Willingness of farmers to adopt quality seed production practices
- Additional investment for inputs in seed production
- Buy-back assurance to farmers from SHGs/NGOs
- Proper seed storage facilities and management in the village



- Availability of funds with SHGs/NGOs for seed procurement, seed 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, accesses, and procurement of breeder's seed for seed production at regular intervals
- Fund for procurement of seed produced by farmers for seed bank

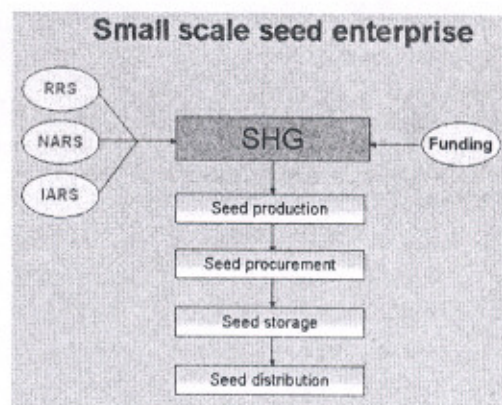
### Small scale seed enterprise models

Despite the strength of local or farmers seed systems are not fully adequate to current farmers needs. Even traditional crops and varieties benefit from maintenance of sources of quality seed with varietal purity and seed health. For improved or modern varieties, links between farmers seed producers and sources of foundation seed are important. Even more critical are the linkages that allow farmers seed producers access to new varieties, hybrids, that are not available from traditional seed producers. And finally, established linkages between the formal and informal seed sector can re-build seed stocks following disasters or crop failure and thus reduce dependence on external relief programs.

Farmers as seed producers can be quite efficient and some will have potential to expand as specialized, small-scale seed enterprises. Seed trade associations, government agribusiness promotion programs, and especially NGOs, SHGs, and Krishi Vignan Kendras (KVKs) have a potential role in promoting improvement in production, marketing, and distribution systems for traditional farmers seed producers. This may involve an array of activities, including training in seed production and handling, establishing linkages to sources of breeder /foundation seed, developing marketing skills and approaches, and finally transformation into rural small or medium sized commercial seed enterprise. For these interventions to be sustainable, they must be based on training and market development and not on direct subsidies. Government programs may focus efforts on the development of the informal seed sector by linking farmer seed producers to sources of improved foundation seed developed by formal sector and helping to expand marketing (where appropriate) systems for farmer-produced seed. Programs will need to be vigilant in eliminating subsidized seed production, and distribution, that restrict local seed enterprise development. key to success in strengthening informal seed systems will be improving farmer and seed producer access to information on product and seed price and market options (Anonymous, 2004).

#### Model 1: Self Help Groups (SHGs) mediated system - Pros and cons of the model

- Availability and accesses to improved varieties to all groups of farmers
- Minimum overheads
- Seed stored in the village
- Seed available at reasonable price and at right time, at farmer door steps



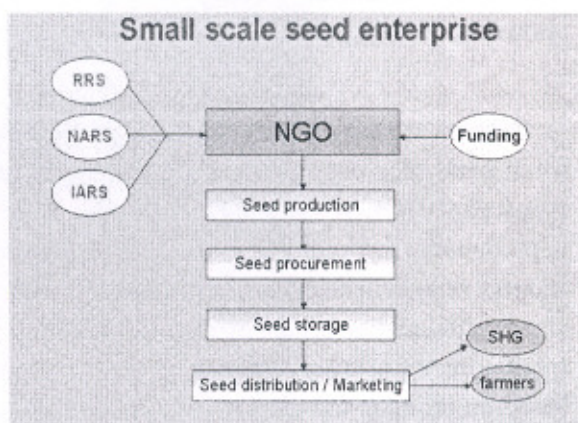
- Control on fixing procurement and selling price of seed
- Priority for farmers preferred variety
- Need institutional support for technical backstopping and supply of breeder seed

#### **Model 2: Non-Governmental Organizations (NGOs) mediated system - Pros and cons of the model**

- 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
- Seed availability and accesses to all groups of farmers
- Overhead costs are minimum
- Need institutional support for technical backstopping and supply of breeder seed

#### **Model 3: Krishi Vignan Kendras (KVKs) mediated system - Pros and cons of the model**

- Operational area is large (may be at Mandal level)
- Centralized and need large storage place ( godowns)
- Comparatively more overhead costs
- Involves more than one crop and variety in production
- Less scope for farmers participation and choice of varieties
- More inclined towards commercial seed trade
- No scope of involvement of farmers in fixing procurement and selling price of seed They have infrastructure and technical capabilities to some extent



#### **Strategies to improve informal seed systems**

The informal seed systems may be the most appropriate in

- Remote areas, where formal sector find difficult for seed distribution and farmers can't reach seed markets easily
- Due to narrow agro-ecological zone, where formal seed market may not show interest because of limited market of specific variety and widely marketed varieties may not suitable for that region
- The crops which have high seed rate and bulky in nature eg., groundnut pod, implying high transport cost to move seed from distant production sites to growing areas.



### Strengthening the stakeholders

Specifically rural community seed programs should be provided with technical backstopping by International, National and or State research institutes to strengthen the stakeholder in seed self sufficiency

- Farmers participatory evaluation of genotypes suitable for a particular agro-eco-regions
- Maintenance of farmers 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
- The farmer in the remote areas have poor awareness and accesses to improved varieties and even if they have its difficult for them to accesses the seed. Creating awareness about improved agricultural practices and information on the availability of seed material suitable for their agro-ecological region is important to bring change in the rural food security.
- Train farmers in better selection, treatment and storage practices of seed produced from their own farms. As 80% of seed used by the smallholder farmers comes from own-saved seed or local seed systems in developing countries. The training will help them to increase production through better use of their own saved seed and genetic resources and indirectly conserving crop bio-diversity in the region.
- Training in seed health management and seed storage methods is equally important in saving the precious seed by preserving the viability of seed till the next season. Seed-borne microorganisms and storage insects can make seed unproductive during storage is a major problem of smallholder farmers. This problem is more pronounced in leguminous seed and it's a difficult task for them to keep a check on storage conditions and control them with chemicals seldom available in rural areas.
- Know how in selection and harvesting of crop at right time and post- harvesting precautions in preserving the seed for considerable period before sowing in subsequent season is essential for good harvest.
- The varieties developed by the national, international and state research centers have to be made available to smallholder farmers in the interior villages. These modern varieties have to be multiplied and disseminated through formal and informal seed delivery channels at affordable price. This strategy will work but for farmers who can persuade to buy inputs, provided seed is available at prices considered worth the risk by those farmers. Several strategies were implemented by ICRISAT and partners in Tanzania (Rohbach et al., 2002) and in Zimbabwe (Monyo et al., 2003)
- Generally seed certification is state subject governed by state governments. Certifying seed means its endorsing the quality of seed produced and fit to be sold in the market. Giving assurance of minimum quality standards likes purity of genotype, germination percentage and processed for seed uniformity. Hence, all the process of seed certification will enhance the cost of the seed from production to marketing. Whereas any informal method of seed production and dissemination doesn't have any standers and producer himself is responsible for quality of seed.
- The concept of village based seed banks (VBSB) have initiated by NGOs, KVKs, SHGs, CBOs, where the village seed committee takes all the responsibility of seed production and quality aspects(Ravinder Reddy, 2004). The practice of certification of seed produced by the smallholder farmers is not in vogue, moreover the committee feels its an expensive and cumbersome activity for village based seed banks. Village seed



committee members took up activity of seed quality responsibility and seed producers themselves vow to supply quality seed to VBSB. The statutory standards of commercial seed sector will increase the cost of seed which the farmer feel they can keep the cost of seed at very low if the seed is unprocessed and uncertified.

- If a policy can evolve to certify the village / community based seed production schemes without taxing the smallholder farmers, scope to improve the farmers capacity in seed production and supply improved varieties quality seed to other farmers in interior areas, this may influence access and availability of improved varieties to resource poor farmers at affordable price.

### **Recommendations for sustainable seed systems in semi-arid tropics**

1. Farmer to farmer seed exchange and local seed markets are popular throughout the project area but are not adequately linked with systems for improved seed. It is important that public sector research organisations which are strong on varietal production are linked with the informal seed supplies. Locally operating institutions, such as NGOs, extension services, KVKs, farmers associations and other CBOs could play an important role in effecting this link.
2. Farmer seed producers can be efficient and some will have potential to expand as specialised, small or medium sized local seed enterprise (Ravinder Reddy, 2005). For these interventions to be sustainable, they must be based on training and market development and not on direct government subsidies.
3. Sustainable, competitive groundnut seed systems will require substantial re-orientation of government philosophies and programs involving groundnut seed distribution. Rather than attempting to directly supply seed to farmers, government programs will need to provide support services that allow developing formal and informal seed enterprises to respond to market (farmer) 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.
4. Programs will need to be vigilant in eliminating subsidised 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 by providing access to information on product and seed prices and market options.
5. Development of alternative seed systems for groundnut seed production and distribution at Ananthapur and Kurnool is an urgent need. The formal seed sector has shown little or no interest in seed multiplication for crops like groundnut, with high seeding rate and low multiplication rates. Transportation, processing, bagging, and certification costs make the seed expensive for farmers. Community based or Village based seed production and distribution schemes have gained increased popularity in recent times (Sreenath Dixit et al, 2005). The concept of village based seed bank involves improved seed and technical assistance focused on targeted pilot villages in order to train farmers in seed production, storage, seed health and distribution.



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**Table1: Agro-ecological features of the project area**

Feature	District		
	Nalgonda	Mahabubnagar	Kurnool
Physiography	North Telangana Plateau	North Telangana Plateau	South Telangana Plateau (Rayalaseema) and Eastern Ghats
Soils and Available Water holding Capacity (AWHC mm/m)	Deep loamy and clayey mixed Red and Black soils with medium to high AWHC (100-200)	Deep loamy and clayey mixed Red and Black soils with medium to high AWHC (100-200)	Deep loamy to clayey mixed Red and Black soils with medium AWHC (100-150)
Agro Ecological Sub Region (AESR)	Hot Moist Semi-Arid ESR	Hot Moist Semi-Arid ESR	Hot Dry Semi-Arid ESR
Average annual temperature °C	26.4	26.9	28.1
Average annual rainfall (mm)	742	754	630
Onset of monsoon	06 June	05 June	04 June
Withdrawal of monsoon	01 November	05 November	10 November
SW monsoon rainfall (mm)	554	611	449
NE monsoon rainfall (mm)	120	92	112
PET (mm)	1615	1666	1725
LGP	120-150 days	120-150 days	90-120 days

(Source: Kesava Rao, 2005)

**Table 2: Farmers knowledge on seeds of improved varieties of food-feed crops**

Farmer group	Mahaboobnagar district <sup>a</sup>	Kurnool district <sup>b</sup>	Nalgonda district <sup>c</sup>	Ananthapur district <sup>d</sup>
Small farmer (< 5 acres)	*	*	**	*
Medium farmer (5-10 acres)	*	*	**	*
Large farmer (>10 acres)	*	**	***	*

a= sorghum, Maize, groundnut, pigeonpea; b= groundnut, pearl millet, sorghum, Korra, pigeonpea;

c= Maize, sorghum, pearl millet, pigeonpea; d= groundnut, pigeonpea

\* Poor; \*\* average; \*\*\* Good

**Table 3: Farmers knowledge on seeds of forage crops**

Farmer group	Mahaboobnagar district <sup>a</sup>	Kurnool district <sup>b</sup>	Nalgonda district <sup>c</sup>	Ananthapur district <sup>d</sup>
Small farmer (<5 acres)	*	*	*	*
Medium farmer (5-10 acres)	*	*	*	*
Large farmer (>10 acres)	*	*	**	*

\* Poor; \*\* Average; \*\*\*Good