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ENHANCED FODDER PRODUCTION WITH INNOVATIVE SUSTAINABLE INFORMAL SEED SYSTEMS FOR FOOD-FEED CROPS: A CASE STUDY OF VILLAGE SEED BANKS, INDIA

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Abstract

This paper describes an innovative informal institutional arrangements adapted for making rural communities seed secure in food-feed crops in Karivemula village in Kurnool district of Andhra Pradesh, India. Small and resource poor farmers are often at a disadvantageous position in absorbing the agricultural technology related to genetic enhancement of productive potential of agricultural crops in general and food-feed crops in particular. But, these crops has vital stake in crop-livestock interaction at smallholder level. Village seed banks (VSB) established as part of Andhra Pradesh Rural Livelihood Program (APRLP) a DFID funded project implemented by International Crops Research Institute for the Semi Arid Tropics (ICRISAT) were proved as an alternative sustainable informal seed system to make farmers seed secure. The two models *village seed bank* (VSB) and *individual farmer as seed bank* were adapted in the project villages. Here shift was observed in local seed system among small and resource poor farmers due to availability and access to improved varieties, on time seed availability and at affordable cost. The area under improved groundnut crop varieties has increased from 1.2ha in 2002 to 142ha in 2005 and expected to cover 400ha in 2006 rainy season. Increase in fodder quantity by 15%, and income by Indian Rupees (INR) 12,500 ha^{-1} over local variety was recorded in the year 2003. In addition village women self help groups (SHGs) who maintain VSB earned a net profit of INR21, 330 in 2004 rainy season by selling seed. The benefits would be much higher if the amount saved by farmers with low price, timely and quality seed availability and benefit from livestock due to enhanced fodder availability and improved crop yields is taken into account. Impressed by the success, government of Andhra Pradesh has announced to scale-up and scale –out the "village seed bank" model developed by ICRISAT to 322 villages in the state.

Introduction

The great majorities of the world's food crops are annual species for which seed must be sown each season to establish a new crop. Consequently, seeds are the fundamental biological component of agricultural production. Agriculture in India is over 5000 years old. Farmers have been breeding, selecting and collecting enough seeds, all these years 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 that has been nurturing over time. These systems have been variously called a farmer-managed seed system (Bal and Douglas, 1992); Informal seed system (Cromwell et al 1992), traditional seed system and local seed system (Almekinders et al., 1994). But, constant rising population increased pressure on food grain production, which is a great task before the agricultural scientists to achieve. In order to achieve the projected demands, quality seed of improved cultivars is the pre requisite. Improved seed is a catalyst for making other inputs cost-

effective. In spite of many efforts, seed supply particularly of food grain crops is a serious concern till today. More than 80% of crops in developing countries are sown from seed stocks selected and saved by farmers (Osborne and Faye 1991; Jaffe and Srivastava 1992; Almekinders et al. 1994) and Banerjee (1984) stated that more than 85 percent of total seed sown in India is produced by farmers. Groosman *et al*. (1991) also confirmed these observations. Maury (1998) stated that quality seed availability is only 12 percent of the total seed used for sowing each year. Hence, large area under food grain crops is still sown with seeds saved by farmers. Experimental evidences are there that cereal crops give 10-20 percent less yield per ha when farmers use their own saved seed. With simple calculation, one could say that about 20-30 million tones food grain production may be added in our total production through the use of quality seed of improved varieties and hybrids.

Groundnut seed systems in semi-arid tropics of Andhra Pradesh

Seed systems in Andhra Pradesh, like the rest of the country, consist of public, private and civil sectors. 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. Groundnut seed supply in Kurnool district is about 40% of farming community avail subsidized government seed supply. The formal seed sector of groundnut is from Seed Development Corporation (government). 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 2004). 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 and farmers. 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.

In this context, the concept of 'village based seed bank', (VBSB) 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 innovative attempt was made to promote the concept of village based seed banks by the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) as an intervention of Andhra Pradesh Rural Livelihood Program (APRLP) in Andhra Pradesh state. Successful Community initiatives were first documented by an in depth study of the seed villages in Tata-ICRISAT project sites at 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 Andhra APRLP. In this case study, a detailed documentation of process in implementation of project in Karivemula village of Kurnool District, A.P. state in India from 2002-2005 was presented.

Process

Implementing the seed village concept in project villages started with reconnaissance survey undertaken to assess the ground situation and ascertain the demand for seeds and understand the existing seed systems. Karivemula, a nucleus watershed village in Kurnool district of A.P. state was chosen as a pilot village for this purpose. Survey reveals that traditional seed systems are location specific and also varies greatly within farmers' communities. A detailed over view 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, it is possible to identify three main groups of farmers with regard to seed sourcing behavior.

- Seed secure and 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. This would suggest that variety awareness is not always as well developed in traditional farming communities (Table 1). 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 access.

Table 1. Sources of groundnut seed for sowing in Karivemula village

Farmer category	Percentage of farmers	Awareness about improved cultivars[a]	Seed sources		
			Own-saved seed	Un organized Markets and Govt. supply	Barrowing from other farmers*
Small farmer (<2ha)	39.9	Poor	30%	20%	50%
Medium farmers (2-4ha)	55.9	Average	40%	30%	30%
Big farmers (>4ha)	4.1	Good	100%	-	-

[a] Groundnut, Pearl millet, Foxtail millet, Pigeonpea

* Groundnut seed is taken on loan and repaid in kind (seed) in the ratio of 1:1.5

Salient findings of village survey

- Karivemula has a vibrant agricultural economy. The most important crop of this village is groundnut, which is grown in over 400 ha. Other crops of significance are tomatoes (320 ha), cotton (192 ha), sunflower (160 ha), pearl millet, (120 ha) and chillies (40 ha).
- Over 70% of small farmers depend on other sources for groundnut seed
- Awareness about improved groundnut varieties is dismal
- Average groundnut pod yield from local non-descript varieties was 300-500kg /acre.
- Over 95 % of the farmers' own small/medium sized land holdings and are not aware of improved cultivars.

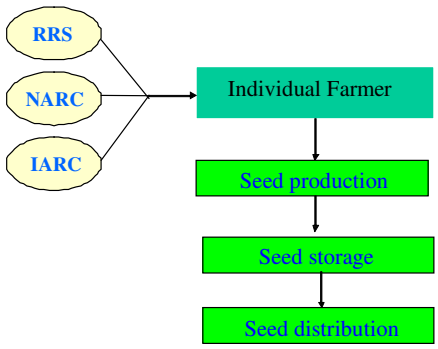
- Majority of medium land holders and almost all large holders use own-saved seeds for sowing while small farmers depend heavily on external sources for seeds.
- Most of the small and medium farmers source groundnut seed from other farmers, unorganized markets, moneylenders, fertilizer/pesticide dealers, and subsidized groundnut seed from government agencies. Distribution of seeds by government agencies is mostly delayed; as a result, they often end up lost cropping seasons.

The findings gave an insight into the areas that need to be emphasized while mobilizing the groundnut cultivators for setting up village seed bank. It was decided to approach the problem more holistically by taking into consideration the constraints the cultivators were facing. For, a good seed needs to be facilitated with scientific practices like seed production technology, Integrated pest and disease management, seed health and storage management and marketing linkages to yield sustainable results. Therefore special emphasis was given to holistic approach to develop alternate seed systems through consortium approach, involving agricultural university, regional research stations (RRS), state agricultural department, National agricultural research centers (NARC), Non-governmental Organization (NGOs), Community Based Organization (CBOs) and farmers. Two models were adapted to make the village seed secure. The models are 1.) Individual farmers as seed bank and 2.) Village Seed Bank (VSB).

Model 1: **Individual Farmer as Seed Bank**

During reconnaissance survey we came across a village seed system, which is common and in operation in many villages since time immemorial. In this system the big farmers play a key role intentionally or by practice they store large quantities of grain in their storehouse for two purposes. The first one is to sell the grain during off-season for higher price and the same grain is used as seed during sowing time in drought year or during shortage of seed. Even otherwise small and resource poor farmers source their seed requirement from large farmers is a general practice in villages and return them in kind @ 1:1.5 or cash which ever is convenient for both. In some villages big farmers already practicing informal small seed business by growing Open Pollinated Varieties (OPV) under irrigated conditions specifically for seed purpose in case of groundnut, without using breeder/certified seed and seed production principles for production. Farmers' believing that sowing groundnut seed produced in post-rainy season (Rabi) gives higher yields than sowing seed produced in rainy season (Kharif). The other belief is that, sowing the seed produced in other fields or other areas yield higher than sowing own field-produced seed. The above perceptions are one of the reasons for groundnut farmers' dependence on external sources for seed every year. Taking strength of existing local seed system "**Individual Farmer as Seed Bank**" model (Figure 1) was attempted to produce improved varieties for enhancing crop productivity, access to improved varieties, availability of seed at right time at affordable price to resource poor farmers.

Figure 1. Individual Farmer as Seed Bank



Initially in the year 2002 Kharif season, breeder seed of groundnut crop was distributed among selected farmers on participatory basis to conduct trials on farmars field and selection of suitable variety was left to farmars choice. Subsequently interested big farmers were selected to take up chosen variety for seed production in Rabi season, 2002 under irrigated conditions. As majority of the cultivated area in the village is under groundnut cultivation farmers were more inclined and interested in groundnut seed multiplication, the quantity of seed produced and distributed by individual farmer as seed bank is given in Table 2.

Selected farmers, along with NGO, Watershed Development Team (WDT) and village para-workers were trained on-station and on-farm in seed production techniques, Integrated Pest and Disease Management (IPDM), seed health and seed storage management aspects.

Table 2. Groundnut seed produced and distributed by Individual farmers in Karivemula village in Kurnool dist. of A.P.

Year	**No. of farmers**	**Varieties**	**Quantity of seed transacted (q)**		**Quantity of seed retained for his own use (q)***
			Cash	**Kind****	
2003	2	Improved	18	2	25 (45.0)
		Local	20	-	6(26.0)
2004	5	Improved	23.5	2	21.5(47.0)
		Local	39	6	22(62.5)
2005	6	Improved	35	3	18.5(56.5)
		Local	25	-	12(37)

* Figures in parenthesis are total quantity of seed produced in quintals
** Seed sold on kind basis at 1:1.5

It is evident from the outputs (Table 2) of the intervention, that there is an increase in number of individual farmers adopted improved varieties seed production and distribution and also using the improved varieties for cultivation on his own farm. The sale of seed is more on cash basis than on kind. Here we can see the shift in local seed system among small and resource poor farmers due to availability and access to improved varieties, on time seed availability and at affordable cost, farmers are willing to invest on inputs like improved variety and good quality seed. Several studies in Africa mention that facts of seed exchange are changing, as most farmers are at least partially integrated into the market economy (Lewis and Mulvany, 1997). The exchange of small grains seed was generally free of charge, or bartered for labour, an axe, or any other material of common interest but now it is cash basis. In Zimbabwe selling seed to other farmers has become the most prevalent form of exchange (Mugedeza, 1996).

Production of improved varieties and local variety and number of farmers producing seed has increased. The changes in attitude and adoption of technology among small and resources poor farmers is a positive indication that farmers are ready to adopt a technology suitable for their eco-region provided access and availability of materials of new technology in their vicinity and purview. Due to adoption of improved varieties the village farmers has encouraged the seed producing farmers in the village, thus the concept of "individual farmer as seed bank" is a innovation in local seed systems. The age old practice has been redressed by introducing new science tools in seed production was successful and found sustainable at village level in disseminating improved varieties and improved production technologies.

The pros and cons of the model

- This model can be tried where NGO/private sector 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 (seed producer)
- Technical institutional services not justifiable for individual farmers
- Procurement of breeder seed is difficult at farmer level once the project is completed
- No control on fixing selling price of seed
- No control on seed distribution to different communities in the village
- Seed distribution is limited and among selected groups
- Effective and wider scope for adaptation and disseminating improved varieties into informal seed channels

Model 2: Village based seed banks

The concept of village seed banks was initiated with great enthusiasm by Self Help Groups (SHGs), Village Organization (VO) and Project Implementing Agencies (PIAs) in project village. The whole village took up the concept with lot of enthusiasm during gramasabha (village level meeting where in all the villagers have the chance to take part). The proposal for separate village committee for management of seed bank was successfully implemented by PIAs. The secretaries of the village organizations and SHGs have become members of the village seed bank committee (VSBC) to take up the responsibility of seed production, procurement, storage, fixation of procurement and selling price of seed. The PIAs and committees to ensure the quality of seed and redistribution of procured seed in the village passed resolutions. Their responsibilities also include decisions regarding allocation of seed quantities to each farmer in the Nucleus watershed and to other satellite villages.

Capacity Building Strategy

In order to harness the synergy between the technology and the community participation, special emphasis was given to build farmers' capacity to produce quality seeds. A systematic on time (crop stages) training program was developed to attain the objectives. A peripatetic training strategy was adopted for attaining maximum coverage in the given time. In each nucleus watershed two persons each from the PIA/NGO and WDT member besides 2-3 interested farmers each from the nucleus and satellite watersheds and the ICRISAT field staff were targeted for training.

The PIAs implementing the Project were informed to identify potential farmers and project staff for the training course. PIAs were assigned with the responsibility and liberty to make appropriate arrangements best suited to their conditions. The course consisted of technical details about the seed production. The trainees were exposed to details such as the characteristics of the varieties, isolation distance, purity of seeds and pest and disease management in the seed production plots and seed health and storage management. Posters and illustrations were used as teaching aids during the program. Important details that need to be kept in mind were detailed on a poster and displayed in the PIAs' office for ready

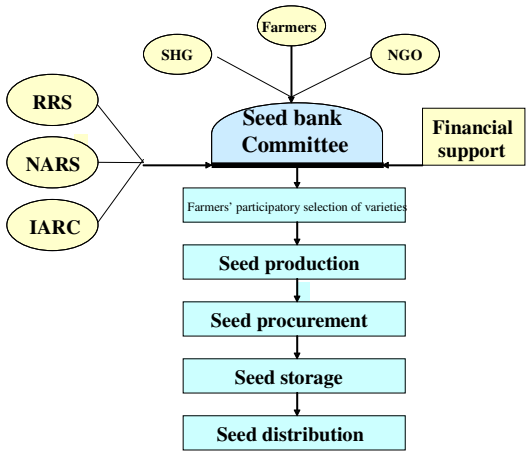
reference after the training was over. On-farm training in identification and control of pests and diseases and seed health management strategy was imparted to trainees.

Farmers with the help of PIAs were encouraged to come out with questions and doubts about seed production process and formulate their own bylaws at community level to enforce quality seed production among fellow farmers. PIA, VSBC and farmers in consultation have passed a resolution for quality seed production to create a moral binding among the communities in their village. The process of farmers' capacity building was taken up in several steps right from selection of variety. The process is briefed under the following steps.

Farmers' participatory selection of varieties

In Kharif 2002, breeder's seeds of different crops selected varieties were procured from various research stations and provided to interested farmers on subsidized price for evaluation. Seed were provided to the farmers who volunteered to take up on-farm trials with their local varieties as control. At the end of season PIAs, Village Organizations (Vos), and farmers were involved in evaluating these varieties based on pod yield, fodder value and other varietal characters. Farmers of Karivemula watershed has selected three varieties of groundnut ICGS11, ICGS76, and ICGV86590 and multiplied during Rabi season, 2002. In Kharif 2003, seed production of different crops and selected varieties were produced and seed procured by VSBC (Table 3) and distributed the same on demand to other farmers of the village. During seed production process members from PIAs and VOs, seed growers and ICRISAT scientists jointly inspected the seed production plots. The farmers were trained and imparted proper technical guidance in different steps of seed production like, selection of field, identification of varietal characters, removing the off-type plants (roguing) and diseases and pests control measures, precautions during harvesting and threshing, and finally in seed health, grading and storage management.

Figure2 Village based seed banks



Seed procurement and distribution

The farmers and seed committee members inspect the quality of the seed not only at the time of procurement but also while the seed production is under way in the field. A sample of the seed is kept aside from each seed lot and subjected to germination test before seed distribution in next season. The seed committee and the farmers would decide the procurement price, which would usually be 5-10% above the market price (Table 3). The committee however will decide the selling price during the next cropping season taking into consideration the market price of the seeds and grains. Thus, the committee ensures that the farmers get an incentive to sell and buy the seeds within the village. The basic amount required for procurement of seed from seed producing farmers was secured from the District Water Management Agency (DWMA), a govt. of Andhra Pradesh, organization funded by DFID program. The amount was extended to VO as revolving fund, the VO intern fund SHG

involved in village seed bank committee with minimum interest rate for procurement of seed for village seed bank.

Table 3. Seed procurement price at Karivemula watershed seed bank

Crop	Seed procurement price Rs / kg	Grain price range in market Rs/kg
Groundnut	17.50	15-16
Castor	15.00	13-14
Pigeonpea	17.50	14-16

The VSBC resolved to sell seed only to farmers of their village and small quantities to satellite villages. Incase of seed surplus over the demand, it would be sold to individual growers of other villages at the same price as sold to the local farmers. The selling price is usually less than the commercial market price and more than the procurement price. The difference in price is to cover expenses such as the premium paid to producers of seed, processing costs, salaries, wages, electricity, bags, chemicals, rent etc, cost of seed treatment, transport and cleaning losses, interest on the capital for purchase of seed.

Table 4. Quantity of Groundnut seed procured and distributed by Village Seed Banks in Karivemula village in Kurnool District , 2004

Year	Crop	Cultivars	Seed distributed (q)	Number of farmers benefited	Area (ha) under improved cultivars
2004	Groundnut	ICGS 11	36.00	17	36
		ICGS 76	40.00	21	
		ICGV86590	16.00	12	
		TAG 24	8.90	5	
2005	Groundnut	ICGS 11	10.00	4	142
		ICGS 76	3.00	7	
		ICGV86590	5.60	11	
		TAG 24	21.70	24	
		TMV 2	103.00	22	

Farmers of nucleus and satellite villages approached Village seed bank (VSB) in Karivemula for procuring seed in the month of May-June and Priority was given to those farmers who have registered their names by paying Rs. 100/- in advance. In satellite villages' responsibility of seed distribution was given to respective SHGs of the village. While distributing the seed (groundnut pod) to the farmers, a pack of seed treatment chemical (fungicide) was given to each farmer and instructed to take up seed treatment at the time of sowing and improved crop management practices for high crop production.

Advantages of village based seed bank as perceived by farmers

- Availability of improved varieties seed 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 varietial 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/VSBC
- 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

Livestock and seed interrelationship

The farmers who depend on agriculture and livestock, cash income from agriculture is supplemental to the production of livestock products (milk, butter, ghee). But resource poor farmers have limited livestock assets and are therefore at a serious disadvantage. In rainfed areas farmers growing cereals like sorghum, pearl millet, foxtail millet etc, have suffered from low grain yield and poor market prices for grain and sometimes marketing places being far away burdening the farmer with transport charges, as a result cultivation areas of such cereals are shrinking day by day affecting livestock population because of fodder shortage. Sale of livestock in off-season is a common practice, and dependence on farm machinery for agricultural and transport operations is increasing and decrease in livestock population has more pronounced effect on small farmers in the project area.

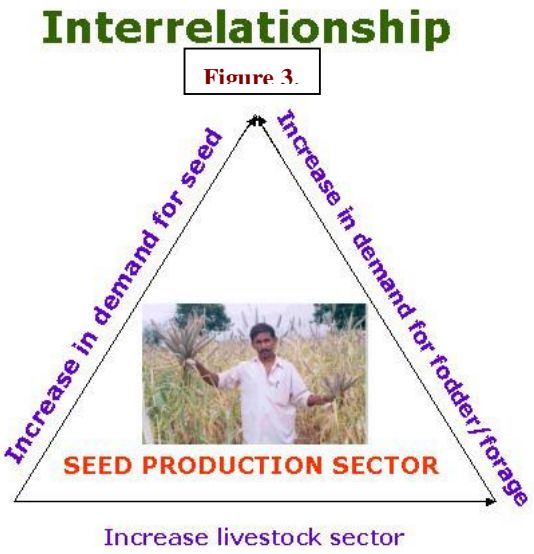


Figure 3.

The commercial demand and cultivation of fodder/forage crops in project area is weak, because of poorly developed livestock sector in which animals are kept mainly on subsistence. The demand for fodder/forage seed will depend upon the development of 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/forage 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 (Figure 3).

Increased adaptation - Enhanced food-fodder production

Groundnut (*Arachis hypogaea*) haulms provide important fodder resources for livestock feeding in mixed crop livestock systems (Larbi et al. 1999, Rama Devi et al. 2000, Omokanye et al. 2001). In these systems fodder shortage is considered one of the major constraints to high livestock productivity and its corollary, high income from the marketing of livestock products. Shrinking common property resources and the little or no scope to expand arable land are further limiting the availability of fodder resources in the rainfed semi-arid tropics. These factors are increasing the value of groundnut as a food-feed crop for which both pod and haulm yields and quality traits are important.

Table 5. Adaptation of improved varieties of groundnut by farmers of Karivemula village

Varieties	**Number of farmers**				
	Year 2002K	**Year2002R**	**Year2003K**	**Year2004K**	**Year 2005K**
ICGS11	1	1	4	17	4
ICGS76	1	2	6	21	7
ICGS86590	1	1	3	12	11
TAG24	-	-	-	5	24
TMV2	-	-	-	-	22
Total	3 (1ha)	4 (2ha)	13 (8ha)	50 (36ha)	68(142ha)
K-Kharif; R-Rabi					

The area under improved groundnut crop varieties has increased from 1.2ha in 2002 to 8 ha in 2003, and 36 ha in 2004 and 142ha in 2005, the number of farmers adapted new varieties increased from 3 in 2002 to 68 in 2005 (Table 5). Based on seed quantities collected and distributed by VSB, it is expected to cover 400 ha under improved varieties in 2006 Kharif season in nucleus watershed. The message about seeds of improved varieties and VSB activity has spread to satellite watersheds through farmer-to-farmer interactions, relatives, farmers' day celebrations and local newspaper. Groundnut crop is cultivated in all satellite villages around Karivemula and is a major crop, it is expected to cover the major area in nucleus and considerable area in satellite villages by year 2006-2007 with improved varieties of groundnut. It is estimated that there is an average increase in groundnut production by 55% over local variety and fodder production by 15% (Table 6) and the monetary benefits increase is around Indian Rupees (INR) 12500 ha^{-1}.

Table 6: Effect of Improved varieties of groundnut on yield of pod and fodder

Varieties	**Yield of pod (Kg ha^{-1})**	**% Change in pod yield over local**	**Yield of fodder (haulm) Kg ha^{-1}**	**% Change in fodder yield over local**

ICGS 76	2380	+73	2670	+34
ICGS 11	2128	+54	2200	+11
ICGS 86590	1916	+39	1968	+1
Local cultivar	1374	-	1989	-

Groundnut haulms are excellent fodder for ruminant livestock, probably as good or better than most of the planted forages in the semi-arid tropics, and that livestock productivity can be increased through choice of groundnut cultivars (Blummel et al 2005). Hence, more quantity of groundnut haulms available will directly result in increased productivity of livestock.

Enhanced Livelihood option

Livelihoods of the villagers enhanced by increased production and returns per unit area are through adaptation of duel purpose improved groundnut varieties and seed security by adopting and operating alternative seed systems, through village seed bank concept, it also generated employment for couple of people in the village (Table 7). It has been proved that VSB concept not only increase the production but also educate and increase awareness on new/improved crop varieties and production technologies. Thus, VSB improve the livelihoods of village farmers due to enhanced crop and fodder production and also improves overall revenue generation in the village by increase in yield of grain and milk production due to enhanced production of fodder

Table 7. Revenue generated by SHGs by operating VSB at Karivemula watershed in 2004

Crop	Quantity of seed procured (q)	Purchase price per kg (Rs.)	Selling price per kg Seed (Rs.)	Gross profit (Rs.)
Groundnut	92.42	17.50	20.00	23105.00
Castor	5.00	15.00	20.00	2500.00
Pigeonpea	8.65	17.00	22.00	4325.00
Total income				**29830.00**
Expenditure*				8500.00
Net income				**21330.00**

* Seed store rent, seed cleaning, and grading, packing, pest control

Basic Guiding Principles for developing sustainable alternative seed systems

1. Alternate seed systems-"Seed bank" should be built upon a solid understanding of all the seed systems farmers' use and the role they have in supporting livelihoods. The local system is usually more important in farmers' seed security and has been shown to be quite resilient. Depending on the context, the focus of seed bank should normally be on keeping the local seed system operational. One practical problem is that local seed systems are often not sufficiently understood, because of its complicity. Hence, there is a need for more emphasis on understanding local seed systems and their role in supporting livelihoods, and on needs assessment.
2. Effective with the immediate objective of facilitating access to appropriate and improved varieties seed
3. Alternate seed systems –"Seed banks" interventions should facilitate farmers' choices of crops and varieties.

4. Seed bank interventions should aim to improve, or at least maintain, seed quality and aim to facilitate access to improved varieties that are adapted to local environmental conditions and farmers' and their livestock fodder needs, including nutritional needs.
5. Monitoring and evaluation should be built into all seed bank interventions, to facilitate learning by doing and thereby to improve interventions.
6. An information system should be put in place to improve from pilot village learning and as a repository of information gained from cumulative experience. Such information systems should be institutionalized at national levels, to the greatest extent possible.
7. A strategy to move from the "pilot village" level to district and state level, capacity building or development phase should be included in the design of the intervention.

Key Learning

Up scaling of seed villages in APRLP- ICRISAT project sites was a very good learning opportunity. Interesting discussions, questions and concerns from farmers on the viability of the seed village concept. Government of Andhra Pradesh state has adopted the village based seed bank model developed by ICRISAT to upscale in 322 mandals in the state to strengthen the alternative seed systems. The results of this intervention will encourage SHGs, NGOs, KVKs, and farmers to invest in the development of rural small-scale seed enterprises, thus enhancing the adoption and dissemination of new improved varieties and production technologies.

- Seed production capacity in small farmers has been developed and farmers have been successfully linked to institutions and NGO for technology backstopping.
- The program disseminates improved OPVs to smallholders farmers in dry areas, greatly accelerating diffusion of improved varieties
- Small farmers seed producers are motivated by incentive of higher procurement price for seed produced by them
- The new varieties are long duration than local
- Low preference/ acceptability in the market
- Low selling price for improved variety over local by 10-15% in the local markets
- Enhanced productivity (pods) by 55-60% and fodder by 15% over local variety
- Availability of improved varieties at reasonable price and on time to all groups of farmers

Conclusion

Small and marginal farmers are often at a disadvantageous position in absorbing the agricultural technology related to genetic enhancement of productive potential of agricultural crops. This is because of centralized production and distribution of improved seeds. Though the organized sector is able to produce a large quantity of seeds, the supply chain is unable to cope with the huge demand for seeds across the length and breadth of the country. Thus, the farming community depends to a large extent on own-saved seed and external sources like unorganized markets, borrowings from other farmers, govt. departments for important input like seeds. The formal seed sector has small contribution in seed multiplication for crops like groundnut, with high seeding rates and low multiplication rates. Transport, processing, bagging and certification costs make the seed too expensive for farmers to purchase. For such crops, the most economical way would be to produce seed at 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 seed system to this problem and help farmers become self-reliant. This initiative needs both

organized communities and institutional technical backstopping to strengthen local seed systems. Efforts towards up-scaling seed banks in other project sites resulted in encouraging learning outcomes. During the field day on 14 October 2004 organized in Karivemula, Minister for Agriculture, Government of Andhra Pradesh has announced to scale-up the "village seed bank" model developed by ICRISAT to 322 villages in the state.

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