NATURAL RESOURCES SYSTEMS PROGRAMME

PROJECT REPORT[1]

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R8192

Report Title

Enabling rural poor for better livelihoods through improved natural resource management in SAT, India. Scientific report. Part 2.

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NRSP Production System

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Section 4

Farming system diversification and enterprise promotion

Link to project log frame

Output III: Diversified farming systems/enterprises identified and promoted for improved livelihoods of various target groups through the use of appropriate participatory methods.

OVI

1 By mid 2003, existing farming system and constraints in the targeted villages assessed and documented.

2 By 2004, target groups (both end users and intermediate service providers) see evidence of ways by which they can benefit from improved utility of CPR and PPR products.

3 By 2005, at least 2 target groups report adoption of at least 2 management practices for improved livestock production.

Activities

1. Characterisation of existing farming systems of targeted groups.
2. Identification and promotion of alternative land use systems / enterprise diversification by appropriate participatory methods.
3. Identification and promotion of feed and health management practices for improved livestock production.

4.1 Introduction

Traditionally the farmers are growing crops like sorghum, pigeonpea, castor, finger millet, groundnut under rainfed conditions depending upon the quantum and distribution of rainfall in the specific areas. Depleting natural resources, labour scarcity during peak periods of farm operations, socio-economic and cultural conditions of the farmer are forcing him/her to diversify the existing cropping systems (Singh et al., 1999). The diversified cropping systems are also emerging due to the changed dietary pattern over the past two decades away from millets as the staple and towards rice (due to the availability of rice at highly subsidized rates in Public Distribution System), quick and timely availability of the seed material, a reduced irrigation source due to the increased incidence of poor monsoons, and the demands of the local markets. For instance, the nearness and presence of poultry feed firms in the vicinity of Mahabubnagar enthused the farmers to grow maize, as sale in the local market is a viable option.

The livestock production systems in the selected clusters are based on availability of crop residues, grazing resources, and low opportunity cost of family labour. The traditional production system has rapidly undergone change in recent years. Although the organization of livestock production in small units still persists, household production systems are increasingly getting integrated into input as well as output markets (Misra et al., 2004). As a result of gradual transition from subsistence to marketisation, the economic dimensions of livestock keeping have assumed increasing significance in household behavior. The growing pressures of human as well as livestock population on land and NRs, crop residues and grazing lands have increasingly become a binding constraint. Changing consumption pattern, increasing incomes, growing urbanization and population growth are likely to influence the demand for food of animal origin. Consumers in urban areas have more options to diversify their diets and are, therefore, likely to consume more meat and milk products. The occurrence of frequent droughts due to monsoon failure has also made the farmers to have livestock enterprises to support their income. Besides, the crop diversification to grow produce suitable to livestock like paddy straw, maize etc. have created the conducive atmosphere for raising dairy animals. These changes bring both opportunities and challenges for the farming and livelihood systems in the region. NR-based livelihood diversification and enterprise interventions, if appropriately designed and introduced, can contribute to improving the stability and sustainability of NR-based rural livelihoods, including particularly those of the rural poor.

4.1.1 Rationale of Output IV

The changes in the quantity of rainfall received and in its distribution pattern in the project location are leading to intermittent droughts during the crop period that result in crop failures. This is further aggravated by the poor yield potentials of the prevailing crops and local cultivars. Both agricultural drought and the poor yield potentials of the crops can be managed by increasing the awareness of the farmers about improved farming practices and the improved cultivars of different crops. Therefore, by introducing diversified crops/cropping systems, which are less risky, less drought prone and with high yield potentials, the farmers can be made aware of improvements in agriculture.

In the project sites, irrigated crops, mostly paddy, are grown during rabi. Ground water levels are now depleted due to poor monsoons in the previous years, growing high water requiring crops like paddy, and due to the State Government policy of free electricity to the farming community. With low groundwater levels, farmers have reduced the area under paddy and other irrigated rabi crops leaving fields fallow during rabi and consequently reducing the land productivity per unit area. By introducing alternatives in place of paddy such as Irrigated Dry (ID) crops like chickpea, maize and fodders, the productivity per unit land area and per unit of irrigation water can be increased.

Livestock is also an important component of farming systems in the project area as elsewhere in India and livestock production also offers opportunities for improving the livelihoods of the rural poor. Traditionally, livestock rearing has been closely integrated with crop production. Livestock support livelihoods of the poor in diverse ways:

- as a source of food, and the livestock owning populations are expected to consume more of milk, meat and eggs than others.
- as an important source of cash income for the poor. Livestock products such as milk and eggs are easily sold on a regular basis.

- as an important renewable natural resource. The resource can be accumulated through natural reproduction in times of plenty and can be sold in times of crisis.
- as an important source of draught power for cultivation, and transport for inputs and outputs;
- as the source of dung-manure for soil fertility maintenance in the mixed farming system.
- as a cushion against income shocks arising due to crop failure. This function assumes significant importance in drought-prone areas.
- as fuel for cooking for the poor household.

Rearing of milch animals provides supplementary income to over 70 percent of rural households. Milk production contributes on an average 27 percent of the household income; its contribution varies from about 19 percent in the case of large farmers to about 53 percent in the landless category in India (Shukla and Brahmankar, 1999). Apart from the monetary benefits provided by milch animals, the role of small ruminants like goats and sheep is very important as they serve as a lifeline during drought years by providing income and sustenance. This is especially true for areas like Anantapur and Mahabubnagar where in drought years the problems of water scarcity are multiplied by the low fertility of the soil. Such regions tend to have a large number of small ruminants, which are not dependent on crop residue for fodder and are able to more easily migrate to areas where edible vegetation is still available in common grazing lands. Backyard poultry is also, in many cases, an important source of supplemental income for small and marginal farmers.

Technologies to improve livestock productivity and its contribution to the livelihoods of the rural poor do exist: however, the rate of adoption of livestock-related technologies in smallholder mixed (crop-livestock) farming systems worldwide is consistently low (Francis and Sibanda 2001; Parthasarthy Rao et al., 2005). In order to solve this problem, approaches that guarantee effective linkages among researchers, NGOs, extension workers, decision-makers and farmers, who have a complex knowledge base and widely dispersed expertise, are needed (Misra et al., 1997; Conner et al., 1998; Reddy et al., 2005). Since members of farming households have access to most of the vital information, the local circumstances, culture and real goals of farming, they appear to be better equipped than outsiders to optimally design their farming systems. This implies that any interventions in smallholder crop-livestock systems should be properly tested and gradually introduced, focusing on economic viability and social acceptability.

For all interventions of farming system diversification and enterprise promotion, emphasis is placed on farmer-led, farmer-to-farmer extension, with volunteer farmers serving as resource persons. This strategy serves to empower the farmers so that they can select and adapt technologies most appropriate to their agro-ecological and socio-economic situations. This adaptation to suit their situation is expected and encouraged, facilitated by project staff-farmer and farmer-farmer discussions about the possible interventions.

For this purpose, exposure visits and dialogue are used as a guiding principle, involving open discussion among farmers, NGO workers and researchers. Apart from this, focused group discussions and diagnostic surveys are undertaken in order to obtain full information at various stage of implementation. Making available several intervention options allowed the farmers to choose what was most appropriate in their circumstances. All

stakeholders benefited from each other's accumulated experiences, skills and observations, resulting in the socialisation and sharing of knowledge.

Through these livestock and crop-based interventions to improve the rural poor livelihoods, it was hoped to reduce the seasonal urban migration which many of the cluster farmers practice. When the drought situation prevails continuously for 4-5 years, migration to cities takes place by small and marginal farmers and landless poor. Increasing livelihood options based on local resources by diversifying and introducing less risky enterprises can reduce this migration.

For ease of compilation, reporting in the remainder of this section is structured largely by main activities such that crop related issues are contained in the section 4.3, with most livestock interventions in the section 4.4. This hides the project reality of multi-and inter-disciplinary teamwork in the field with both crop-based and livestock-based interventions integrated within land use systems and enterprise diversification.

4.2. Farming system characterization.

The initial PRA in each village was designed to elicit information and understanding about the local farming systems [Annexure C and Section 2). Where further information or clarification was needed, subsequent and focused PRAs were carried out (Section 4, e.g. 4.4.1.2). This characterization of the farming systems of the target groups has informed and guided the planning and implementation of all interventions and is reported as appropriate in each section (Sections 3, 4 (4.4.1.3), 5).

In Anantapur cluster, agriculture +cattle is the dominant farming system. The scarcity of fodder during summers suggested that an appropriate intervention could be cultivation of fodder, with farmers choosing whichever fodder crop they liked to grow. This will enable the farmers to realize the gaps in managing livestock and grow fodders for lean/summer season. In Mahabubnagar cluster, the dominant sheep based farming system, suggested the "Silvipasture system" of pasture-based interventions as an alternate and supplementary land use in addition to their shepherding. This enables the shepherds to be self-reliant during the years of drought. Agriculture dominates the Tumkur cluster farming system: consequently, varied options of cultivars, vermicompost application *etc.* were offered.

In all clusters, issues of livestock productivity, livestock feed and livestock health arose from the PRA, from all farmer resource groups. Interventions on each of these issues seemed to be relevant.

4.3 Diversified Farming

The crop-based farming systems interventions carried to achieve project output III are presented cluster wise. Under each cluster, crop interventions are discussed first, followed by alternative land use systems (sections 4.3.2-4.3.4). Other non-crop based diversification options (forest nurseries and bee keeping) are presented in sections 4.3.5-6). Livestock-based interventions are presented and discussed in section 4.4.

4.3.1. Process: alternative land use systems and enterprise diversification

Climatic and soil conditions, prevailing crops/ cropping systems, local/ improved cultivars of each cluster and issues of concern to the farmers were brought out through PRA. [Annexure-C and Table 2.5, Section 2]. Two to three meetings and interactions with groups of farmers after the PRA (but without the *Salaha Samithi*) to discuss with them the available interventions and find out their interest did not result in farmers committing themselves to any of the interventions. This is because many are shy to share their experiences/ problems in the group. Though they expressed their ideas about and interest in interventions, the interventions were not carried to the fields.

Therefore, to ground interventions like introduction of improved varieties or crops during *kharif* or *rabi* as alternatives to the existing crops, individual interaction with the farmers at their field locations was found to be helpful. One-to-one interaction gave the specialists insight into the real individual situation and the constraints; enabled the farmers and, importantly, the household women who were usually absent from the public meetings, to understand the total package of practices of the proposed intervention - its potential and limitations, including the source and availability of seed, the marketability and market location of the produce *etc*.

The crop interventions were carried out at individual farm level in Anantapur and Mahabubnagar clusters. In Tumkur, the farmers preferred that the interventions were laid out as a trial-cum-demonstration on the farm of one interested individual. The farmers suggested this approach rather than many individuals testing the interventions separately as they were apprehensive about crop failures and the project had no compensatory mechanism for crop failures. Even so, at individual farm level, each and every farmer was informed and trained about the practices. For promotion of enterprises as livelihood options for landless poor, discussions were held with the target groups and the *Salaha Samithi* members. Training and exposure visits were arranged to livestock farms and training centres at Tumkur cluster for up-gradation of skills for handling the enterprises like nursery raising, ethno-veterinary practices, etc.

4.3.2 Anantapur Cluster

The soil is red sandy loam with black soil in some patches (Section 2 Table 2.1). The soil depth is approximately 30 to 50 cm with moderate nutrient status. As per Vittal *et al*., (2003), the general recommendation for groundnut is 20-40-40 N, P_2O_5 and K_2O kg ha^{-1} and if the soil test value is medium or moderate, 50% of recommended nutrients may be applied. If the soil test is low, as per the recommendation, the total recommended nutrients need to be applied. The slope of the land is ranging from 2-6 %. Average rainfall of these villages is about 520mm and the rainy season starts from April and ends in the month of December with a peak rainfall in September - October. The major crops grown in this area are cereals (sorghum, paddy), pulses (green gram, horse gram, red gram, and cowpea) and oilseeds (castor, groundnut). Papaya is a commercial crop as is groundnut, the most extensively cultivated crop of the cluster. Pigeonpea, cowpea and castor are grown as intercrops ranging from 8:1 to 20:1 proportion.

4.3.2.1 Crop Interventions

4.3.2.1.1 Introduction of improved varieties

Improved varieties were introduced in place of existing local cultivars in order to realize the potential and excellence over the performance of existing ones. A variety called Vemana (K-134) in groundnut was grown in 7 farmers' fields, ML-267 in greengram and SPV-462 in sorghum were introduced and their performance was evaluated which is mentioned in the Table 4.1.

Table 4.1: Average productivity and yields of improved cultivars of crops in Anantapur cluster

Crop	Existing cultivar		Recommended cultivar		
	Name	Average productivity (kg ha^{-1})	Name	Average productivity (kg ha^{-1})	Yield % increase over local
Groundnut	TMV-2	800-900	Vemana (K-134) (7 farmers)	1200	50
Castor	Kranthi	314	Kranthi (Research station seed) (41 farmers)	430	37
Pigeonpea	LRG-30	150	LRG-30 (Research station seed) (41farmers)	250	67
Greengram	Local	356	ML-267	410	15
Sorghum	Local	1100	SPV-462	1400	27

(Source: Project experimental plots; figures in parentheses are number of farmers)

Introduction of improved cultivars on an average increased the yields by 15-30%. The farmers felt that introduction of suitable, improved cultivars undoubtedly brings tangible benefits as improvement in the cultivar enhances the yields in the range from 15-60%. Cultivation of groundnut (popular variety of TMV-2) in this cluster costs around Rs. 8310/- ha^{-1} (with family labour uncosted) and the gross returns is to the extent of Rs. 11000/- to 14400/- ha^{-1} to make this crop a viable choice.

4.3.2.1.2 Seed cost reduction in groundnut cultivation through use of shriveled seed

Anantapur cluster area is dominated by monocropped groundnut. Groundnut is also intercropped with pigeon pea, cowpea and castor at 20:1, 8:1 and 8:1 proportions respectively.

The seed of groundnut is not only expensive (per kg) but the requirement of seed per unit area is also high because of the boldness of the seed and hence its high seed rate. About

100 kg kernels ha^{-1} is required which costs around Rs.3000/ha. Generally the farmers store the previous year's seed (variety TMV-2) for the coming season) but when there are continuous drought years, the small and marginal farmers are forced to sell the entire crop without retaining the produce for seed purpose. Also, during drought years, local production of bold seed is less. The seed from the outside source is costly and often not available, so farmers face shortages of bold seed (Reddy, T.Y., pers. Comm.) Therefore, promoting shriveled seed as a substitute for the bold seed may help small and marginal farmers: seed costs are reduced by the cheaper seed (25/-kg^{-1}) and lower seed rate (85 kg ha^{-1}). 8 male farmers tried this technology and their average yields obtained using shriveled seed are given in Table 4.2. From the table, it can be observed that the use of shriveled seed has given almost equal yield as compared to using assorted/bold/medium bold and small seed. However, by using shriveled seed an amount of Rs.2300/- per hectare (cost of bold seed is Rs. 3500/- per hectare) was saved in the cost of seed without affecting the yields. This technology was promoted especially to the small and marginal farmers to save the seed cost.

Table 4.2: Effect of seed size on growth and yield of groundnut in Anantapur cluster (No. of farmers:8)

Category of seed	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Cost of seed (Rs. ha^{-1})	Net returns (Rs. ha^{-1})
Assorted	1097	2135	3125	6105
Bold	1180	2302	3500	7032
Medium	1169	2229	2300	8014
Small	1001	1801	1440	7100
Shrivelled	987	1958	1200	1211
SEm ±	105	89		
CD 5%	NS	267		

The farmers were happy to get the confirmation from the researchers of the equivalent yields harvested from shriveled seed similar to the bold seed as they were forced to adopt this technology during drought years. The farmers will continue to practice when the drought is prevalent though priority is given to bold seed only.

Availability of micro-credit may help the farmers to procure bold seed, but its frequent non-availability and its high cost may deter the small and marginal farmers to buy bold seed. During drought years, micro-credit may be burdensome, rather than of help, to the small and marginal farmers.

Further, some refinements of the existing intercropping were advocated. For example pigeonpea is generally grown with groundnut at 8:1 to 20:1 proportion. Observing the drought conditions prevailing in this area, it was suggested to the farmers to increase the number of pigeonpea rows, as its performance would be better even under drought

conditions, to reap more of pigeonpea, a major pulse crop even if the groundnut crop fails. The farmers are impressed with the suggestion and agreed to carry out the same in future.

4.3.2.1. 3 Fodder production

The priority crops to grow as given by the farmers are in the order of the staple crops, and then commercial crops and orchard: fodder crops are not considered a priority. Moreover, the initial project PRA was conducted when green fodder scarcity would not be felt due to its availability in plenty at that time. The necessity for fodder arises during *rabi* when the rainy season ends, and the green fodder availability cease. At that time, whatever little irrigation source is available may not suffice to grow a paddy crop, which yields fodder well as grain. Some farmers are able to feed nutritious fodder of groundnut haulms but for only 1-2 animals. Owing to these reasons, for many farmers, their livelihood strategy is to purchase animals during rainy season because of fodder availability and sell them during summer season because of fodder shortage, when the farmers may migrate away. Further, the daily milk yields realized from local breeds are low (1-2 l/cow). If green fodder was available during *rabi*, cattle sales and human migration might be reduced, milk yields could be increased and the farmers' livelihoods could be improved. Therefore, the idea of fodder production was introduced to the farmers to encourage productive livestock management even during *rabi* and summers.

To overcome all these problems, it was proposed to introduce Napier hybrid CO 1, which is a highly nutritious perennial and multi-cut fodder, under irrigated conditions in a smaller area alongside the farmers' priority of their staple crop of paddy under irrigated land. However, most farmers still initially refused to spare their land due to the reasons given above. One women farmer came forward to take up Napier planting in her field. She was supplied with the cuttings for an area of 1/10 of an acre, which she grew successfully and started feeding to her milch animals. This has resulted in increased milk production and also quality of the milk (Annexure G, Case study-1). Seeing this benefit, more farmers came forward to take up fodder cultivation and now at present around 60 farmers representing all socio-economic classes are growing CO1 fodder. The yield and economic benefits accrued from growing fodder is furnished in Table-4.11. The seed material (cuttings) was being shared freely by the farmers to their fellow farmers, which is unique. Two farmers who started growing fodder first have increased the fodder cultivation area from 0.02 hactare to 0.2 hactare due to increased milk yield and purchased additional milch animals.

Farmers opined that fodder from 0.12 hactares area and staggered cutting is sufficient to feed 5 – 6 animals throughout the year and due to the high nutrient content of fodder, the animals gave more milk (average increase of 1.5 litres/day with a maximum increase of 3 litres /day) and thicker milk, earning an extra amount of Rs. 5-15/-/day/animal (net) or Rs. 10-35/-/household. Furthermore, the milk supply is continuing for 9 months instead of 6 months, as with staggered cuttings the availability of fodder is regular. Consequently this has encouraged stall-feeding also. The farmers were very happy with this intervention since their livelihood is maintained for 9 months in a year. With a rainfall situation in these drylands tracts that is highly uncertain and not dependable, their available meager land and minimum irrigation resources, the farmers realized that integration of growing fodders and rearing milch animals provides a better livelihood. (See also Section 4.3.1.9 for an analysis of the economic benefit of fodder cultivation for milch animals).

4.3.2.2 Alternate land use systems

Due to intermittent drought, the monocropped area under groundnut leaves the farmer without reliable income support. To overcome the instability in income, risk of crop failures and labour scarcity, alternate land use systems like agri-horticulture were promoted.

About 7 men and 2 women farmers initially came forward to take up horticulture plantation in their groundnut fields. Most of the farmers preferred mango under rainfed situation. The farmers have taken up planting mango (225 numbers) or tamarind (505 numbers) plants in their fields along with groundnut and red gram crop (groundnut + red gram + mango/tamarind). In addition to this, farmers with irrigation facilities (about 21 men farmers) came forward to take up pure horticulture plantations of sweet orange, acid lime and papaya (1520 plants) as there is a good market demand for these crops.

The alternative land use of agri-horticulture system is expected to produce five-fold income compared to the traditional cropping system. The tamarind and mango plantations yield from the 4^{th} and 5^{th} year onwards respectively. However, production of economic yield starts from 7-10 years onwards. A net income of Rs.10, 000-15,000 per ha is then expected from the tamarind plantation, depending upon the age of the plant, with an annual maintenance of Rs.5000/- per ha. (personal communication from BAIF). In the case of mango, annual maintenance per ha ranges from Rs.15,000 to 25,000 for the initial years and the net returns from year 9 onwards are about Rs.30,000-45,000/ ha (Sujatha, 2004). During the early years, and depending upon the rainfall situation, the farmers can sustain on the income from annual crops in the plantation. Due to the low rainfall, seedling survival was disappointing at about 30% survival. Given the continuous years of drought, survival of plants during summer is of great concern to the farmers.

The agri-horticulture system was also promoted with the help of *Salaha Samithi* members in CPR land i.e., unutilized temple endowment land. 85 mango and 20 tamarind plants were planted together with some vegetables and flowers sown in a small area near the farm pond that was dug out in the CPR. This land is managed by a landless labourer.

Mostly the spread of area under alternate land use systems especially agri-horticulture system is nearer to the hillocks which harbour wild boars. These wild boars in search of food attack the annual crop of groundnut, which is relished by them. Since killing wild boar is against the rules of Forest Department, the incidence of crop damage appears to be larger. Farmers are adopting measures like electrifying the field fence, increasing watch and ward of the crops which reduces but does not prevent crop damage. Therefore, identification of alternative crops that are not favoured by wild boars for the agri-horticulture system becomes a researchable issue.

Besides the agri-horticulture system, the plantation consisting of horticulture (sweet orange) and forestry plants (1979 seedlings of Glyricidia, Subabul, Neem and Pongamia) was carried out on farm boundaries, bunds, embankments etc., covering approximately 107 acres.

4.3.3 Mahabubnagar Cluster

The soils in this cluster are red sandy and black clay. The soil depth is 30 to 50 cm with moderate nutrient status. Average annual rainfall in these villages is about 600mm and the rainy season starts usually from June end or early July with 15-20 rainy days. Major crops are castor, sorghum, maize, pigeonpea, groundnut and paddy in *kharif*, groundnut, paddy and vegetables in *rabi*. Farmers in cluster villages grow castor with pigeonpea, sorghum with pigeonpea / green gram.

4.3.3.1 Crop interventions

4.3.3.1.1 Contingent cropping

As a contingent crop, pearl millet was suggested to the farmers to grow in this cluster. However, all the farmers had refused to grow justifying that pearl millet is neither a cash crop nor a staple crop. It ceased to be a staple crop due to the shift in the dietary pattern (which had moved towards rice): it is used in preparing livestock feeds and fodders but only in small quantities. Although pearl millet is a contingent crop, it failed to become popular due to the above reasons. Therefore, to encourage such crops, ways to add value, either in livestock feeds (increasing its proportion) or through increased consumption in the form of malt or snacks may be a researchable issue.

4.3.3.1.2 Introduction of improved varieties.

Sorghum and castor are grown as major rainfed crops in Mahabubnagar cluster. Traditionally farmers were following this practice for the past 3-4 decades. Sorghum is grown for both grain and fodder for which the dryland farmer invests around Rs. 2,800 to 3,000/- per hectare and may come out with gross returns of around Rs. 8,000 to 8,500/- per hectare. Therefore, a dual-purpose cultivar like SPV-462 was introduced in which case the farmer can reap the good quantities of fodder. For the existing crops like castor, which is cash crop, Kranthi was introduced. With castor, the farmer invests about Rs. 4,000-4,500/- per hectare for gross returns of Rs. 8,550-9,000/- per hectare. Similarly for pigeonpea (LRG-30), maize (DHM-107), chickpea (Annegeri and ICCV-2) *etc*. the high yielding varieties were introduced to enhance the harvest potential. The potential yields of these improved cultivars were unable to be realized, due to drought and unbalanced rainfall distribution.

However, through the provision of improved cultivars for the on-farm trials and information on source of availability of seed material, awareness about the new varieties was created among the farmers. Despite not realizing their potentials, the improved cultivars increased the yields from 20-30% as is mentioned in Table 4.3. Except in some cases like maize, the introduced cultivars are open pollinated varieties. With this there is hope of varietal continuation in these cluster villages even after withdrawal of the project.

Table 4.3: Average productivity levels and yields of crops under improved cultivars in Mahabubnagar cluster

Crop	Existing cultivars		Improved Variety		
	Name	Productivity (kg ha^{-1})	Name	Yields (kg ha^{-1})	% increase in yields
Castor	Jyothi	220	Kranthi (74)	340	55
Sorghum	Local	800	SPV-462 (7)	1000	25
Pigeonpea	LRG-30	150	LRG-30 (40)	210	40
Maize	Private Hybrid	1600	DHM-107 (6)	1700	6
Groundnut	TMV2	400	TMV-2 (7)	540	35
Paddy	Tella Hamsa, Sona Mahsuri	1500	Not introduced	-	-

(Figures in parentheses are number of farmers tried)

4.3.3.1.3 Introduction of low water requiring crops as irrigated dry (ID) crops in place of paddy

Traditionally people raise paddy as irrigated crop during *rabi.* Continuous and regular drought for the past 4-5 years led to reduced groundwater resource resulting in a large paddy land area being left fallow during *rabi*. In order to utilize this land, to increase per unit area productivity and increase water use efficiency, irrigated dry crops (ID) were introduced. Chickpea (ICCV-2 and Annegeri), maize and fodders (PC 23, Co-1, Para grass, Lucerne) were tried as alternative crops in place of paddy as they require less water. It was observed that chickpea is a very good alternate crop as it has a good market potential; it comes up with the minimum stored soil moisture and was adopted by the farmers. Maize and fodders were also good.

As was mentioned above, the fodders are definitely the most widely adopted intervention but require more irrigation water. Less water is required by the chickpea crop and sometimes no water at all in low-lying areas. With water from 1 hectare paddy, 3-4 hectares chickpea could be raised using the water efficiently (Policy brief- III, Annexure F). The impact of ID crops was evident in the increased number of farmers interested in growing chickpea and fodders during *rabi*. (Table 4.4). Though the increased number of farmers growing chickpea was just 2, there were requests from more than 25 farmers to supply seed, but who could not sow due to delayed seed supply. Further, the wild boars are not relishing chickpea, which is a blessing.

Table 4.4 . Farmer uptake of alternative *rabi* crops to paddy

Crop	Number of farmers growing		Average yields obtained (kg ha^{-1})
	2003	2004	
Chickpea	8	10 (25 farmers requested)	350
Maize	2	3	640
Groundnut	7	10	350
Fodders Co-1/ Para grass PC-23	3	82	**Green** 200 t 50 t

Lucerne was grown as a palatable and nutritious ID fodder crop but was palatable and nutritious to wild boars also. The severity of the damage leads project staff to conclude that lucerne may be promoted when the wild boar deterrent practices are standardized. However, farmers identified it as a promising fodder crop and on their own initiative planted it during a second year and started to develop improved practices for wild boar deterrents. This is an example of farmers using their own indigenous knowledge and blending it with that of the scientists to adapt the technology to their own situation.

4.3.3.1.4 Fodder production

Initially the farmers in this cluster were reluctant to grow green fodder crops in their fields as paddy is the staple crop and priority is given to it. During the first year (2003) only one farmer has grown fodder crops in his paddy fields in *rabi* season. After an exposure visit to Anantapur and farmer-to-farmer interaction, the farmers' initial reluctance was weathered as they realized that with minimum land, depleted water resources and prevalent drought conditions, it is really difficult to continue livelihood with only agriculture. They realized that integration of livestock and fodder production within their land and water resources could improve their livelihoods and a large number of farmers came forward for growing fodder crops rather than paddy. Thus during 2004, around 82 farmers have taken up growing fodder crops. (See also Section 4.4.10 for an analysis of the economic benefit of fodder cultivation for milch animals).

4.3.3.2 Alternate land use systems

Silvi-pastoral system

This system was promoted in the marginal lands, which were not used for crop growing. 2 male farmers who have marginal lands wanted to take up pastures along with trees like Subabul. Subabul had only 33% survival while establishment of *Cenchrus* was not successful due to prevailing drought conditions. Though the farmers realized the value of this system, the long-term gestation and the off-season attention of protecting the plants from grazing as well as the water required made this intervention less adoptable. For such

interventions, it is important to keep the interest of the farmer at its peak through continuous follow-up and monitoring even after the project period.

In addition to this, plantation of horticultural plants (acid lime) and forestry plants teak (275 no.), subabul (Leucaena leucocephala -230 no.), Gliricidia (210 no.), etc. was carried out in 19 farmers' fields.

4.3.4 Tumkur Cluster

In this cluster, finger millet was grown as a major dryland crop under both rainfed and irrigated conditions. Considerable areas in the cluster come under coconut plantations, which are totally rainfed. The soil type is red sandy and slope is between 1-2%. Finger millet ranked first in terms of cropping area, whereas horse gram, dryland paddy, small millets and Niger (*Guizotia abyssinica*) occupied a smaller area, to meet the household food needs and as fodder for their livestock

During early *kharif* green gram and black gram were grown as sole crops and niger and field bean were grown as mixed crops with finger millet. During late *kharif* and *rabi* season, finger millet, cowpea, small millet crops were grown in this area. Crop rotation methods were traditionally followed by most of the farmers. They were not using the improved varieties due to lack of knowledge of advances in technology.

4.3.4.1 Diversified crops/cropping systems:

4.3.4.1.1 Introduction of improved varieties

Most of the farmers were found growing local varieties of crops like finger millet, sorghum, red gram, *etc*. In view of this, observation plots were planted by one farmer with the following improved varieties of these crops. The yields obtained and presented in Table 4.5 show that on an average 30-50% increase in yields were recorded. In the words of the farmers of Tumkur cluster, the improved cultivars of different crops did make a great impact in terms of the yields achieved. Therefore more numbers and more area of demonstration-trials are suggested for the future.

Table 4.5. Existing local cultivars and improved cultivars yield comparisons of different crops in Tumkur

Crop	Existing cultivars		Improved variety		
	Name	Yield (kg ha^{-1})	Name	Yields (kg ha^{-1})	% increase in yield
Finger millet	Local	600	MR-1 (5) GPU-28 (9)	1000	67
Sorghum	Local	800	CSH-14 (33)	1250	56
Pigeonpea	Local	700	TTB-7 (5) Hy-3c (5)	950	36

(Figures in parentheses are number of farmers planting)

4.3.4.1.2 Fodder production

The major source of fodder is crop residues of the finger millet (*ragi)*, sorghum (*jowar)*, greengram and horsegram. During off-season, their scarcity and exorbitant price (Rs. 5,000/- per cartload) made them unaffordable to most farmers. The village milk co-operative society provides mineral mixtures (@Rs. 30/- per kg) and seeds of fodder crops at a subsidized price and so farmers gave no importance to growing fodders. After the involvement of the project staff, 20 farmers came forward to take up cultivation of fodders (Appendix 2.1). Napier grass Co-1 and Co-2 cultivars were introduced in the coconut orchards and on bunds. Co-2 (210 tonnes ha^{-1}) performed relatively better than Co-1 (190 tonnes ha^{-1}).

4.3.4.2 Alternate Land Uses

Plantation of horticulture and forestry plants was carried out by providing each family with horticultural plants (total 3850 seedlings) *viz* mango, cashew, tamarind and jackfruit, which were planted on bunds, borders and in trench cum-bunds. The periphery of the land of these participants was planted with more than 15 varieties of forestry plants (Cassia, Subabul, Glyricidia etc).

4.3.5 Nursery raising

Nursery raising and maintenance in the cluster villages is a new intervention being carried out for the first time in the villages. In the clusters most of the people are small, marginal farmers and landless people. To improve the livelihoods of the landless poor, landless poor persons including women were identified for nursery training. Five men in Anantapur, two women per village in Mahabubnagar and 10 women in Tumkur were trained. During the training at Lakkihalli farm in Tumkur, the participants were taught grafting techniques, propagation methods and the techniques of nursery raising. After training, 4 nursery units (one per village) started in Mahabubnagar cluster, 3 men started in Anantapur cluster, and the ten women in Tumkur, raising a nursery in their backyards to supply seedlings to project supported tree interventions related and earning income.

Inputs like seeds, polythene bags, were supplied with a buy back system, from the project @ Rs. 2 /- per live seedling. The cost and returns from nursery raising is presented in table 4.6. From this it can be seen that the women could obtain around more than Rs.10,000/- profit by utilizing their free (and uncosted) labour. This has also enabled some of the women to obtain some capital assets and investment. One landless woman who has raised nursery informed that she has purchased some gold ornaments and also invested in starting a small grocery shop. This shows that this activity can be a sustainable activity for developing women entrepreneurship. The women are willing to continue this nursery activity but are now uncertain of where to market their produce. Facilitating linkages with State departments like Forestry and also local big nurseries in the nearby district headquarters could be a solution; or diversifying their nursery production to meet local needs for example vegetable seedlings.

Table 4.6 Cost and Returns of Nursery Raising

(Mahabubnagar cluster)

Total No. of Plants: 7500	
A. COSTS :	**Rs.**
i) Labour for filling the polythene bags with soil 20 women labour @ Rs. 30/day	600.00
ii) Cost of material (FYM, soil & sand) **	2400.00
iii) Cost of polythene bags (7500) @ 0.25/bag **	1875.00
iv) Cost of seed **	500.00
Total cost	5375.00
B. GROSS RETURNS: 7500 plants @ Rs.2/plant	15000.00
C. RETURNS for family labour*	**9625.00**

* Watering was done by the landless women who have raised the nursery

** Supplied by the project

For two women of Chowderpalli village of Mahabubnagar cluster, water availability was a problem. But with the intervention of *Salaha Samithi* members, water at the site was arranged from nearby farmers having water sources.

Community members participated in larger number on the day of Green Festival (*Hasiru Habba*) in Shankarnhalli, and planted 49,000 seedlings that were supplied by the nursery activity participants. One farmer was motivated to start a commercial nursery with 10,000 seedlings with varieties of forestry and horticultural seedlings that were in great demand at Shankarnhalli. Through this enterprise, the gender issue was taken into consideration.

The participants can utilize the profit obtained from nursery as "Seed Money" for further development of nursery in the coming years and to try for loan from banks for nursery development with the support of *Salaha Samithi*, Bank, Forestry Dept., VSS and others.

Nursery raising, as a group activity is not recommended, as the returns are unlikely to be sufficient to maintain interest of group members. It is an activity that is best be promoted at the individual level.

4.3.6. Bee keeping

Bee keeping was introduced in the Tumkur cluster to 21 farmers. However, the yield from the honeycomb was poor due to frequent migration of bee colonies, which was thought to be due to intensive pesticide application for gherkin cultivation. Therefore, bee keeping may be a potential livelihood option under the circumstances of non-pesticide intensive farming.

4.3.7 Sheep rearing

Sheep rearing was offered as a livelihood diversification option for the poor and landless villagers in all clusters. This is reported in full in section 4.4.10.

4.4 Improved livestock production

4.4.1 Process adopted

The project introduced a participatory approach to developing livestock technologies with stallholder farmers in selected clusters. The approach takes advantage of indigenous knowledge and the capacity of farmers to experiment and solve their own livestock feeding problems. It uses many of the principles of Participatory Rural Appraisal, but extends the active participation of farmers well beyond the initial stage of appraisal to technology development and evaluation on farms. The approach begins with in-depth participatory diagnosis by a broad cross section of the farming community, including both men and women and farmers from the different wealth groups. This helps the community to define, group and prioritize their main problems.

After identifying the major problems, various interventions, mostly in the form of observation trials-cum-demonstrations, were planned and discussed in *Salaha Samithi* (farmer advisory committee) meetings. Several interventions were brought to the doorsteps of farmers in the form of a 'basket' of technologies' in order for the farmers to select those interventions they felt could assist them in producing optimal farm management systems. Then, a comprehensive schedule for implementing the technical interventions was discussed and finalised in the *Salaha Samithi* meetings. An 'open door policy' was adopted for the interventions, implying that all interested farmers in the community were free to participate in them. *Salaha Samithi* facilitated implementation and monitoring of interventions. Volunteer farmers served as advisory persons. The evaluation process is monitored and assessed by the *Salaha Samithi* members and necessary changes made to any technology that is being developed or adapted. The core principle of the process is active, decision-making involvement of farmers at all stages of technology development with technical input and facilitation by project staff. Attendance of community members at the SS meetings and the number of farmers willing to introduce the technologies into their farming systems were regarded as indicators of acceptability.

4.4.2 Livestock resources in selected clusters

Table 4.7 presents the livestock resources of the selected clusters. The population of small ruminants (sheep and goats) was highest in and Mahbubnagar and Anantapur cluster whereas local cattle dominated Tumkur cluster.

Table 4.7. The livestock population of the selected clusters

S.No.	Particulars	Anantapur	Mahabubnagar	Tumkur
	Livestock resources, Nos (%)			
	Cows	730 (15)	310 (7)	550 (58)
	Buffaloes	402 (8)	500 (10)	25 (3)
	Bullocks	450 (9)	270 (5)	210 (22)
	Large Ruminant	**1582 (33)**	**1080 (23)**	**785 (83)**
	Sheep	2590 (54)	1850 (39)	80 (8)
	Goat	620 (14)	1850 (39)	85 (9)
	Small Ruminant	**3210 (67)**	**3700 (77)**	**165 (17)**
	Total	4792	4780	950
	Poultry	1650	5700	65

4.4.3 Major traditional livestock production systems in selected clusters

The livestock production systems are rather complex and generally based on traditional and socio-economic considerations, mainly guided by available feed resources. (Misra et al., 1997 and NRSP Project PRA 2003; Reddy et al., 2005) The traditional livestock production can be described as low input system. These traditional production systems are designed to be self sufficient at the household level and are dependant on the low-cost agro-by-products as nutritional input to animals for producing quality food of high biological value. This kind of livestock production system is very common in rural areas and practiced by small and marginal farmers or landless people. Low technology uptake, insufficient market facilities and infrastructure and small economies of scale are common. Keeping livestock in rural areas is treated a means of security and sometimes of status, whereas in peri-urban areas, milch animals are primarily kept for production of milk. The characteristics of various kinds of production systems are given below:

4.4.3.1 Cattle and Buffalo:

Predominantly local buffalo and cattle are largely kept for production of milk for direct consumption and occasional sales in rural areas. The animals are maintained mostly on open grazing and locally available feed resource. In peri-urban areas, mostly graded or pure bred Murrah buffalo and occasionally high blood crossed Jersey/Holstein Friesian are maintained. Most of the feed and fodder is procured from outside and the enterprise is profitable because of the closeness of a quality-appreciating market and the resulting high value of milk.

The productivity of animals depends on many factors, such as genetic potential, quality of feed, availability of animal health and breeding services, and management practices. Production traits of milk animals play a crucial role and have a profound influence on the cost and returns of dairy enterprise. Milk production in the selected clusters is a low-input, low-output farm activity with a smallholder production system. The average milk productivity per year per cattle is about 1,124 kg. The available data on milk yield indicate that average productivity of cows went up substantially during last 2 decades. There is an increase in the yield of buffaloes also, but it is less sharp than that of cows. A key factor accounting for the sharper increase in cow milk yield is the increasing proportion of crossbred cows (NRSP Project PRA, 2003) due to government supported AI facilities. In general, buffaloes have higher yields than indigenous cows, but crossbred cows are more productive than either indigenous cows or buffaloes. The average productivity of local cows is 3.08 kg/day. For crossbred cows it is 5.73 kg/day. The average productivity of buffaloes is 4.15 kg/day.

4.4.3.2 Sheep and goat:

In Anantapur, Nellore sheep are kept in mostly stationary flocks whereas, in Mahabubnagar, mainly Deccani, partly stationary partly migratory flocks are maintained. In Anantapur, farmers purchase lambs for the purpose of fattening for a period of 4 to 5 months and sale for ready cash. Flock size fluctuates from a few to 30 head. In Mahabubnagar, most villagers have few goats that utilise the available fodder trees. The concentration of goats is higher in Mahabubnagar than in Anantapur: farmers of Andhra Pradesh consider sheep and goats as a working capital and opt for a zero input system of production.

4.4.3.3 Backyard poultry:

Keeping a few chickens for eggs and meat for direct consumption is a widely spread practice in Anantapur and Mahabubnagar. By contrast, in Tumkur cluster poultry is a less preferred species of animal because of the dominance of *Lingayat* community who are mostly vegetarians.

4.4.4 Problems related to livestock production in different clusters:

In Anantapur, livestock are experiencing serious fodder and water scarcity in summer, accentuated by the drought in the last four years, and leading to a sharp decline in livestock population. Foot and mouth diseases and premature abortions have been mentioned as major diseases among cattle and buffaloes.

In the Mahabubnagar cluster a similar situation prevails. Fodder availability is maximum for four months between August and November with acute shortages between March and June. Foot and Mouth Disease (FMD), Black Quarter and Haemorragic Septicemia are the major diseases among cows and buffaloes. Among sheep and goats, FMD and Blue Tongue are common. Livestock diseases occur mostly between November and February. Similarly in Tumkur cluster, heavy morbidity due to FMD was reported with shortage of fodder in summer as the main problem.

Thus, low productivity of livestock due to inadequate availability and poor quality of feed and fodder; high incidence of diseases; and inadequate knowledge on appropriate management of livestock was identified as the major problems facing smallholder farmers in the selected cluster villages. The most important constraint prioritized by the farmers in all the cluster villages was the problem of fodder availability.

Table 4.8 presents the suspected causes of low productivity of livestock in selected clusters and strategies adopted to solve the problem by NRSP project

Table 4.8: Identified constraints to low livestock productivity, suspected causes and adopted strategies

Problem	Suspected Causes	Adopted strategies
Inadequate quantity and poor quality of feed resources	Lack of fodder production efforts and inadequate knowledge on how best to utilise locally available feeds	Promote fodder production and chopping of fodder
Low milk yield in cows and buffaloes	Poor genetic potential of native breeds and imbalanced nutrition	Up-gradation of native animals with improved breeds and supplementary feeding of mineral mixture and urea molasses mineral blocks
Poor health particularly in dry months due to high incidence of infectious diseases	Heavy worm loads, compounded by poor nutrition and irregular deworming/vaccination	Promote regular deworming and timely vaccination
Poor management practices	Inadequate knowledge on appropriate livestock management practices	Reinforce farmer training on all aspects of livestock management

Table 4.9 is a summary of the technical interventions carried out to address the problems. As indicated in 4.1.1, adoption of livestock-related technologies by smallholder mixed (crop-livestock) farmers is usually slow. Farmers need to be able to test such interventions taking into account their economic viability and social acceptability. The project assisted the farmers to do this, with back-up from appropriate specialists.

Table 4.9 shows the number of farmers who participated in the intervention trials. The detailed outcome of the various interventions undertaken is given in the following sections: but the large number of participating farmers is proof of the acceptability of the technologies and practices.

Table 4.9. Summary of technological interventions and number of farmer taken the interventions

Technological intervention	**Number of participants/units**			
	Anantapur	**Mahabubnagar**	**Tumkur**	**Total**
Animal health camp	-	2	2	4
Animal treated	-	3200	670	3870
A. I. Centre established	-	1	-	1
A.I. done	-	411	-	411
P.D. Confirmed	-	187	-	187
Calves borne	-	76	-	76
Training in A.I. to youth	3	3	3	9
Training in ethno-vet.	-	4	3	7
Fodder production (perennial / annual)	61	82	20	163
Chaff cutter (manual + power operated)	3+1 = 4	3+1 = 4	3+1 = 4	12
Demonstration of UMMB feeding	-	20	-	20
Demonstration of mineral mixture supplementation	-	200	28	228
Sheep rearing	45	20	8	73
Backyard poultry	19	70	2	91

4.4.5 Integrated animal health camp:

Almost 90 % of the farmers in the cluster villages did not follow the deworming and vaccination calendar recommended by the veterinary staff. Most of the farmers lacked confidence in applying the extension advice and cited cash constraints as a compounding problem. This problem was discussed in *Salaha Samithi* meetings along with the local veterinary staff of the respective clusters. As a result and in conjunction with the local Animal Husbandry Department, animal health camps were conducted in Mahabubnagar and Tumkur cluster. Promotional campaigns were also launched in these clusters that encouraged farmers to adopt a regular vaccination and deworming schedule as a preventive measure and to provide mineral supplements to animals to overcome the problem of infertility in case of buffaloes and crossbred cattle. In Anantapur camps were not conducted because of the regular availability of Government veterinary staff in the village. Initially, the cost of medicines was met from the project funds. Afterwards, the *Salaha Samithi* mobilised the funds from the farmers.

In Mahabubnagar cluster, two animal health camps were conducted during November and December2003, in which 2500 sheep and goats, 700 cows and buffaloes were dewormed against intestinal parasites. Three hundred cows and buffaloes were vaccinated against Foot and Mouth Disease; 150 animals were examined for infertility and 6 artificial inseminations were performed. Besides this, 1 kg each of mineral mixture was given to 200 dairy farmers for use in concentrate feed. Another castration camp was organized in the cluster in which 184 calves were castrated to prevent unwanted breeding.

Similarly in Tumkur cluster, an animal health camp was organised during January, 2004 at Shanakarnahalli village, in which more than 500 animals were treated. Irrespective of the species, all the animals were dewormed. About 165 sheep and goats and 30 poultry birds were vaccinated and about 100 cross breed cows, fifty local cows and fifty buffaloes were given gynaecological treatment and supplementary feed (mineral mixture).

Another, follow up animal health camp was conducted in February, 2004, in which 170 cattle and sheep were treated for deworming and vaccination for foot and mouth disease. It was observed that most of the animals suffered from malnutrition, therefore 50 kg of mineral mixture were supplied to 28 participants to improve the nutrition of the cows and buffaloes.

The impact of the animal health camps on livestock productivity was monitored by recarding the farmers' observations on mortality, growth and health of the animals at regular intervals among the selected households. Implementation of scheduled prophylactic health measures has reduced mortality from 17 to 8 percent in small ruminants and from 12 to 7 percent in large ruminants. Most of the farmers reported an increase in growth rate of 25 - 30 percent in the animals between 6 and 12 months of age in their flocks. The treated cows recovered from mastitis. About 30 percent of the animals which were suffering from the gynaelogical problems become pregnant after treatment ((Tumkur cluster). Further, farmers reported immediate recovery of animals from recurrent attacks of gastro-intestinal parasite infestation. A large gathering of farmers from all livestock owning wealth groups was evidenced during the animal health camps. Camps created awareness among farmers regarding the adoption of better livestock practices. Farmers are demanding more number of such camps in the clusters. The more progressive farmers are following the recommended livestock management practices at their own cost.

4.4.6 Ethno-veterinary training :

From each cluster, 3-4 persons who are already involved in the livestock treatment of diseases were identified and trained at BIRD-K Shankar Lakkihally in order to upgrade their skill and capacity. All the trained persons are doing good service as para vets in their respective clusters. They are helping the farmers in identifying the health problems, providing information on husbandry practices and treating the sick animals. They have become a good link between the Animal Husbandry department and farmers. Even the Animal Husbandry department recognized their talent and seeks help from them during vaccination and deworming camps.

4.4.7 Artificial insemination centre: breed improvement and capacity building

The project staff encouraged farmers to breed indigenous cows and buffaloes with improved breeds, particularly Jersey and Murrah, through A.I. This was done in order to combine the hardy characteristics of indigenous cattle (namely tolerance to poor nutrition, heat stress and tropical disease challenge) with high milk-producing qualities and hence the higher income potential of the improved breeds.

To support this, an artificial insemination (AI) centre was established in Chouderpally village of Mahabubnagar cluster to provide door to door artificial insemination service and to serve as a training centre to promote entrepreneurship among the unemployed youths in the project villages.

An unemployed youth of Mahabubnagar cluster was trained in Artificial Insemination at Tumkur for three months to enable him to take up the cattle breeding AI for breed improvement in the project area and to train the other interested persons. The AI trained youth at the AI centre has now trained another three persons and is running the AI centre successfully. He is earning on an average Rs. 3000/ per month from the AI centre by charging the farmers Rs. 20/ per AI done. In addition, he receives an incentives of Rs. 50/ per calf born from "Farmer's Corpus Fund" of BIRD-K.

The performance of the AI centre since its inception in November 2003 until project closure (31st March, 2005) is presented in Table-4.10. This shows that the conception rate achieved by the centre is considerably higher than the usual Veterinary Department AI conception rates (GOI, 2004; 2005).

Table-4.10: Performance of Artificial Insemination Centre at Chouderpalli, Mahabubnagar cluster

Particulars	**Cattle**	**Buffaloes**	**Total**
AI Done	77	334	411
Pregnancy diagnosis performed	38	149	187
Calves born	23	53	76
Male	10	34	44

Female	13	19	32
No. of services per conception	1.4	2.0	1.7
Conception rate (%)	71.4	50.0	68.75
Animal Husbandry department conception rate			20-45%

More than 300 farmers from all sections of the community (Rich/Poor; Forward /Backward caste; SC/ST)/ used the AI service for breeding their cows and buffaloes. Farmers from the surrounding villages (apart from project villages) also used the services of AI centre for up gradation of local cows and buffaloes.

Most of the cattle/buffalo owning farmers accepted this extension advice to crossbreed their animals using AI, and have suggested that the AI manager should be provided with a mobile phone for easier and prompt contact! However the absence of stall-feeding makes it more difficult to control breeding when cattle are in the field during grazing.

4.4.8 Chopping of crop residues:

In all the clusters normally the farmers offer fodder without chopping where as in case of sorghum and maize they cut it by sickles into large pieces (50 cm length). In this kind of prevalent practice, wastage of the fodder is very high. In order to reduce the wastage of feed resources, the chaffing of fodder was promoted. The advantages of feeding chaffed feed are that it avoids wastage and prevents selective consumption. Feeding of chopped roughage reduces the energy wasted while chewing, increases the feed intake and improves digestibility. Farmers observed that cutting of the fodder into small pieces is laborious task but good feed to the animals.

Two kinds of chaff cutter: manual and power operated, were promoted in all the clusters (Section 5). By using the cutter wastage of the fodder could be reduced substantially (up to 30%). For personal use, villagers preferred the manual chaff cutter rather than the powered chaff cutter, because of its low cost as well as easy operation. Only two persons are required to cut the fodder by manual chaff cutter, whereas for the power operated chaff cutter, a minimum of three persons are needed to perform the task satisfactorily. The power chaff cutter is generally fixed in one place to which people have to bring their fodder for cutting, which is not preferred by some social groups. However, one advantage is that it can provide a livelihood option: because of its output capacity, the owner or operator charges a cutting fee (Rs. 0.70/crop residue bundle of about 10 kg) to villagers those wishing to cut their fodder.

4.4.9 Improved feeding practices

A focused group discussion and formal topical survey showed that the farmers were mixing different feed (concentrate) ingredients such as wheat bran, rice bran, cakes, broken grains, *chunies* (broken grains of pigeon pea/ black gram) before offering them to their animals as supplements or in a few cases, as complete diets. However, the quantities of individual feed ingredients included in the concentrate mixtures seemed to depend on their relative availability rather than on the farmers' conscious desire to supply better quality feed to their animals. Only lactating cows and bullocks during work were allocated the supplementary feed. This eexisting farmer practice appears to be a good example of strategic supplementation. Lactating and work animals require extra nutrients to meet the requirement and farmers use their limited available resource (concentrate feed) based on the priority of the animals. Thus, the existing practices seem to be good. Nonetheless, future research to assess the nutritive value of the feed ingredients used by the farmers in the area for diet formulation could enable recommendations for improved formulation and nutrient balance to be made. In this region, such information presently is not available.

The farmers reported that repeat breeding was a serious problem in their herds particularly in buffaloes and crossbred cows. Probably, this was the major cause of the long calving intervals. Mineral deficiencies were suspected to cause this problem. Use of mineral mixture in concentrate feed was demonstrated to the farmers of Tumkur cluster to overcome this problem. Farmers' response was very encouraging: they observed an improvement of 0.5 to 1.0 litre/animal in milk yield due to supplementation with mineral mixture. They also reported that mineral supplementation was helpful in increasing the appetite of animals. Now farmers from all wealth groups have started purchasing the mineral mixture from the local market and mixing in the concentrate.

In order to improve the productivity of milch animals, supplementary feeding of mineral mixture through urea molasses mineral blocks (UMMB) was demonstrated to the farmers in Mahabubnagar cluster. The main objective of UMMB supplementation is to provide a constant source of degradable nitrogen throughout the day and promote growth of rumen microbes in ruminants fed poor quality forage. The UMMB contains soluble and fermentable nitrogen from urea, highly fermentable energy from molasses, and essential minerals. Natural proteins source such as groundnut or cottonseed extract have also been added to provide preformed peptides and amino acids, increasing the nutrient content.

Twenty local lactating buffaloes were selected for demonstrating the benefit of supplementing UMMB. The feeding was done during March-April, 2004. The buffaloes were managed as per the farmers' own practice. Based on the traditional feeding practices, animals were grouped into two groups: T_1 – Farmers practice (10 animals) and T_2 - Farmers practice + UMMB *ad lib* (10 animals). The feeding of selected animals consisted of dry and green forage, plus a small amount of dairy concentrate varying from 1.0 to 3.0 kg/animal per day, with grazing for 4- 6 hours. The forages consisted of mixed species grasses, paddy straw and green fodder. The UMMB was kept in front of animals in the wooden dispenser to allow optimum licking. The farmers recorded intake of block and milk production on pre-designed data sheets. These sheets were checked at each visit for accuracy and consistency.

The intake of UMMB ranged from 200 to 275 g and the average intake observed was 250 ± 49.5 g/buffalo/day. An average increase in 1.25 litre/day in milk yield was observed due to supplementation of UMMB during summer. Besides the increase in milk production,

all the animals of supplemented group showed symptoms of heat at the proper time and conceived at first service. By comparison, in the un-supplemented group, one cow did not conceive even after third service/insemination and on average 1.7 services were needed for conception. No symptoms of mineral deficiency and disease were observed in the supplemented group whereas animals of un-supplemented group showed symptoms of mineral deficiency. The cost benefit ratio was 2.83. Further, farmers reported that by supplementing UMMB, buffaloes consumed more roughage, maintained good health and productivity even during summer months when green fodder scarcity was acute. All the farmers readily accepted the practice of using UMMB supplementation and are willing to purchase UMMB. However, they expressed apprehension about the availability of quality UMMB supplement from the local market.

4.4.10 Impact of adoption of improved forage production on livelihood of farmers

The survey was conducted on a pre-tested format to study the impact of feeding green forage on milk production and income of the farmers during February-March, 2005. Fifteen farmers were selected from each cluster for this purpose. The details of survey are summarized in Table 4.11 and given in full in Appendix 2.

All farmers profited from producing and feeding green fodder. Livestock farmers of Anantapur cluster received the highest return (Rs. 44/day) compared to Mahabubnagar (Rs. 40/day). The minimum return was in Tumkur cluster. The reasons for this variation were: (i) wide variation in milk animals (ii) variation in price of milk. Response of feeding green fodder was more visible in Anantapur and Mahabubnagar cluster than Tumkur. The probable reason for this may be that animals of Mahabubnagar and Anantapur cluster are under fed and their diet may not be balanced whereas the farmers of Tumkur cluster are using a balanced concentrate mixture supplied by the milk cooperatives.

Table 4.11: Impact of adopting improved forage on milk production and income of the farmers in selected clusters

Particulars	**Ananta-pur**	**Mahabub-nagar**	**Tumkur**	**All**
No of households adopted improved forage species	61	82	20	163
No of household surveyed	15	15	15	45
No of buffaloes/household	3.80	6.27	1.07	3.72
No of cattle /household	1.40	1.07	2.40	1.62
No. of milch animals/ household	3.00	3.73	1.73	2.82
Area under improved forage crops/household (ha)	0.19	0.16	0.13	0.16
Percent of total area under improved forage	4.42	4.56	2.77	3.92
Milk yield, litre /animal/day	4.07	4.77	6.28	5.04
Feeding schedule of milking animals				
Grazing (hrs)	6.07	5.80	4.33	5.40
Green fodder (kg/day/animal)	9.60	11.13	8.67	9.80
Dry fodder (kg/day/animal)	8.47	8.67	7.87	8.33
Concentrate (kg/day/animal)	2.10	2.37	2.30	2.26
Impact of feeding green forage				
Increase in milk yield (litre/day/animal)	1.47	1.16	0.97	1.20
Milk rate (Rs./litre)	12.93	13.33	9.54	11.94
Gross return (Rs.day/animal)	19.01	15.46	8.97	14.33
Cost of green forage (Rs./day)*	2.40	2.78	1.73	2.30
Cost of additional labour (Rs./day)**	2.0	2.0	2.0	2.0

Total cost (Rs./day/animal)	4.40	4.78	3.73	4.30
Net return (Rs./day/animal)	14.61	10.68	5.24	10.03
Net return (Rs./day/household)	43.83	39.84	9.07	30.91

*Cost of fodder production: Rs. 20/100kg of sorghum,

Rs. 25/100 kg of Hybrid Napier/Lucerne/guinea grass.

** 1/2 hour/day in cutting, transportation, chopping, etc Rs. 2/day

Through farmer-farmer interaction, many farmers realized the economic benefits of feeding green forage to animals and came forward to take the cultivation of improved forage cultivars (Section 4.3).

4.4.11 Sheep rearing:

In order to promote sheep rearing as a source of income generation and self employment for the poor and landless households, including widows, two models of sheep rearing, (i) lamb fattening (ii) breed multiplication, were tried to evolve a practical model for replication elsewhere and to identify the potentials and constraints of wider uptake of sheep as a livelihood enterprise.

The project staff approached the poor and landless people and asked them to choose different alternatives for uplifting their standard of living during *Salaha Samithi* meetings and group discussions. The options offered to them were: sheep rearing, goat rearing, poultry farming, nursery raising, vermicomposting, depending upon caste and social customs. The majority of the poor people selected sheep rearing for improving their livelihood mainly because of easy maintenance and availability of ready-made market round the year.

A focused PRA was conducted and survey was made in order to have an idea about the sheep production system prevalent in the cluster villages. Based on a decision taken in the *Salaha Samithi* meeting, sheep units of 4-5 sheep in Mahabubanagar and Tumkur for breed improvement and multiplication purpose and units of 3 (later reduced to 2) sheep in Anantapur for fattening purpose were given to improve the livelihoods. The project had planned for all sheep units to contain 5 animals but the Anantapur farmers pointed out that they were not certain of accessing sufficient fodder for 5 animals, neither did they have the labour resources to herd the sheep. With 3 animals, they thought they would be able to take the sheep with them to graze while they were working as daily agricultural wage labour. They later decided that they could not manage more than 2 sheep under this system and this became the size of their fattening unit .

The conditions for provision of sheep agreed with the S*alaha Samithi* and intending sheep owners was as under.

- The animals should be bought from the local market.
- The owners should rear them with care and responsibility.

- The owners should supply feed using local feed resources as advised by the project staff during lean period.
- The animals should not be sold or slaughtered before lambing in case of multiplication or before attaining the body weight of 25 kg in case of fattening.
- The owners should inform the project staff before sale or slaughter of the animals and in case of any illness or theft.
- The field staff would supervises the activity and arrange insurance of animals and should collaborate with the owners.

The numbers of sheep given in different clusters are mentioned in Table 4.12. The *Salaha Samithi* proposed 10 - 40% contribution of total cost from the participating farmers, on a sliding scale based on the owner's capacity to pay. In Mahabubnagar and Tumkur the contribution was 10% whereas in Anantapur it was 40%. The contribution became a part of the revolving fund managed by the *Salaha Samithi* (see Section 2).

Sheep rearing participants

The important demographic characteristics of sheep rearing participants are presented in Table 4.12. About 70% of the landless poor work as agriculture labour. The main reason which forced them to work as labourer is poverty. Lack of credit worthiness, confidence and know-how may be other reasons. In the villages, the landless poor obtain jobs during the crop season only. Approximately 40 percent of the poor people migrate in search of work to other places, preferably to nearby city/towns (Table 4.12). In the majority of cases only male members of the family migrate from the village and provide livelihood to other family members.

Table 4.12 Demographic characteristics of selected household

Particulars	**Anantapur**	**Mahabubnagar**	**Tumkur**	**All**
No. of HH	16	15	9	40
Male	50	53	22	45
Female	50.00	46.67	77.78	55.00
Family size	4.4	5.6	4.9	4.9
Social group				
Forward caste	6.25	0.00	0.00	2.50
Backward caste	43.75	73.33	33.33	52.50
Scheduled caste & scheduled tribes	50.00	26.67	66.67	45.00
Average age of respondent (yrs)	31.13	35.53	40.89	34.98
Occupation				
Crop production	0.00	13.33	0.00	5.00
Small ruminant	6.25	13.33	0	7.50
Wage labour	56.25	66.67	100	70.00
Others*	37.50	6.67	0	17.50
Education status of respondent				
Illitreate	56.25	80.00	33.33	60.00
Read & Write	0.00	13.33	33.33	12.50
Primary	31.25	6.67	33.33	22.50
Secondary	12.50	0	0	5.00

Migration				
Yes	43.75	33.33	44.44	40.00
No	56.25	66.67	55.56	60.00
Kind of migrants				
Male	85.71	80.00	100	87.50
Both	14.29	20.00	0	12.50
Period of migration				
< 1 month	42.85	20.00	100	50.00
1-3 month	28.57	20.00	0	18.75
3-6 month	14.29	40.00	0	18.75
> 6 month	14.29	20.00	0	12.50
Frequency of migration				
Every year	100	60.00	75.00	81.25
Alternate year	0	40.00	25.00	18.75

Traditional sheep production system

Sheep farmers obtain forage from a combination of crop residues, private land and common gazing land. Thus, a sheep rearer obtains benefits from both common lands and framers' filed. In Anantapur and Mahabubnagar cluster, some farmers graze their animals on forestland sometimes illegally, as community managed forests ban grazing to regenerate the woody vegetation and also prevent the mishappening of fire. Farmers' cultivated lands become common grazing lands for poor peoples' animals after harvesting the crop. Grazing norms do exist, but lack of institutional support and the disintegration of community management structures have contributed to the uncontrolled and illegal grazing on common lands. In Mahabubnagar district, fallow lands contribute 25-51 percent of total dry matter requirement for livestock through free grazing (ISPA, 1997). The owners also migrate along with their sheep flocks in search of grazing lands during summer. Thus more research is needed to understand the extent of grazing on private/forest land and the implications for herders' livelihoods and sustainability.

In a few cases old members of the family, who are unable to go for labour and are having no other opportunity cost, generally look after the sheep. They themselves opt and prefer to take animals for grazing because they feel that they can accomplish this task while going for collection of fuel wood, as they can not perform heavy work. Families also think that grazing of animal is an appropriate productive acitivity for old people. Slowly and slowly it is becoming the social norm. In some cases, people who are going to work as agricultural

labour, bring the sheep along with them and tether them in the field for grazing and also offer the weeds or tree leaves that are available in the private lands where they are working.

Assessment of sheep rearing intervention

In Anantapur cluster, the 16 participants in 2003 increased to 54 in 2004. The individuals are selling the sheep after 4 – 5 months of rearing/grazing and again purchasing the sheep with the balanced amount after repaying the loan to the *Salaha Samithi*. Three cycles of lamb fattening are completed. It is interesting to mention that in Anantapur cluster, all poor families are covered under this intervention and now every individual in the group has a minimum income of Rs. 4,000/- per year only from lamb rearing as subsidiary livelihood interventions. Results have shown that the contribution of sheep rearing to family income ranges between 20-35 percent with an average of 25 percent.

The performance of the sheep breeding units of Mahabubnagar and Tumkur cluster is presented in Table 4.13.

Performance of the sheep-breeding unit was better in Mahabubnagar cluster than Tumkur. This may be due to the availability of more grazing and common lands in Mahabubnagar. Farmers in both the clusters are selling lambs at an early age due to necessity of money required to meet the household expenditure. Almost all sheep in Tumkur cluster are sold in local market whereas in Mahabubnagar cluster 60 percent farmers sold sheep within the village itself. The location of marketing had significant influence on earnings of the farmers.

After realizing the economic benefit, many families from the forward community in Anantapur and Mahabubnagar are coming forward to take a loan from the S*alaha Samithi* to start sheep rearing.

Experience showed that support either in the form of funding or stock animals are good tools in starting the livelihood programme. In addition basic knowledge of sheep keeping should be provided directly. Through sheep rearing, the poor increased their income, improved the nutrition of the family, the stability of the households and their self-reliance. Rearing of sheep by women for improving their economic status created an immense interest among other people.

Table 4.13 Performance of sheep breeding unit in Mahbubnagar and Tumkur cluster

Details	**Mahabubnagar**	**Tumkur**	**Average**
No of households 2003	15	9	
No of households 2004	23	9	
No of sheep given	5	5	5

Nos of lambs born	9	6.7	7.8
Single birth (%)	80	78	79
Twins (%)	20	22	21
Male (%)	43	53	47
Female (%)	57	47	53
Total sheep sold (nos) With in village (%) In local market (%)	14.0 60 40	5.0 0 100	9.5 30 70
Av No of sheep sold/household	2.5	2.0	2.3
Av. age of sold sheep (months)	8.6	7.0	7.8
Amount earned from sale Rs.	2,850	3,356	3,103
No of sheep existing/household			
Adults	8.7	6.3	7.5
Lambs	3.4	2.6	3.0
Estimated value of sheep (Rs.)	16,143	12,178	14,161

Some specific points emerging from this intervention are:

- Training institutions (particularly those for watershed development) should organize training for rural poor women in small ruminant production technologies and its importance for income generation.
- Efforts should be made by both research and development institutions to link up rural poor/women with funding agencies.
- Government and development institutions should provide support in the form of routine vaccination and deworming for small ruminants. Farmers are ready to pay for the medicines and this would contribute to improved herd productivity and the improved livelihoods for the sheep owners.
- Rearing sheep requires less capital and is appropriate where capital is scarce.
- Sheep rearing can provide part time self-employment without affecting the main occupation.
- Sheep rearing is an enterprise that does not demand very special skills compared to other agricultural enterprises.

In conclusion, the lamb fattening sheep unit represents a very reasonable livelihood option for agricultural labourers as it require less capital and not demand very specialized skills. The breeding unit, which requires the part time involvement of the farmer, or his family member, provides a very stable and attractive income generating part time self employment without affecting the main occupation.

4.4.12 Backyard poultry unit

Backyard poultry was promoted through the project as a livelihood option for the landless poor in all the clusters (Table 4.8). Improved strains of birds, Giriraja and Vanraja, were provided to landless poor people @ 5 birds/unit to rear in the back yard. The purpose behind this intervention was that the poultry would be a laying unit that could be managed by the landless and poor, and would produce eggs that are sold at three times the price of local eggs and hence generate income.

The success rate of poultry was very low (10-30%) in most of the clusters. Farmers reported the following reasons for failure of poultry:

- The birds died in summer due to high temperature. The chicks were very vulnerable to the heat.
- The birds are not able to move quickly or fly due to their heavy weight. Because of this, the dogs and wild cats caught the birds and ate them.
- Because of their heavy weight, when birds fell from some height, their legs broke. This might be due to less bone strength.
- The birds were cut for meat during festivals or also offered when some guests arrived as a part of meals.
- Few people realized how much they could earn from the five birds

Experience shows that the poultry unit as livelihood intervention did not achieve its purpose in any of the clusters: however, they improved nutrition to the poor families, as in most of the cases, people just preferred to have them in their plate and palate than in their backyards! Some of the causes for the poultry failure might have been avoided if increased attention had been given to planning with the recipients how to manage the birds and protect them from heat, predators, etc. A technical factor, which needs re-examination, is the vulnerability of small chicks during summer. This intervention is an example of where there is a gap between an improved technology and the resources of the (poor) farmers to manage it. An alternative approach might be to work with a group of farmers and an improved management system of looking after the birds.

4.5 Synthesis

The project had an ample effect not only on the farming community but also on the landless. The project experiences suggest that a continuous dialogue is essential for promoting the interventions, which requires time. Unfortunately the time was too short for both the community and project staff to confidently assess the long-term benefit, impact and sustainability of the NRM interventions, monitoring and evaluation. Promotion of ID crops gave insight to farmers on managing their water resources productively. Two crops, namely groundnut (with adequate water and no wild boar) and chickpea (with little water and not

susceptible to wild boar) hold promise in *rabi*. Ground nut and chickpea being legume fit well in the cropping system in place of paddy during *rabi* season and will reduce pressure on ground water and nutrient requirement, mainly nitrogen. A satisfactory policy support is needed to promote ID crops in the context of subsidized or free power supply. Of late, maize is becoming popular but it is a risky crop in drylands lacking supplemental irrigation although market is favourable for yellow varieties as poultry feed. ID maize is prone to wild boar menace.

Contingent crop planning is the need of hour but should be based on food habits and market availability. An attempt of promoting pearl millet in Mahabubnagar cluster during the delayed monsoon situation failed as the people have forgotten the crop and their food habit has changed. Similarly, horsegram, for which the profit is marginal, was not well accepted,. A favorable market and buy-back arrangement was found to be an important incentive: where a good market exists, farmers are ready to grow even a new crop such as gherkin in Tumkur cluster.

As an alternate land use option, farmers of Anantapur cluster were inclined towards the agri-horticulture system followed by the silvi-pastoral system in Mahabubnagar cluster and horticulture and forestry plantation in Tumkur cluster. The presence of wild boar prevented large scale uptake of agri-horticulture system as the cost of fencing was too high and live fence (agave) is not effective in its early stages. Similarly, the *rabi* groundnut was not grown in Bukklonipally (Mahabubnagar) or Shankarnhalli (Tumkur) just because of damage by wild boar (now protected by the Forest Department Act) which forces farmers to lose a crop and season. There is a need of either policy legislation or removal of wild boar from the list of protected wild life or encouraging the cultivation of alternate remunerative crops like chickpea or lucerne as leguminous fodder.

The potential of new varieties and crops could not be demonstrated adequately due to drought in 2003 (Tumkur & Anantapur) and 2004 (Mahabubnagar):however varieties like Annegeri (chickpea), SPV-462 (sorghum), Kranti (castor), Vemana (groundnut), GPU-28 (ragi), Pigeonpea (Hy-3c, LRG-30) were introduced. Intercropping systems like sorghum/maize + Pigeonpea, groundnut + Pigeonpea were successfully demonstrated.

Animal health camps created awareness among farmers regarding the adoption of better livestock practices like supplementation of mineral mixture in the concentrate ration. Farmers are demanding more number of such camps in the clusters. Through farmer-farmer interaction, many farmers realized the economic benefits of feeding green forage to animals and came forward to take the cultivation of improved forage cultivars. The landless were benefited in several ways, sheep rearing was found quite beneficial across the clusters while poultry had mixed results. After realizing the economic benefit, many families from the forward community in Anantapur and Mahabubnagar are coming forward to take a loan from the *Salaha Samithi* to start the sheep rearing.

Further, experience showed that support either in the form of funding or stock animals are good tools in starting the livelihood programme. In addition, basic knowledge of sheep keeping should be provided directly.

The weavers (SHG organization for managing a wool carding machine) and washer women/men communities (through improved water storage (Section 3)), although less directly related to NRM, for the first time in their life received help through this project that greatly reduced their drudgery, saving them time and money. Nursery raising and vermin-composting was both found to be feasible and potentially beneficial enterprises for the poorer households but their uptake as income generators depends on the existence of a market. Lastly, the community members understood that integrating livestock within their farming or livelihood systems is an answer for the drought prone areas while landless improved their skills.

4.6 Achievements

Output 3 OVIs	**Achieved**	**Comment**
By mid 2003, existing farming system and constraints in the targeted villages assessed and documented.	Fully	The initial PRA and subsequent topical PRAs, focus group interactions and surveys assessed the farming (livelihood) system. This information is compiled in Annexure C and detailed within the sub-sections of this Annexure A. The gaps and constraints land various options were discussed and the community members chose those of interest
By 2004, target groups (both end users and intermediate service providers) see evidence of ways by which they can benefit from improved utility of CPR and PPR products.	Fully/partly	Most interventions described in this section resulted in increased benefit from PPR products, which farmers recognised. The interventions were also applied to CPR (tankbed in Mahabubnagar; temple endowment land in Anantapur cluster). Service providers in the clusters and at project workshops became aware of the achieved and potential benefits. Benefits from some alternate land use systems like agri-horti, silvi-pasture will impact in future.
By 2005, at least 2 target groups report adoption of at least 2 management practices for improved livestock production.	Fully	In all clusters, landless poor including widowed women have improved their income from sheep rearing. The intervention of fodder crops and AI of local breeds has improved the milk yields of dairy.

4.7 Key learning's for livelihood diversification

- Our crop interventions were effective in creating awareness about improvements regarding seed, seed source and practices.
- Timely availability of seed/seedlings and one-to one communication with the farmer at his/her field can convince the farmer to test new crops / cropping practices / land-use practices.
- Contingent crops, to meet the future needs of the farmers, should be marketable through, e.g. value addition. This will prevent the contingent crop being relegated to minor status. The *Salaha Samithis* can take a lead in convincing the farmer to take up the contingent crops and/or in maintaining a seed bank for future.
- Small and marginal farmers target only local markets. Therefore, they need to be able to sell their produce in the nearby local markets.
- For nursery raising, buy-back arrangements with local commercial nurseries would make it more successful as a livelihood for the landless.
- Seed interventions are self-replicating but farmers should be encouraged to replenish the old seed with pure seed to avoid genetic degradation after every 3-4 years.
- Alternate land use interventions are slow to demonstrate their benefits and need a long gestation. Further, they should be introduced as a package that includes arrangements for water availability during the dry months and for some appropriate fencing even if it is from local materials.
- As seeing is believing, exposure visits should precede interventions and the visits should be arranged relevant to the interest of the participating villagers.
- The routine PRA exercises provide an overview of NRM management in communities but are not adequate for detailed planning of NRM interventions. This needs focused interactions with small groups or households.
- The researchers came to understand that even when technologies are relevant, extra forces like market, wild boar, food habits, customs, etc. limit the choice and uptake by farmers. Previously, this was sometimes difficult for researchers to comprehend.
- Most developmental agencies treat crop and tree interventions as secondary and give preference to soil & water conservation works, farm tools & implements, artificial insemination, *etc* which are visible and take away the lions' share in the budget. These interventions will only yield their maximum impact if they are supported by interventions in crop and livestock management.
- The adoption of improved livestock technologies (AI centre, sheep rearing, fodder production, establishment of silvi-pasture, poultry etc.) requires medium to long-term investment. Livestock interventions need to be attempted as part of a total package of interventions including watch and ward, protection from wild animals and resources to research into problems that arise (e.g summer mortality of poultry).
- The adoption of livestock technologies tends to be slow and limited, especially during the initial phase of the project. Once initially reluctant farmers had been able to assess the performance of the interventions taken up by early adopters, and realized their suitability, uptake accelerated.
- Establishing some compensatory mechanism for the farmers in case of intervention failure could be taken up as policy issue.

- ❖ Integrated watershed management with a farming systems approach is key to natural resource management, and benefits both landed and landless.
- ❖ A researcher-NGO-extension worker-farmer partnership is possible for research to test, develop and promote technologies under a participatory mode.

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Appendix 4.1. Socio-economic characteristics of a sample of livestock intervention participants

The important socioeconomic characteristics of sample households (who tried fodder intervention) are presented in Table 4.1.1.

Table A 4.1.1. Demographic characteristics of selected households by cluster

Particulars	**Anantapur**	**Mahabubnagar**	**Tumkur**	**Av. of all**
No. of households	15	15	15	45
Family size	4.9	5.7	4.7	5.1
Social group (%)				
Forward caste	27	40	20	29
Backward caste	46	53	73	58
Scheduled caste & scheduled tribes	27	7	7	13
Age of respondent (years)	47	41	44	44
<25 (%)	7	7	7	7
25-49 (%)	33	67	47	49
>50 (%)	60	26	46	44
Education status of respondent (%)				
Illiterate	53	20	7	26
Read & Write	7	7	7	7
Primary	7	13	40	20
Secondary	7	53	33	31
Higher secondary and above	26	7	13	16

Farmers categories (%)				
Landless	7	7	7	7
Marginal	20	32	7	20
Small	40	27	13	27
Medium	13	27	53	30
Large	20	7	20	16
Land details, ha				
Irrigate	1.0	0.9	1.4	1.1
Dryland	3.3	2.6	3.3	3.1
Total	4.3	3.5	4.7	4.2

The average family size of the surveyed households was 5.13 members per household and did not vary much across clusters. About 29 percent of respondent belong to forward caste, 58 percent to backward caste and only 13 percent to scheduled caste and scheduled tribe community. The age structure of households indicates that the average age of head of household was lower in Mahabubnagar cluster than other clusters. About 55 percent of the population was in the age group of <49 years. The education level was higher in Tumkur cluster. Education plays an important role in the adoption of innovations/new technologies, and young farmers are expected to be early adopters. About 90 percent of households in the Tumkur cluster and 80 percent in the Mahabubnagar cluster were litreate.

The concentration of landless and marginal farmers was more in Mahabubnagar cluster (40%) than Anantapur (27%) and Tumkur (13%). The majority of respondent belongs to small and medium categories.

Land is an important asset of farmers, although in the case of dairy production, purchased or exchanged feed and fodder can be substituted for land holdings. The average size of land holdings was smaller (3.50 hectares) in the Mahabubnagar cluster than Anantapur and Tumkur cluster. It ranged from about 0.30 hectares in the case of marginal farmers to about 8.23 hectares in the case of large farmers. The landless farmers are dependent on leased land for fodder production and also depend on market-purchased feeds and fodder. Nearly seven percent of households had taken land on lease from other farmers for growing of food and forage crops. The terms of lease were mainly a fixed amount per unit of land and varied depending on the availability of water resource and quality of the land.

Appendix 4.2 Impact of adoption of improved forage production on livelihood of farmers

The survey was conducted on pre-tested format to study the impact of feeding green forage on milk production and income of the farmers during February-March, 2005. Fifteen farmers were selected from each cluster for this purpose. The details of survey are given in Table 1 below.

The average number of animals per household varies with the size of the farm; however, there were striking differences in terms of composition of animal population across clusters and categories of households. Buffalo was a main source of milk production in the Anantapur and Mahabubnagar cluster, while crossbred cattle in Tumkur cluster. Among marginal and small farmers, about 90 percent of milk animals were buffaloes, while large farmers kept both buffaloes and crossbred cows for milk production. Buffaloes constituted about three-fourth of milk animal population; the rest were cattle.

The average number of milk animals kept by farmers were 2.83, ranging from 1 to 20. The average area allocated for improved forage crops ranged from about 3 percent (Tumkur) to about 6 percent (Mahabubnagar). The area under improved fodder crops ranged from 0.09 hectare on marginal and small farmers to 0.25 hectare on large farmers, with an average of 0.16 hectare for all categories. Maize, *jowar* (sorghum) (PC-23), hybrid napier (Co-1), guinea grass and lucerne were important fodder crops.

The quantity of milk production on a dairy farm does not depend on the total number of animals in the herd but on the number of animals in milk. The higher the proportion of animals in milk, the lower the cost of milk production. The proportion of animals in milk was generally higher in Anantapur (67%) than in Mahabubnagar (56%) and Tumkur (57%). The productivity of milk animals is of vital importance to livestock owners because it has a direct influence on costs and returns. Therefore, the average milk yield of lactating animals was worked out.

Milk is an important source of nutrition in rural areas. Dairy farming system provides a variety of outputs, such as milk, organic manure, draft power, and cash income. The farmers retain part of the milk for home consumption (liquid milk and milk products) and sell the rest in the market to get cash income. The average milk production per household has a direct relationship to farm size. The average share of milk sold is higher in the Mahabubnagar cluster than in Anantapur and Tumkur. In Tumkur cluster more than 95 percent farmers sell their milk to dairy cooperatives where as in Anantapur and Mahabubnagar cluster farmers sold milk directly to consumers and milk/sweet shops.

The average per capita availability/consumption of milk was higher in Mahabubnagar cluster (279 g/day) than Tumkur (220 g/day) and Anantapur (209 g/day). The average per capita consumption ranged from 217 grams per day for marginal farmers to 262 grams for small farmers.

Table A 4.2.1: Impact of adopting improved forage on milk production and income of the farmers in selected clusters

Particulars	Anantapur	Mahabub-nagar	Tumkur	All
No of households adopted improved forage species	61	82	20	163
No of household surveyed	15	15	15	45
No of buffaloes/household	3.8	6.3	1.1	3.7
No of cattle /household	1.4	1.1	2.4	1.6
Total cattle & buffaloes/household	5.2	7.3	3.5	5.3
No. of milch animals/ household	3.0	3.7	1.7	2.8
Area under improved forage crops/household (ha)	0.19	0.16	0.13	0.16
Percent of total area under improved forage	4.4	4.6	2.8	3.9
Milk yield, litre /animal/day	4.1	4.8	6.3	5.1
Milk yield, litre /household/day	12.2	17.8	10.9	13.6
Milk sold, litre/household/day	11.2	16.2	9.8	12.4
Milk consumed/day/household	1.0	1.6	1.0	1.2
Milk consumed/capita/day (gm)	209	279	220	238
Feeding schedule of milking animals				
Grazing (hrs)	6.1	5.8	4.3	5.4
Green fodder (kg/day/animal)	9.6	11.1	8.7	9.8
Dry fodder (kg/day/animal)	8.5	8.7	7.9	8.3
Concentrate (kg/day/animal)	2.1	2.4	2.3	2.3

Impact of feeding green forage				
Increase in milk yield (litre/day/animal)	1.5	1.2	1.0	1.2
Milk rate (Rs./litre)	12.9	13.3	9.5	11.94
Gross return (Rs.day/animal)	19.0	15.5	9.0	14.3
Cost of green forage (Rs./day)*	2.4	2. 8	1.7	2.3
Cost of additional labour (Rs./day)**	2.0	2.0	2.0	2.0
Total cost (Rs./day/animal)	4.4	4.8	3.7	4.3
Net return (Rs./day/animal)	14.6	10.7	5.2	10.0
Net return (Rs./day/household)	43.8	39.8	9.1	30.9

*Cost of fodder production: Rs. 20/100kg of sorghum, Rs. 25/100 kg of Hybrid napier/Lucerne/Guinea grass.

** 1/2 hour/day in cutting, transportation, chopping, etc Rs. 2/day

The average price received by the household for buffalo milk was higher in all clusters. In general price received for milk was higher in Anantapur and Mahabubnagar cluster than Tumkur cluster. The reason for this that in both Anantapur and Mahabubnagar farmers sold milk directly to the sweet shops and consumers whereas in Tumkur cluster most of the milk was sold to dairy cooperatives where price was based on fat and solid-not-fat (SNF) content.

Livestock farmers of Anantapur cluster received the highest return (Rs. 44/day) compared to Mahabubnagar (Rs. 40/day). The minimum return was in Tumkur cluster. The reasons for this variation were: (i) wide variation in milk animals (ii) variation in price of milk. Response of feeding green fodder was more visible in Anantapur and Mahabubnagar cluster than Tumkur. The probable reason for this may be that animals of Mahabubnagar and Anantapur cluster are under fed and diet may not be balanced. Most of the farmers of these clusters purchasing individual concentrate ingredients daily while going to sell the milk from the town and preparing concentrate themselves. Even they are not adding mineral mixture and salt in the concentrate mixture regularly. The farmers of Tumkur cluster are using balance concentrate mixture supplied by milk cooperatives.

After realizing the economic benefits of feeding green forage to animals, many farmers came forward to take the cultivation of improved forage cultivars.

Crop Interventions

Mixed cropping in farmers field
(sorghum + castor + horse gram + niger) in Tumkur cluster

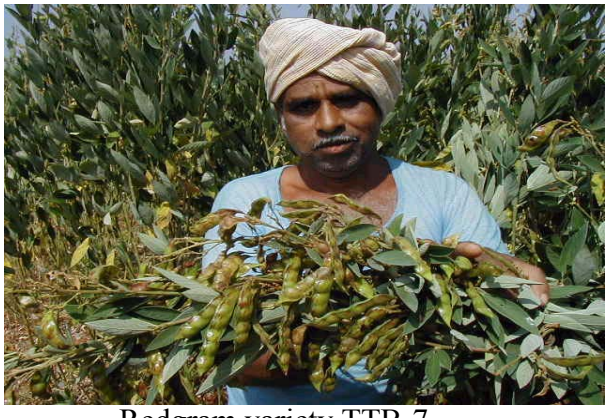
Inter cropping (sorghum + finger millet) alternated with the high density tree planting (1500 plants /ha) in Tumkur cluster

Groundnut + Redgram

Improved Crop varieties Tumkur cluster

Jowar + Redgram

Ragi - GPU-28



Redgram variety TTB-7

Improved Crop varieties Tumkur cluster

Redgram variety TTB-7

Chilli Variety - Samrudhi

Chilli Variety - Samrudhi

Jowar Hybrid - CSH-14

Scientific staff observing the Pheremone
traps in Redgram field

Efficient Use of Water

Alternative to Paddy Crop

Dried up paddy due to water scarcity
Used as fodder in Chowderpalli, Mahaboobnagar

Ragi in paddy fields in Chowderpalli, Mahaboobnagar

Chickpea crop – Alternative to paddy in
Chowder palli, M'nagar

Maize as intercrop in groundnut in Mahabubnagar

Rabi horse gram in paddy fields
in Chowderpalli, Mahaboobnagar

Para grass – in paddy fields
in Chowderpalli, Mahaboobnagar

Fodder Development

Lush green fodder in farmer's field, Anantapur

Woman farmer showing
her fodder crop, Anantapur

Fodder crop in farmers' field in
Anantapur

Alternate Land Use systems
Agro-forestry

Co-1+ Teak on bunds –Ramulu in fodder park at Zamistapur, Mahaboobnagar

Groundnut + mango + pigeon pea in Anantapur

Tamarind + groundnut in Anantpur

Alternate Land Use systems
Agro-forestry

Tamarind + groundnut(harvested) + Horsegram plantation in Anantapur

Tamarind plant with coconut mulch in Anantapur

Sweet orange plantation in Anantapur

Livelihood Interventions for Women

Nursery of Thirupathamma at Chowderpalli in Mahaboobnagar

Introduction of Vanaraja in the
Backyard Poultry

Sheep units of Chowderpalli village in Mahaboobnagar

Organised formation of 'Weavers association' at Chowderpalli

Weaving of blanket with sheep wool

Vermicompost unit at Chowderpalli in Mahaboobnagar

Section 5
Improved tools and implements

Link to project log frame

Output IV: Improved tools, implements and techniques for reducing drudgery and increasing outputs promoted

OVI

1 By 2003, suitable tools/implements/techniques identified for better management of natural resources in targeted areas and for reducing drudgery.
2 By 2005, 20% of target groups report adoption of improved implements / techniques and reduction in cost and time
3 By 2005, 30% of target groups including women report reduced drudgery
4 By 2005, ways established to sustain availability of improved tools etc by existing service providers.

Activities

1 Identification of appropriate tools and implements for various farm operations in the targeted areas.
2 Capacity building of rural service provides unemployed youth for maintenance and upkeep of tools and implements.

5.1 Introduction

Indigenous tools and implements are frequently less efficient compared to specialized, improved tools and involve men and women in drudgery. A PRA conducted in the cluster villages (Section 2) identified the cluster wise need and priority of the community for farm tools and implements (Table 5.1). These were procured as an intervention for this output. Since some of the implements are costly, it was proposed that they could be organized on a community basis through cluster level or village level (for Mahabubnagar) custom hiring centres (CHC). These centres were piloted in selected states in India under the National Agricultural Technology Project (2001-2005) and CRIDA successfully introduced 3 centres in Mahabubnagar and Anantapur district of Andhra Pradesh. Under a CHC, the implements become an asset of the community and available for hire by community members. The hire charge is used to cover implement repair and replacement and living costs for the manager of the CHC. In this way the implements generate income, create an employment opportunity and are available to benefit all categories of farmers. Table 5.1 shows that all the implements procured, excepting the sprinkler and sprayers, addressed agricultural operations that are traditionally undertaken by women: their use therefore reduces women's drudgery.

Table 5.1. Implement distribution to clusters and hire charges

Implements requested and provided		Work of women?	No. items	Cost of machine	Charges	Operation cost saved
I. Anantapur cluster				**Rs**	**Rs***	**Rs**
1.	9-Row planter	Yes	1	29500	350/acre	200/ha
2.	Groundnut thresher	Yes	1	35000	20/quintal	20/qu
3.	Power sprayer	No	1	19000	50/day	125/ha
	Foot sprayer	No	1	2500		
	Knapsack sprayer	No	1	2000		
4.	Chaff cutter-power	Yes	1	3500	0.10/bundle	
	Chaff cutter - manual	Yes	4	250		
5.	Sprinkler set	No	1	8000	150/day	
II. Mahbubnagar Cluster						
1.	Tractor planter	Yes	2	25500	350/acre	
2.	Bullock drawn planter	Yes	4	15000	150/acre	50/ha
3.	Plough planter (1-row)	Yes	4	1400	50/day	50/ha
4.	Interculture hoe (oxen)	Yes	4	1200	100/acre	
5.	Manual weeder	Yes	20	550	20/day	215/ha
6.	Maize sheller	Yes	1	32000	15/quintal	2.5/qu
7.	Castor sheller	Yes	1	25000	15/quintal	3/qu
8.	Paddy reaper	Yes	2	80000	300/acre	150/ha
9.	Wool carder	Yes	1	25000	50/hr	55/blanket
10.	Groundnut stripper	Yes	1	11500	20/quintal	2.5/quintal
11.	Chaff cutter (power)	Yes	1	5500	0.10/bundle	
III. Tumkur Cluster						
1.	Multi crop thresher	Yes	1	30000	15/quintal	20/quintal
	Manual weeder	Yes	5	550		
	Manual chaff cuter	Yes	5	250		
	Coconut dehusker	Yes	5	850		

* Hire charges were set by each *Salaha Samithi*, in consultation with project staff, and considering the replacement and running costs of the implement.

The PRA findings showed that acute shortage of human labour and deficit of animal power occurs during the peak operation period of sowing and weeding. This leads to prolonged and delayed operations and hence inability to efficiently utilize the early season rainwater and nutrient resources. Use of improved implements should allow quicker completion of crop operations, reducing drudgery for women and men, better exploitation of natural resources and hence better productivity. Labour deficits also occur at harvesting and threshing, which can lead to substantial post-harvest losses. Interventions to improve this situation were proposed in the project logframe and were implemented in all the three clusters. The process and outcomes of the interventions are discussed cluster wise in the following sub-sections: the "Major learnings" within each cluster report are compiled from interactions with farmers. Details of the custom hire centres are given in Section 5.3.

5.2 Cluster wise interventions

5.2.1 Anantapur cluster :

Groundnut is a major crop in Anantapur cluster. Its main operations, like timely sowing, spraying, life saving irrigation during dry spells and stripping/threshing of the pods, needed an intervention of appropriate implements to enable increased efficiency in NR using for groundnut production. Based on the priority that the community expressed during the PRA, a 9-row planter for timely sowing; a power operated groundnut thresher; back mounted power sprayer; foot operated sprayer; knapsack sprayer, power chaff cutter; manual chaff cutter and an irrigation sprinkler set were procured and placed with the newly formed community operated CHC.

5.2.1.1 Nine-Row Planter:

Traditionally, groundnut is sown using a 4-row bullock-drawn implement, which is slow and prolongs the operations. Rainfall in Anantapur is erratic and scarce leading to hardly 1-3 days being available for sowing. With the traditional implement, only 30-40% of the area can be sown timely and the balance of 60-70% of the area is often badly affected due to non-availability of sufficient moisture during the crop growth period. The PRA indicated that there are some tractors available in the village but no tractor-drawn sowing implement. The nine-row planter placed in the CHC was hired by the tractor owners. This increased operational speed by 3 times, making timely sowing possible with a uniform crop stand. However, there are some limitations of tractor planter use: some field area was left unsown where the tractor turns; and on stony fields seed distribution was irregular.

Major learnings (a) Modification of the planter's furrow openers was needed to suit rocky soils by replacing the rigid opener that jumps out of the soil when it hits a stone with a spring tine (this modification was made). (b) Smallholder farmers were concerned about the "lost" or unsown turning area. However the planter does suit the larger fields found in Anantapur and ensures timely sowing and uniform crop establishment. These benefits outweighed its disadvantages and both small and medium farmers hired it.

5.2.1.2 Power thresher:

Traditionally groundnut is manually harvested and stacked till human labour is available for manual stripping of pods. During harvesting and threshing period acute shortage of human labour occurs. Severe delays in threshing groundnut of up to 4 months often prevent it from fetching the better early season price in the market (at current prices around Rs 18/-kg^{-1} vs Rs 15/-kg^{-1} during the later season). The delays also result in post-harvest yield and quality losses. The power operated groundnut thresher was introduced through the CHC and could thresh 60-80 bags per day as against one bag per day per person, and at 1/3 of the cost (Rs 20/- vs Rs 60/-per bag manually. Quick availability of quality marketable produce was a major gain to the producer.

From hire of the thresher, the custom hiring centre earned Rs. 18,000 during the season, which created a financial resource base for the running and maintenance of the community organized centre and the implements. Farmers who used threshers could market produce at a better price due to the good quality of the seed threshed through machine.

Major learnings: (a) No post-harvest storage losses. (b) Saving in labour cost. (c) High market price of grain. (d) Easy adjustment of the thresher and good quality threshing of other crops. (e) Loss of some employment opportunities for agricultural labour. (f) Technical skill

need to be imparted to the operators before equipment use to ensure operator safety and correct adjustment of the machine.

5.2.1.3 Power sprayer:
Back mounted, hand operated knapsack sprayers are traditionally used for pest and disease control but these are more inefficient and take a longer time, which increases the workload and drudgery. The power sprayer covers a larger area more quickly and reduces the drudgery. A foot sprayer and knapsack sprayer were also made available for hiring through the *Salaha Samithi*.

Major learnings (a) Foot sprayers are not very useful for groundnut: they are too slow and require 2 persons to operate them. (b) Hand operated knapsack sprayers are suitable for small farms but not for larger crop areas (c) Power sprayers are effective for large areas, save time and labour cost and reduce human drudgery (d) Hands-on training is essential for the power sprayer operators (e) The CHC created easy accessibility to the power sprayer for users.

5.2.1.4 Chaff cutter:
Manual and power chaff cutters were given for efficient utilization of fodder. The power chaff cutter was easy to operate and could reduce women's workload compared to the manual chaff cutter. Fodder loss was reduced from 50% to 10% by using a chaff cutter. Power chaff cutters provide self employment to educated youths.

Major learnings. (a) The power cutter performed well. However, Anantapur is a predominantly groundnut area and does not have enough dry fodder from sorghum and other crops to fully utilize a power chaff cutter: hence, power chaff cutters may not be very suitable for this cluster.

5.2.1.5 Sprinkler set:
Dry spells in Anantapur are very common and one life-saving irrigation can save groundnut crop. Rain-harvested water from ponds could be recycled using a sprinkler set for life-saving irrigation. A sprinkler can irrigate 4 times more area than flood irrigation from the same volume of water. The *Salaha Samithi* fixed a low rental charge for using sprinkler set for members and non-members without consultation with technical staff. Farmers who had stored water could hire the sprinkler set and engine and save their groundnut crop.

Major learnings (a) Training in handling and maintenance of an irrigation set is essential (b) Many farmers were able to use the sprinkler because of the (too) low rental charges set by the *Salaha Samithi* (c) Sprinklers reduce the cost of irrigation, save water and irrigate more area in a short time.

5.2.2 Mahabubnagar cluster :
Mahabubnagar cluster has been facing a drought since 1973. The cattle population is going down and fodder is also becoming scarce. Due to the shortage of draught animal power, some farmers have purchased tractors through bank credit. The PRA exercise in the villages indicated that the major crops are paddy, castor, sorghum, pulses, oilseeds and that farmers need equipment for sowing, interculture, groundnut stripping, castor and maize shelling, paddy harvesting and chaff cutting. Small farmers preferred bullock-drawn and manually operated tools and all farmers preferred power-operated machines on custom hiring for paddy harvesting, castor and maize shelling and groundnut stripping. Based on the PRA, the sets of implements were procured and placed in the villages with a trained group of

youths for running the custom-hiring centres. In Mahabubnagar, each of the four villages had a CHC. Most of the implements introduced are new to this cluster and proved acceptable because of their easy availability at low rental charges.

Traditionally the landless and small holders from this cluster migrate during the off-season in search of jobs and better livelihood opportunities in nearby towns. They return during the cultivation season but during peak operation periods, there is a deficit of human labour. Therefore, the implements were perceived to be appropriate, as they reduce the labour deficit. Experience of mechanization projects implemented by CRIDA at 10 locations indicates that use of implements increased cropping intensity by 15-20% and created 10-20% extra employment opportunities for local agricultural labour. The custom-hiring concept was readily acceptable in this cluster. Fifteen youths trained at CRIDA could successfully run the CHCs and earn a good revenue for the CHC and for the youths themselves.

5.2.2.1 Six row tractor-drawn planter:
Traditionally castor and sorghum are sown using the country plough for making the furrow: seed and fertilizer are then dropped manually into the furrow. The operation is slow and no precision in seeding depth and spacing is achieved. Timely sowing holds a key to successful crop production in this area; hence the villages having tractors were given two tractor-drawn planters to be available through the CHCs. The tractor owners could use the planters efficiently on their large plots but the planters could not be effectively used by smallholders, due to their small plot sizes and the land wasted (unplanted) for tractor turnings. The planting operation was much faster with the tractor-drawn planter but its use was constrained by the non-availability of a tractor with the CHC operators and also the limited custom hiring demand. Hence, the farmers revised their demand and requested instead a 2-row bullock drawn planter. Two 2-row bullock-drawn planters, of equivalent total cost, were supplied by the project in place of each tractor-drawn planter.

Major learnings: (a) Most farmers do not own a tractor and neither does the CHC. The tractor-drawn planter would be useful if the CHC owned a tractor (b) Most small landholders were not willing to use the tractor-drawn planter due to wastage of land in turning (c) After testing the planter, the cluster farmers changed their perception and decided that a 2-row bullock drawn planter may be most suitable.

5.2.2.2 Four row bullock-drawn planter:
One of these planters was given to each of the CHCs in Mahabubnagar cluster. The general perception of the farmers as expressed during the PRA was that the 4-row bullock-drawn planter would be workable as bullock pairs are available in the villages: hence the planters were procured and placed at the CHCs. On testing the 4-row planter, the farmers were happy with its technical performance as it gave precision in seed placement and better crop stand. However, in practice, farmers found the 4-row planter a little heavy for their small size of bullocks and also found some operational difficulties due to their smaller plots. The heavy weight of the planter (150 kg), posed a difficulty in manoeuvering it while turning. Hence the farmers decided that a smaller machine was preferred. Since the option of 2-row planters was available, the 4-row planters were replaced with 2-row planters.

Major learnings: (a) Precision of the machine in seed placement was appreciated. (b) Bullock-drawn machines should be chosen as per the size of the bullock power available.

5.2.2.3 Plough planter:
Single row bullock drawn precision planters were included as they match the smallholder farms sowing needs. The seed fertilizer drill unit is mounted on the local country plough and operated similarly to the local sowing method except that seed and fertilizer is metered and placed by a mechanical unit behind the country plough. This implement was readily acceptable to individual farmers and was used very effectively. However, the number of units available were much less than the demand during the sowing season. . More number of machines should be made available by the CHC during the peak sowing period.

Major learnings: (a) The plough planter is acceptable to most smallholder farmers. (b) CHC should keep more number of units as supply is far short of demand during peak sowing period.

5.2.2.4 Interculture hoe (bullock-drawn):
Interculture in these villages is mostly done by running the country plough between the crop rows. One advantage of this practice is that the country plough makes a deep furrow, which serve as moisture conservation furrows. However, using the country plough consumes more time and energy by making several passes through wide row-spaced crops. The bullock drawn interculture hoe makes shallow tillage between rows and covers the complete row width in one pass. It also create a shallow concave surface which serves as a moisture conservation zone and creates a soil mulch. This unit was most acceptable to the farmers and was extensively used.

Major learnings: (a) This is most useful and acceptable tool for interculture. (b) More number of units should be made available by CHCs.

5.2.2.5 Manual weeder:
Hand weeding with a local tool called a *khurpi* (a small sickle) is the common weeding practice and is mostly done by women. It involves adopting a sitting posture while moving forward and using the *khurpi* to remove weeds between and within the crop rows. Hence complete weed removal is possible. However, the women are put to discomfort and continuous operation results in physical fatigue. The weeding practice is also slow and costly. Hence, the most preferred choice of the villagers for weeding was a manual weeder. The weeding operation is most comfortable as it is done in a walking posture, moving forward, with weeding done by the tool mounted on wheeled frame. The manual weeder improves work capacity in weeding 10 times. Five units were supplied to each CHC in 4 villages, but this could not meet the demand. More number of units need to be kept by the CHCs.

Major learnings: (a) The improved manual weeder removed the drudgery for women in weeding and improved work efficiency. (b) More numbers of the manual weeder are needed to meet the demand at CHC.

5.2.2.6 Maize sheller:
Maize shelling is done by manual removal of grains from cobs which is time consuming, costly and causes drudgery to the women who are mostly involved in this operation. Since the area under maize is increasing in this cluster, the availability of human labour for manual operation was a major constraint. Therefore, during the PRA, members expressed the need for a power operated maize sheller for efficient shelling of maize, which, through accelerating the shelling and producing a high quality (clean) product, can capture a premium in the higher early season market prices. One maize sheller unit was given to the cluster to

cover all 4 villages in the cluster. This was charged at Rs.15/quintal for all categories of farmers. This was acceptable to all and there was a demand for one machine in each village.

Major learnings: (a) Power operated machines help in reducing the drudgery of women in shelling operation (b) The shelling is done faster and more efficiently and the clean grains fetch a better price in the early season market.

5.2.2.7 Castor sheller:

Castor is the major cash crop in this cluster and is mostly shelled by manually beating and cleaning. The job is usually done by women with about 40 kg output/day. Since about 60% of area is covered by castor, the labour requirement is very heavy and costly during the peak shelling period. The PRA suggested the need for a castor shelling machine and one unit was supplied to cover all 4 villages in the cluster. The machine was most acceptable and shelled the crop at a much faster rate, giving an output of about 700kg/hr. This benefited all categories of farmers and particularly the smallholders as they could avail the rental machine at a cost of Rs.15/quintal, freeing their labour for alternative employment.

Major learnings: (a) Power operated castor sheller remove the drudgery of women. (b) Small holder farmers were benefited due to faster castor shelling and early marketing at higher prices (c) More number of machines should be provided by CHCs in proportion to the crop area and demand.

5.2.2.8 Paddy reaper: Paddy is the most popular irrigated crop in the cluster as it gives better returns to the farmers. Although the area planted depends upon the irrigation water available, most farmers, irrespective of their size of land holding, cultivate paddy. The crop is harvested, mostly by women using a *khurpi* (local sickle). The women walk in the muddy paddy fields, bending over to cut the rice stems close to the ground and the posture of body causes fatigue and great drudgery to women. Moreover, due to migration of the work force in the off-season, labour availability in the peak harvesting period is a major constraint and hence, during the PRA, a paddy harvesting machine was demanded as a necessity. Two units were given to cover the 4 villages in the cluster on a custom hiring basis and were kept with the CHCs. This was most accepted and became popular because of efficient harvesting of paddy, removal of drudgery of women and because it made the paddy farmers independent of the labour availability status.

Major learnings: (a) The paddy reaper was a most acceptable machine due to efficient and faster harvesting. (b) It saved women from drudgery. (c) Mechanical harvesting reduced the cost of the harvesting operation. (d) Availability of the machine from the CHC benefited small farmers, as they cannot afford to own such a costly machine.

5.2.2.9 Wool carding machine:

At their strong request, the weaver community was provided with a wool-carding machine, which was run by a youth from the shepherd community on a custom hiring basis. Until that time, 70 weavers were traveling a distance of 25 km for cleaning the wool. The Weavers Association, a Self Help Group that formed with project support (Section 2.4.1), was responsible for maintenance and management of the machine. This intervention enhanced the income of the landless poor shepherd community, saving the weavers time and expense in getting the wool cleaned.

5.2.3 Tumkur cluster:

The majority of farmers in this cluster are small and marginal, using traditional tools and implements. As in the other clusters, the frequent droughts mean that many families migrate to other places in search of work. This leads to a shortage of human labour for agricultural operations with the result that the cost of labour has gone up. Due to the short span of the sowing period, conventional tools were found inadequate to meet the demand for timely operations. The drudgery of labouring with these tools is one reason why youths are unwilling to engage in agriculture. During the PRA exercise, when the existing tools were identified, the point on drudgery was prominently brought out by the participating agricultural workers. The major equipment requested by and provided to the cluster was a multi-crop thresher: in addition a manually operated chaff cutter, coconut dehusker and manual weeder were provided. The idea of custom hiring of implements was found most acceptable in this cluster and the *Salaha Samithi* agreed to manage and operate the custom-hiring centre. The SS identified some youths whom the project then trained in repair and maintenance of the equipment.

5.2.3.1 Multi crop thresher for ragi :

Ragi (finger millet) is a major food crop of this cluster and covers about 30-40% of the cultivated area. Traditionally, threshing of the ragi is done by manually beating and cleaning. This requires a large number of human labour, mostly women. Since this area has a large hectarage under coconut and other plantation crops, most of the labour force is diverted to the irrigated areas and is not available for *ragi* harvesting and threshing. The r*agi* thresher was introduced as requested and as agreed during the PRA and was made available through the CHC to predominantly small farmers @ Rs. 15/quintal. There was a good acceptance of this machine.

*Major learnings***:** (a) The *ragi* thresher overcame the crisis of labour shortage during the threshing season. (b) It removed the drudgery of women (c) It was cheaper than manual threshing. (d) Most small farmers benefited due to its availability on a custom hiring basis.

5.2.3.2 Manual weeder, manual chaff cutter, coconut dehusker:

These implements were relevant for the Tumkur farming operations and were supplied to the CHC. The manual weeder did not perform well in stony soil and needed modifying while the chaff cutter handle was found to be too short for easy operation. Both these problems were rectified by local blacksmiths. However there was little demand for either the weeder or chaff cutter, since they are low cost items and hence are affordable to farmers. The coconut dehusker was introduced for growers to assess its usefulness in saving drudgery and cost. It is expected that it too can be purchased by many farmers.

*Major learnings***:** (a) The CHC generated self-employment opportunities and is economically feasible. (b) The manual weeder was not useful in soil with pebbles. (c) The implements reduced drudgery for women and saved time and energy. (d) The chaff cutter minimized fodder wastage. (e) Local modification to the chaff cutter handle was needed for comfortable operation and was done locally.

5.3 Capacity building through custom hire centres

5.3.1 Custom hire centres

Custom hire centres (CHCs) are centres in the communities, where agricultural implements are kept for hire by villagers, and are a recent innovation in India (as outlined in Section 5.1). If successful, they function as a service provider and have the potential to be financially viable and hence a business or self-employment opportunity for entrepreneurs. The concept of these CHCs was discussed within each cluster and was supported by the villagers.

Within each cluster community, youths who were interested in managing the CHCs came forward. From among these, the *Salaha Samithi* nominated those for preliminary training as CHC managers, based on their capabilities (e.g. some experience of machinery), education (had completed at least 10^{th} class) and aptitude for mechanical work. CRIDA provided a one week training to the 15 youths at CRIDA Research Farm, Hyderabad, that covered both machine operation and maintenance and accounting and managerial skills. After the training, the youths were assessed by CRIDA project staff and 2-3 persons for each CHC were chosen as the CHC managers/operators. In addition to running the CHCs, the youths provided technical and operational back-up to the farmers who hired the implements.

The implements, as agreed cluster wise during the PRA exercise, considering local needs, were procured and placed at the disposal of the *Salaha Samithi* which was entrusted with the overall responsibility of running the CHC. The implements were then handed over to the nominated CHC manager(s). The rental charges for each implement were fixed by the SS members in consultation with project technical staff, considering the implement cost, depreciation, running costs and capacity of user to pay. (For the Anantapur sprinkler set, the SS itself fixed the rental charges for members and non-members: in this case the charge was uneconomically low.)

Table 5.2 Implement hire by wealth category of farmers (CHC records)

Cluster	CHC income Rs	Category of farmer users	Percentage %	No. farmers (operation area)
Anantapur	21,000/-	Small Medium Large	40 25 35	21 (26 ha)
Mahabubnagar	18,225/-	Small Medium Large	60 20 20	28 (83 ha)
Tumkur	11,655/-	Small Medium Large	70 20 10	33 (28 ha)

5.3.2 CHC performance and outcome

Interventions of tools and implements are expected to enhance the income of the farmers through reduction of the cost of the different crop operations and enhanced yield due to better utilization of nutrients and moisture. The utilization and income generation for the farmers through hire of the CHC implements in each cluster is discussed below.

5.3.2.1 Anantapur

In the single CHC in Anantapur, 5 major items of equipment and some smaller items (Table 5.1) were supplied and made available through the S*alaha Samithi* on custom hiring to the different categories of farmers. About 21 farmers hired implements from the CFC, which accumulated Rs. 21,000/- income from implement hire. Individual users of the machinery gained by saving labour costs of Rs. 200/- per ha on sowing groundnut, Rs 20 per quintal for threshing, and Rs. 125/- per ha in crop protection spraying (Table 5.1). They also gained by saving their groundnut crop by one life saving irrigation using the sprinkler set during a dry spell, which enhanced crop yield by 30-40%. The chaff cutter saved 50% fodder losses. Overall, due to the implements made available through the CHC, individuals increased their income in the range of 20-30% by saving on labour costs and from the enhanced groundnut yield (Final report, NATP-MMP on Dryland Mechanization, CRIDA 2005)

The implements also reduced drudgery. For example, manual sowing after the country plough involves women labour in walking 30-60 km/ha in the field, while hand stripping of groundnut pods requires long hours of work by women in a sitting posture. The men who operate a back mounted handle pump sprayer must carry the weight on their back for many hours walking in the field. Since power sprayers cover a larger area at each pass, the spraying time and distance walked are reduced, saving the men from drudgery. Additionally, the CHC provided skill training and employment to one person for machine operating, record keeping and running an enterprise and provided him a livelihood.

5.3.2.2 Mahabubnagar

In Mahbubnagar cluster, each village has a CHC. Whereas Anantapur and Tumkur had a lesser number or single unit of more expensive machinery, which was centrally located in the cluster, Mahabubnagar had requested lower cost items. This meant that more number of the items were provided which could thus be placed in the different villages. Thefour CHCs are not all equipped identically but the villages are close together and farmers are able to hire from any CHC. The implements provided were seed planters, interculture hoe, a groundnut stripping machine, castor and maize shellers, paddy harvester, chaff cutter and wool carding machines (Table 5.1). Excepting the power chaff cutter (held as an income earning enterprise by a nominated individual) and the wool carding machine, held by the Weavers User Group, all other tools and implements were made available through the CHC run by a group of 2-3 trained youths in each village. The communities initially requested large multi-row planters, but after testing these, they decided that single row and double row planters were preferable due to the small operational holdings and bullock size of the farmers. The project replaced the multi-row planters by single and double row planters.

Saving on the crop operation cost (Table 5.1) through the use of the different implements is as follows: single row planters save Rs. 50/ha on operation cost, manual weeders saved Rs. 215/ha, the groundnut stripper saved Rs. 2.5/quintal, the castor sheller saved Rs. 3.0 per quintal, the maize sheller saved Rs 2.5 per quintal and the paddy reaper/harvester saved Rs 150/ acre. The power chaff cutter provided livelihood to one youth who earned Rs. 1200/- per month by chaffing fodder at Rs. 0.10/bundle. The wool carding machine saved Rs. 55 per blanket and increased the income of shepherds. The CHC implements were used by a total of 28 farmers for operations covering 83 ha in the 4 villages and accounted for an income raise of 15-18% by way of saving operational costs and increasing crop yields of castor, sorghum and groundnut. The women were saved the drudgery of the work in the field for planting (the traditional practice requires walking approximately 70-80 km/ha sown), weeding, manual harvesting of paddy, groundnut

stripping, and maize and castor shelling by hand beating. This allowed them to look for other productive employment or spend more time at home and caring for their children.

5.3.2.3 Tumkur

In Tumkur cluster the predominantly small holdings and conventional hand tools discouraged the youths away from agriculture. Implements like the multi-crop thresher for *ragi (*finger millet), chaff cutter, coconut de-husker and manual weeder (Table 5.1) improved the income of the farmers by 15-20%, removed the drudgery of women in weeding, threshing and coconut de-husking operation, and made agriculture more attractive to the youth.

5.4 Synthesis

All the three clusters had different rainfall, crops and soils, and consequently needed slightly different approaches to the introduction of tools and implements. Anantapur cluster is predominantly groundnut based system with frequent dry spells and required major interventions relevant to improving livelihoods based on the groundnut crop. Hence, the implements chosen were those that enable the timeliness demand of the groundnut crop to be met; life saving irrigation; and faster marketing of a quality product through mechanical threshing.

In Mahabubnagar, due to frequent drought situations, a large number of male family members migrate creating a shortage of labour during the peak operation periods. Implements were mostly required to fill this deficit of human labour. In addition, dryland crops like castor, sorghum, maize and the small area under pulses and oilseeds etc required a commodity based approach of selecting some crop specific tools and implements. Rice is the major irrigated crop, which suffers most due to labour shortage during harvesting. Overall, the interventions were essentially required to meet labour shortages and improve efficiency of small-scale farming by facilitating easy accessibility of costly machines through custom hiring centres.

Tumkur cluster is predominantly a small scale farming area and mostly required an intervention that suits small farms. A large capacity machine, the multi-crop thresher was considered and provided for custom hiring, since, if it was easily accessible, it would service many small farmers.

All the three clusters clearly indicated that interventions of tools and implements were most appropriate due their impact on reducing the drudgery of men and women during the concerned agricultural operation, improving efficiency of operations, reducing cost and improving profitability. One feedback from the clusters farmers was that due to interruptions in electrical power supply, engine powered machines are more suitable than electrical ones.

The flexibility of the project, including in budget allocation, enabled the project to respond to the on-going joint learning of villagers and project staff. For example, when Mahabubnagar farmers decided that the multi-row planter that they had initially prioritized did not match their resources and needs, the project replaced this with more appropriate single and double row planters. Again, when farmers suggested some modifications to the implements, the project made the modifications, using local craftsmen where possible. The combination of the knowledge and ideas of villagers and project support staff contributed to

the appropriateness and adoptability (as indicated by demand for) the implements held at the CHCs.

The concept of custom hiring was widely appreciated. It was a most acceptable mechanism for maintaining a selection of implements within the community for use by the community. By developing the capacity (including skills) of the community and the CHC managers to successfully maintain the CHC, the CHCs provided improved livelihood options to the entrepreneurial managers (who were unemployed youths). Through the implements hire, the CHCs enabled improved production efficiency of inputs like labour, water and nutrients and thereby improved the livelihoods of the rural farmers. The CHCs demonstrated that they can manage and mobilize a good amount of revenue from implement hire. In the clusters, this provides resources for further village development but also suggests that CHCs could be viable as a private business elsewhere in the region.

5.5 Achievements

Output 4 OVIs	Achieved	Comment / Justification
By 2003, suitable tools/ implements/ techniques identified for better management of natural resources in targeted areas and for reducing drudgery.	Yes	A special PRA was conducted and tools and implements were identified for drudgery reduction and better management of natural resources.
By 2005, 20% of target groups report adoption of improved implements / techniques and reduction in cost and time.	Yes	More than 20% of target groups utilized improved tools and implements from the custom hiring centres (CHCs) and reported 20% reduction in operation cost and 45% saving in time.
By 2005, 30% of target groups including women report reduced drudgery.	Yes	Most of the implements made available through the CHCs addressed women's cultivation tasks like sowing, weeding, paddy harvesting, shelling of maize and castor, threshing of groundnut and ragi which involve a tremendous drudgery for women. About 40% of women were relieved of drudgery due to use of these implements.
By 2005, ways established to sustain availability of improved tools etc by existing service providers.	Yes	Custom hire centres were set up for hiring of implements to needy farmers and undertaking repair maintenance etc while maintaining all the accounts and generating revenue under the guidance of *Salaha Samithi*. The persons who were trained to be in charge of the CHCs are maintaining them. A post -project review showed that the CHCs are well established and sustaining due to their economic feasibility and the employment opportunity they provide.

5.6 Key learnings

- Interventions of improved tools and implements have improved the efficiency and economics of crop operations.
- Small tools, and particularly the manual weeder, plough planter and manual chaff cutter, proved to be significant contributors in reduction of the drudgery of farmwomen.
- The wool carding machine provided better livelihood opportunities to the most poor and poorer rural households. It also provided an opportunity for capacity development through the weavers self-help group that managed the machine.
- The concept of a custom hiring centre for implements proved to be a boon to all categories of farmers, landless and poor people due to its effect on improving productivity, profitability, employment opportunities etc. The project team is confident that the CHCs will sustain in the post-project period due to their economic feasibility and benefit to users.
- Individually owned large capacity implements for which there is a local demand can also provide livelihood opportunities to the landless poor e.g. the power chaff cutter given to a nominated individual in Mahabubnagar cluster.
- Capacity building of rural unemployed youths, *e.g.* through training and on-the-job back-up, is an essential factor for successful interventions through tool and implement hire and CHC management.
- Farmers do not always choose appropriate implements eg the multi-row planter in Mahabubnagar. This may be due to lack of experience of the machines. Assessment by project staff during PRA of the draught power resources and operational land holding size of the rural households may help the communities to select appropriate implements, avoiding later stage replacements.
- The flexibility of the project enabled the implements to be provided according to the different cluster needs and enabled the project to actively respond to the new learnings of the farmers by replacing implements that the farmers had found to be unsuitable with those that were better suited.
- Creation of rural infrastructure for capacity building of youths as service providers, and the financial constraints to initiate CHCs and also during the different phases of tools and implement based interventions in dryland agriculture, require greater attention of policy makers in order to achieve better results.

Agricultural Implements Interventions

Inauguration of Custom hiring Centre

Demonstration of Groundnut stripper

Chaff cutter at Chowderpalli in Mahaboobnagar

Agricultural Implements Interventions

A Farmer operating Rotary Weeder in his Field.

Multi Crop Thresher.

Demonstrating the nine row planter at farmers field

Section 6
Reaching to stakeholders

Link to project logframe

Output V. Understanding of enabling processes for both rural community motivation and service provision , which are inclusive of various target groups of the poor , improved and communicated to policy makers.

OVIs

1 By mid-2004, project stakeholders (grassroots and other rural institutions) interactively compile the lessons learnt on transacting NRM change and formulate at least three policy briefs for policy makers at different levels.

2 By 2005, at least one key policy-related institution in the state of each target area of the project [is] well briefed on project's findings.

Activities

1 Regional workshops for compiling the lessons learnt.

2 Inter-regional workshop for validation of findings.

3 Dissemination workshop for policy makers.

4 Research study component: standardization of checklist and documentation tools; field level data collection and facilitation of documentation across all outputs; data analysis and report writing.

6.1 Introduction

The project aims to communicate the project learnings / (research) products to its stakeholders. The main intention of Output V is to ensure that this happens and that the findings of the project are made available to concerned stakeholders – policy makers or implementers; at local, national or international level. Any learning or recommendations from the project will then have the potential to impact beyond the project area.

6.2 Project Communications

In the project, emphasis was laid on open communication to different stake holders, through a variety of appropriate means: workshops, reports, policy briefs, case studies, photo exhibitions etc. and folders. To assist with the planning of this communication, and so that appropriate information would be sent to the relevant stakeholders using an effective method, the project held an internal workshop to consider a series of communication planning

questions (Box 6.1). These questions were drawn from a more comprehensive sequence appended as Appendix 6.1.

	Box 6.1 Communication Plan Question
i	Who are the communication stakeholders for the project?
ii	What are the project (research) products and other issues that the project team needs to communicate about with the communication stakeholders?
iii	What are the objectives of communicating about the products to the communication stakeholders (i.e.what might the stakeholders want to be able to do once the project team have communicated with them)?
iv	What media and channels might be used to communicate the project (research) products with the various communication stakeholders (e.g. what media and channels are accessible to the various stakeholders, what are their preferences, what can be sustained)?

The project identified five main groups of stake holders in the project and three main groups of project findings ((research) products and issues) that it would need to communicate about (Box 6.2): these were updated as the project developed. The main communication interventions that the project undertook to maintain effective communication with these stakeholders on the project learning, products and issues, are presented in the remainder of this section.

Box 6.2 Project communication stakeholders and products to be communicated
Main stakeholder groups: Andhra Pradesh (AP) and Karnataka (Ktk) • District Collectors or Deputy Commissioners (DCs) • Project Officers (POs) of District Water Management Agency (DWMA) (AP) and Drought Prone Area Program (DPAP) in Ktk • Selected Non-government Organisations (NGOs) working in rainfed areas • Community based and farmers organizations(CBOs and FOs) • Division of Natural Resource Management (NRM) in ICAR, and the research institutes under this division, State Agricultural Universities (SAUs) • Line departments (Agriculture. Forestry, Horticulture and Animal Husbandry)
Project (research) products or issues to be communicated
Products • Options for achieving greater equity between the landed and the landless poor while facilitating NRM • Enabling processes that improve access to CPR/PPR by the poor • Policy guidelines to facilitate institutional arrangements for NRM leading to better livelihoods of the poor Issues • Equity • Sharing of assets created eg harvested rainwater • Availability of quality inputs; • Sustainability of alternative institutions

6.2.1 Workshops/ Group interactions

6.2.1.1 Interactive meetings with primary stake holders in target areas

To sensitize the community, CBO's and other rural institutions about the project activities, cluster or village level focus group interactions and *gramasabhas* were organized at the project inception stage. Besides this awareness progarmmes like cycle rallies, green festivals and *kala jathas* (local festivals) were also conducted One of the most efficient ways to learn about primary stakeholders viz., farmers and village institutions is by interacting with them about different aspects of the project. The PRA interactions have already been presented in Section 2. To truly obtain a well-rounded view of stakeholders' needs and expectations, it is necessary to involve them right from the inception of the project, and its implementation

till withdrawal from the project. Project partners achieved this through the participatory planning, implementation and review of project supported interventions (Sections 3-5).

Adequate sensitization of the rural institutions through consultations facilitated smoother conduct of project activities aimed at better use of NRs. Regular interaction was maintained with PRIs and other SHGs through both formal and informal interaction meetings at the village/cluster level. The PRIs and SHGs were in fact represented in *Salaha Samithis* formed at cluster level.

6.2.1.2 Regional workshops for compiling the lessons learnt:

Three regional workshops were conducted at the project sites in late 2004 – early 2005 to share the experiences and learnings of the project with the district level authorities concerned. The proceedings of three regional workshops are enclosed in Annexure -D

A regional workshop for stakeholders i.e. Development Department officials of the Anantapur district, was held during September 24-25, 2004 at the Agricultural Research. Station, (ARS) Anantapur, A.P. The meeting was attended by the Joint Directors of Agriculture and Animal Husbandry departments, Project Director, District Water Management Agency DWMA, Professors of the Department of Rural Development, SK University, farmer representatives from selected clusters, project staff and ARS Staff

A regional workshop for sharing the project findings from Mahabubnagar cluster with stakeholders i.e. Development Department officials of the Mahabubnagar District, was held during December 18, 2004 at Adarsh Mahila Resource Centre, Moosapet (Mahabubnagar). The meeting was attended by the District Collector, the Joint Directors of Agriculture and Animal Husbandry departments, farmer representatives from selected clusters, *Salaha Samithi* members and project staff.

The regional workshop for Tumkur was conducted at S.Lakkihalli, Tiptur on 6th January 2005 to share the experience and learning of the project with Government, Non-government and research institutes and farmers, to suggest appropriate policy issues on natural resource management, for dissemination of information to a wider section of the farming community and to document feed back from development organizations, research institutes and the farming community to fine-tune the technology/practices.

The different development departments involved and policy makers like District Collectors participated in the workshops. The policy makers were impressed with the project work and showed keen interest to take up similar activities in their on-going development programs.

The findings of the regional workshops were as follows:

- District level authorities appreciated the role of the SS.
- Enabling process is slow and takes time to understand the dynamics of change in the rural communities. . Hence, the project duration was found to be not sufficient. A need was felt for extending the project.
- Projects involving NRM should be at least 5-6 years duration to allow the real impact to be known.
- Women and youth were found to be more receptive to new ideas.
- Development departments and policy makers were positive in their response and expressed their willingness to take the learnings forward.
- Utility and effectiveness of the SS institutions have been brought to the notice of the stakeholders (policy makers at district level) through the regional workshops.
- Target group expressed their satisfaction towards exposure visits to see new and different situations: this helped in changing their mindset and outlook towards the improved practice. Examples Of this for Mahabubnagar are the functioning of other district *Salaha Samithis*, fodder cultivation etc.

6.2.1.3 Inter-regional workshop for validation of the findings

This was incorporated within the workshop to plan the preparation of the project final technical report (FTR). This, the pre-FTR workshop, was held in March 2005 and attended by project partners from all three regions. As a foundation to planning the structure and content of the FTR, project partners presented the project findings and outcomes by output. Discussions lead to agreement (validation) of what were the project findings and their implication for future NRM development interventions or projects.

6.2.1.4 Dissemination workshop for policy makers

A separate workshop for policy makers was felt to be unnecessary. The participation of senior decision makers in the regional workshops, the active dissemination and promotion of the project approach and progress by CRIDA scientists during other policy level workshops and conferences (e.g. Ramakrishna Y.S, and Subrahmanyam K.V, 2004) meant that the outcome expected from this planned dissemination workshop had already been largely achieved.

6.2.2 Efforts for beyond the project (international promotion)

The experience of the project implementation process was shared with international institutes and delegates from developing countries by arranging visits to the project sites. A team from International Livestock Research Institute (ILRI), Nairobi, Kenya, including the Director General of ILRI, the ILRI Asia Regional Representative and an ILRI Project Manager visited Mahabubnagar cluster and appreciated the project work, specially on livestock interventions and promotion of fodder cultivation in the cluster. Similarly a five member Ethiopian delegation from the Government of Ethiopia AMAREW Project, also visited Mahabubnagar cluster and appreciated the work done under the project in improving the livelihoods of poor people.

There is a good scope for an ILRI-ICRISAT project being implemented in this cluster by the project NGO partner, BIRD-K. Thus the project through its communication activities is attracting the interest of foreign development staff and donors for continuing the efforts to improve the livelihoods of poor people in India and internationally.

6.2.3 Other communication materials

To reach the large number of the target group quickly and simultaneously in a time-effective and cost-effective manner, communication materials like policy briefs, folders, project flyers, case studies etc, were prepared in the project and distributed in hundreds. They not only supported other extension methods but also provided accurate, credible and motivating information to the target audience.

Policy briefs are designed for the policy makers, extension functionaries and media persons for communicating the project findings. Folders give essential information about a particular topic, and are distributed free of cost to end users as and when required during awareness programmes, exposure visits, group meetings and workshops etc,. Policy briefs, folders, case studies and other communication materials used in the project are mentioned below: and are attached in the separate Annexure E

Project Flyer

CRIDA. 2004. Project Flier Hyderabad, India: CRIDA and Karnataka, India: BIRD-K.

Policy briefs

CRIDA. 2004. "Ground Water Management: Decision Support System with People's Participation" Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (Policy brief I).

CRIDA. 2004. "Institutionalization of Farm Mechanization: Innovative Promotional Methods for Successful Implementation in Rural Areas and Policy support"Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (Policy brief II).

CRIDA. 2004 "Efficient Water Use: Policy for Promotion of ID Crops" Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (Policy brief III).

CRIDA. 2005. "Improving Access of CPRs to poor. Lessons from Tankbed cultivation in Zamistapoor" Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (Policy brief IV).

Case studies

CRIDA. 2004: Rediscovering the Value of Green Fodder – The story of Pampanur Farmers Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (Case study 1).

CRIDA. 2004: Rainwater Management for Drought Proofing Farm Pond Technology for Sustaining Groundnut Production in Anantapur Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (Case study II).

Folders

CRIDA. 2003. *Bio fertilizers in rainfed farming.* Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. 6 (folder in English).

CRIDA. 2003. *Cultivation of Maize crop.* Hyderabad, India: CRIDA and Karnataka, India: BAIF. 6 (folder in English)

CRIDA. 2003. *Groundwater recharge techniques.* Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. 6 (folder in English)

CRIDA. 2003. *Preparation of vermicompost.* Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. 6 (folder in English).

Shankar, M.A., Manjunath, A., and Preamalatha, B.R. 2003. *Preparation of vermi compost.* Bangalore, India: University of Agricultural Sciences (UAS-B); Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. 6 (folder in English).

Shankar, M.A., Manjunath, A., and Preamalatha, B.R. 2003. *Preparation of compost.* University of Bangalore, India: University of Agricultural Sciences (UAS-B); Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. 6 (folder in local language -Kannada).

CRIDA. 2004. Biofertilizers in rainfed farming, Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (folder in local language -Telugu).

CRIDA. 2004. *Ground water recharging techniques.* Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (folder in local language -Telugu)

CRIDA. 2004. Efficient water use by growing alternative ID crops instead of paddy cultivation Hyderabad, India: CRIDA and Karnataka, India: BIRD-K. (folder in local language -Telugu).

Project web site and/ other project related web addresses

http://www.crida.ernet.in/DFID brochures/DFID.html

Newsletter articles

Ramakrishna Y.S, Subrahmanyam K.V and Nagasree K 2005. " Enabling Rural Poor for better livelihoods through Improved Natural Resource Management in SAT India " AgREN Newsletter no-51, pp9-10, ODI Network, U.K

Central Research Institute for Dryland Agriculture, 2005. Improved NRM for better livelihoods, CRIDA Newsletter January-June, 2005, Hyderabad, India**.** Central Research Institute for Dryland Agriculture

Workshop Papers, Display of Exhibits and Posters

Ramakrishna Y.S, and Subrahmanyam K.V 2004 "Ongoing Efforts and NRM related livelihood issues" in brainstorming workshop on *Rainfed agricultural technologies for different agro-eco regions of Andhra Pradesh (AP)*, held at CRIDA on August 24, 2004.

Display of Project communication products such as policy briefs, case studies and folders where project findings were shared with the participants of NRSP Workshop on *Realizing Potential: Livelihoods, Poverty and Governance* held during 3-4 August 2004 in New Delhi

A photo exhibition was organized during the one-day brainstorming workshop on *Rainfed agricultural technologies for different agro-eco regions of Andhra Pradesh (AP)*, held at CRIDA on August 24, 2004

Poster Presentation and discussion of the project learnings with Dr Christian Roth, Project Manager, Australian Centre for International Agricultural Research (ACIAR), Canberra, Australia who was accompanied by Dr Lex Cogle, Principal Scientist, Queensland Department of natural Resource Management and Mines, Cairns, Queensland during a visit to CRIDA during 25-26 August 2004.

6.3 Study component documentation

6.3.1 Process documentation

Documentation is the act of capturing core information about strategies, decisions, practices, processes, issues, and contextual factors; organizing and analyzing the information in ways that build knowledge; and creating relevant, accessible products that disseminate the knowledge to a variety of audiences.

Process documentation involves having people observing activities in the project sites, interviewing stakeholders about their decisions and perceptions, analyzing the themes, lessons and issues that emerge, and creating products that communicate findings in clear, action-oriented ways. This is very relevant for a project which includes process oriented outputs such as Output V "Understanding of enabling processes [….] improved and communicated". Hence the idea of having process documentation for the project team emerged, with the following objectives:

Objectives:

- To identify the areas which would be subjected to thorough process documentation.
- To document the process of development,
- To use the learning out of process documentation for modifying and changing the strategies and interventions, if need be.
- To document and create records of the project developments to date.
- To facilitate systematic and comprehensive documentation in all the three clusters of the project.

To attain these objectives within the specified project time frame, the appropriate use of suitable tools would need to be identified.

In this connection in November 2003, a process documentation workshop was organized for project workers in Tiptur, in order to formulate uniform guidelines for the process documentation of the project An expert and consultant for process documentation

was invited for addressing the questions raised, clarification of the concept before starting the process documentation activities. The full proceedings of the workshop are attached as Annexure E. As a result of the workshop:

- The project team at the lead centre, collaborating centres and grass root NGOs gained a common understanding through establishing harmonized identical guidelines for process documentation of the project activities. For the process documentation, project workers tried to analyze the issues that target groups are most concerned about, the strategies and actions of technological and social interventions used to respond to the needs,
- The team members realized the need to capture the information about how the intended change is brought about why some interventions were successful and why others failed, and about the impact created by the project.
- Project partners learnt how to document the learnings and experiences during the process of implementation of social and technological interventions at field level.
- The project team wanted to document the insights and the process adopted in the project for long term and sustainable improvements in the project

After the workshop, the project staff tried to document the project learnings using the standardized guidelines, agreed checklists, and project staff diaries, etc.. A considerable amount of data and information was recorded but as this is the first attempt at process documentation, and for many staff, the project is only a small proportion of their work, they could not fully document all the information or compile it in a systematic way. The project team's inexperience of process documentation may have contributed to drafting over-ambitious process documentation guidelines and checklists which are comprehensive, but too demanding and consequently beyond the work capacity of staff. The process documentation outline is more like detailed M&E and unmanageable for the staff. Instead, a few relevant and measurable indicators need to be developed and used for future process documentation of these type of projects. Individual staff hold a large amount of information about the project process and outcomes but have not been able to concisely synthesis this. Good efforts were made at least in photo documentation of various interventions and

6.3.2 Checklist formation

To further assist with capturing the relevant information and learnings about the project intervention processes, products and outcomes, in June 2004, the project team, supported by NRSP staff, developed a checklist of relevant issues for consideration and documentation. Essentially the basis to checklist formation was to capture the research component of the project and to give more focus to the central issue or research question of "Whether & how improved NRM can lead to better livelihoods for the poor". This checklist is appended (Appendix 6.2).

As with the process documentation, the detailing in the checklist of many of the issues that could influence the process of improving NRM based livelihoods, increased the relevance of the checklist. At the same time, without further selection from the checklist contents to match the specific local issue being investigated, made the checklist was somewhat unmanageable to use.

6.4 Achievements

Output 5 OVIs	Achieved	Comment / Justification
By mid-2004, project stakeholders (grassroots and other rural institutions) interactively compile the lessons learnt on transacting NRM change and formulate at least three policy briefs for policy makers at different levels.	Yes	Regional workshops (Section 6.2.1.1) Stakeholder learnings (Section 6.5) Policy briefs I – IV (Section 6.2.3)
By 2005, at least one key policy-related institution in the state of each target area of the project [is] well briefed on project's findings.	Yes	1) Principal Secretary, Dept. of Rural Development, Govt. of A.P. 2) Secretary, Rain Shadow Area Development, Govt. of A.P. 3) Commissioner, Karnataka Watershed Development Department, Govt. of Karnataka

6.5 Reflections/ learnings from project partners

The regular discussions and contacts with project stakeholders through workshops and communication products enabled their reflections and learning to keep pace with project progress. The reflections summarised below were an output of the pre-FTR workshop in March 2005.

Reflections of CRIDA

- Focus of CRIDA NRM research projects made a shift to livelihoods instead of productivity issues, which is duly reflected in its perspective plan 2025.
- Established effective partnerships outside NARS, which will be continued in future.
- Enhanced people (including rural poor) to scientist interaction.
- Social aspects of technology development and transfer have come in forefront.
- Based on experience of CRIDA, ICAR NRM division may shift their focus on livelihood aspects of NRM development.

Reflections of BIRD(K)

- In future the project experience will help us to involve all partners in selection of project villages
- Flexible approach of the project allows project objectives to be achieved
- Involvement of scientists motivated us to implement activities with a strong scientific analysis
- Linking of CPRs for improving livelihoods of poor people is possible
- Checklist based documentation was focused
- Using and analysing field implementation experiences to bring out policy briefs is completely new to us and very relevant in our work.
- Introduction of improved implements and establishing custom hiring centres as one of the rural livelihood interventions is new to us and an intervention that we should consider supporting in future.

Reflections of University Scientists

- Farmers are capable of organizing themselves for community livelihood improvement as shown by the *Salaha Samithi*
- Relevance of social problems and issues for livelihood improvement and technology uptake is now apparent.
- NGOs by staying in villages establish a relationship of trust with the villagers: this facilitates successful introduction of development interventions
- Working with community based organizations has facilitated uptake of interventions for testing by the village
- Confidence building measures are necessary to gain villagers' trust that the outside professionals have come to help the villagers
- Working with village organizations (SS, PRI etc) as the local decision makers for the development "programme" or interventions is a mechanism to avoid conflict (and build up trust)

Reflections of International Institutes viz. ICRISAT, NRSP

•ICRISAT can use the action research result of this project in the national and international projects executed by them.

•CAPRI- (Collective Action and Property Rights) (CPR-PPR) [with BIRD-K as a partner] can use project findings.

•Recognition of pro-poor systems (wool cording, washer-woman, sheep units) is possible in NR focused projects.

•Opportunities exist to scale-up the project approach and findings through the use of S.S. and linkage to government programmes

•The Final Technical Report will have potential to influence ICRISAT/CGIAR

Influence on ICAR

• ICAR should adopt the flexible approach of this project.

•ICAR should make use of the opportunity to monitor and extract further learning from the project locations post-project.

•ICAR should adopt the project's integrated (livelihood and multi-partner) approach.

Appendix 6.1 NRSP's 10 Communication Plan Questions (Draft 2003)

1 What are the aims of the project's communication plan?

2 Who within the project team will be responsible for the implementation of the communication plan?

3 Who are the communication stakeholders for the project?

4 What are the (research) products and other issues that the project team needs to communicate about with the communication stakeholders?

5 What are the current knowledge, attitudes and practices (KAP) of the communication stakeholders in relation to the products to be promoted (i.e. who will need to know more about what)?

6 What are the objectives of communicating about the products to the communication stakeholders (i.e.what might they want to be able to do once the project team have communicated with them)?

7 What media and channels might be used to communicate with the various communication stakeholders in relation to the (research) products (e.g. what is accessible to the various stakeholders, what are their preferences, what can be sustained after the project is over)?

8 How will the project team ensure that communication materials are useful (e.g. contain relevant information) usable (eg in a language that will be understood) and accessible (e.g. at a suitable time and place) for those with whom the project wishes to communicate

9 Are the proposed communication plan activities nd materials included in the project budget?

10 How will the project team monitor and evaluate the implementation of the communication plan and its component parts.

Appendix 6.2 Check lists for documenting the research processes and out puts in CRIDA-NRSP 8192

Methodology for documentation:

1. Process documentation diary to be referred
2. Process documentation pads to be instituted
3. information gathering through facilitation at the individual and group level
4. focused group discussions
5. stray observations to be captured in the form of notes in documentation pads and indexed for easy access
6. researchers and field investigators to interact closely to understand all the nuances involved in understanding of the processes in adopting a particular farming practices
7. Observations on the impact of the proposed and existing farming practices on the poverty situation and the livelihoods of the poor to be specially observed and documented.
8. Support the stray observations with live case studies
9. organized focused PRAs where ever required
10. Refer to CBOs records
11. Understand the decision making process at the CBOs regarding NRM

Check List for Output 1

Capacity of rural institutions to provide the poor better access to specified natural resources strengthened

1. Inventorise the traditional and project initiated CBOs in the project area
2. What are the institutions directly involved in NRM issues
3. Are there delegated powers with these institutions to manage the NRMs- give details
4. Details of CPRs in the village

SNo	Resource	Extent / No	Uses	Users/community specific arrangements	Management system – restrictions, revenues, manpower arrangement, community specific arrangements,
1	Grazing land				
2	Tanks				
3	Forest				
4	Uncultivated land				
5	Others- endowment lands				
6					

5. Did they find any change in the status of CPRs over time. And for what reasons
    a. What changes did the CPRs under go in the recent past? (eg. New CPRs created, existing CPRs degraded, etc.)
        1. Decline in the number of trees etc?
        2. Decline in the extent of irrigated area under various water bodies?
        3. Change in the availability of grass and fodder?
        4. Are CPRs accessible to the poor? In changes in accessibility over years
    b. How CPRS used to be managed in the olden days?
    c. Are there any regulations in the access and use of CPRs?

1. Eg. Fines for violating social norms
2.

d. Are these regulations enforced? – How?
e. Awareness of CBOs, especially the PRI, about the existence of and access to various CPRs in the village?
f. What role does the village panchayet play in the management of CPRs?
    1. do they have legal powers
    2. any functionaries identified for management of CPRs
g. Who participates in the CPR-related decision making? (only the PRI members, actual users, only the rich and PRI members)
    1. specific ethnic groups who entirely depend on CPRs
    2. Livelihoods depending on CPRs
        a. Grazing
        b. Access to water bodies
        c. Access to fire wood
        d. Access to fodder/grazing
h. Have there been any changes in CPR management in the recent past?
    1. due to negligence
    2. due to legal issues
    3. due to external influences
i. Were any CPR-land privatized by land redistribution to the poor? If yes,
    1. Who are the beneficiaries:
    2. No. families benefited?
    3. Land distributed to each family:

6. What are various formal or informal social groups existing in the village?

Acivities of group

Group	No.	Members in each group	Total members (No)	Activities	Remarks	
SHGs						
WUAs						
UGs						

7. Other natural resources in the village and their management regimes
    a. Eg:public wells

b. Forest lands

    1. JFM activities

c.

8. What did the project do to enhance awareness among the CBOs about the better access by poor and better use of CPRs?
    a. Training
    b. New institutions – how are they planned?
    c. Formalisation of informal institutions
9. What other options did the project consider before arriving at the above option?
    a. Talking to people and the village elders to find out the possible options – results?
    b. Using the existing PRI
10. What is the process followed to implement the social interventions?
    a. Impact of this intervention on
        1. decision making process
        2. decisions taken or likely to be taken
        3. compliance to the decisions
        4. providing access to poor
        5. productivity and sustainability of CPRs

11. Whether and how were the training and exposure visits helpful in enhancing awareness and adoption of better practices (other interventions) related to CPRs or PPRs?
    a. Any examples that influenced decision making
    b. Need for social mechanisms for technical interventions

Out Put 2:

1. Base line situation regarding the soil and water conservation measures
    a. Who had done these measures (peoples initiative/govt programme etc)
    b. When
    c. What measures and design
        i. Local designs
        ii. Proposed by engineers
        iii. Local skill based
    d. Impact
    e. Maintenance
        i. What status
        ii. Any repairs required and who will do it
        iii. why the community is not initiating the repair work
    f. If poor /good, why,
    g. What is proposed to be done for maintenance
    h. Which are the measures liked and accepted by the people

For each intervention, answer the followings
1. Is it a new intervention?
2.General purpose
3.Specisfic purpose
4.Level of awareness
5.Motivating factor
6.Quantify the interventions
7.How the interventions were arrived at
8.Problems posed by the farmers

2. Inventory of the project interventions put in place
    a. Soil conservation
        i. Trench-cum bund
        ii. Vegetative measures
        iii. Cultivation practices
    b. Waterharvesting
        i. Farm ponds
        ii. Check dams
        iii. Repair of the existing structures
        iv. Diversion channels for old wells
    c. Drainage line treatment
        i. Water ways
        ii. Vegetative checks
        iii. Mechanical checks
        iv. Gully control structures
    d. Ground water recharge structures
        i. Diversion channels for old wells

Describe decision making process for each intervention
PRAs
Focussed group interaction
Focussed PRA
Site visit

Implementation process
1. How the action plans were prepared
2. Mode of contribution
    a. Local materials?
3. participation in construction
4. Comment on the cost aspects-unit costs
5. How the designs made
    a. Local wisdom
    b. Earlier experience
    c. literature

ii. Farmponds
iii. Percolation tanks
iv. Renovation of wells

e. Impact seen
    i. Area treated under various measures – CPR/PPR details
    ii. Impac on crop diversification
    iii. Impact observed by the people-direct and indirect
    iv. Current perception on these treatments
    v. Perception about costing
        1. location
        2. No of beneficiaries
        3. impact of subsidy
        4. agencies active in this regard and their influence on the community

f. learning/new knowledge
    i. awareness creation
    ii. feed back firm farmers
    iii. optimizing the number of structures
    iv. Social and political implications of the interventions
    v. Role of the community in monitoring and maintenance

g. Policy implications for wider use and replicability of the interventions

3. Impact on equity and livelihoods
4. Community ownership aspects
    a. Role ofsalahasamithi
    b. Role of PRI
    c. Role of SHGs

Out put 3

Understanding and documenting elements of farming systems and their interdependence in the existing system.

a. Prepare an inventory of the present farming systems in the project area (draw from base line survey)
b. Documenting the relative importance of the elements of the existing and proposed farming systems
    i. Economic (provide a standard format for gathering the relevant information)
        1. Supply and demand scenario
            a. Visit to markets and open dialogue with the traders

b. Factors determining the supply demand scenario

2. Market related information
    a. Local organized markets
    b. External markets
    c. Local business men
    d. Local consumption
3. Cost benefit analysis for eg
    a. Sorghum
    b. Sheep rearing
    c. Coconut cultivation
    d. Rice cultivation
    e. Castor
    f. Chick pea
    g. Maize
    h. ragi

What are the implementation mechanisms
1. Peoples contribution
2.

ii. Social elements determining the farming systems being practiced
    1. Caste factors
    2. settlements
    3. rituals

iii. Food Security (keep equity in mind)
    1. understanding food security scenario as influenced by the current farming systems v/s interventions
        a. shortage of food – season wise
        b. How often they visit ration shops
    2. coping mechanisms adopted by the people to ensure there is food security in years of adverse climate

iv. Fluid cash
    1. what are the means for earning cash incomes and the relative importance of the farming elements (and interventions) in this regard
        a. Emergency cash requirement how do they meet

v. Environmental services
    1. how do thefarmers understand the role of various elements of farming system in addressing the environmental issues
        a. eg. Soil loss
        b. depleting ground water
        c. depleting forest cover

c. Vulnerability scoring for various elements of farming systems
    i. Susceptibility for drought
    ii. Susceptibity to pests
    iii. Market vulnerability
d. Scoring of the new interventions planned into the farming systems
e. Preparing nutrient flow charts (with people)
    i. Focused PRA
    ii. Preparing flow charts

12. Economic aspects of the current farming systems
    a. Finalise the parameters for scoring
    b. What economic indices to be used
13. Linkages with the mainstream development departments
    a. Issues in up scaling
    b. Credit provision
    c. Crop insurance aspects
    d. Subsidy issues
14. Equity issues
    a. Who are positively/negatively affected
    b. Any externalities created
    c.
15. Social aspects of the farming systems
    a. Why they do what they are doing
    b. Impact of fencing on grazing by poor people
    c. Adoption by others
    d. Improved knowledge base
    e. What are the impediments in wider adoption and replicability

Research questions:

Whether and how NRM can lead to better livelihood opportunities for the poor

Cropping system scoring:

	Existing	proposed
Economic	++++	+++++
Social	+++++	+++
Food	+++++	+++
Security		
Fluid cash		
Environmental services		
Vulnerability scoring		
Local market issues		
Equity issues		

16. Intervention options (for each major intervention)
    a. How they were decided
        i. Peoples choices
        ii. Literature
        iii. Local markets
        iv. Experiences of other farmers in the area
        v. Exposure visits and training
    b. What is new
        i. Technology
        ii. Process
        iii. utility
    c. What is the source of information for making choices
        i. Training
        ii. News papers
        iii. Exposure
        iv. Market
        v. Extension departments

Crop interventions

vi. Neighbours
vii. Rich farmers
viii. Other districts/areas

d. What is the impact of the exposure visits and trainings
e. What are the communities' perception

17. Process of decision making mechanisms for deciding the intervention strategies
    a. Role of individual farmers (eg rich man leading the discussions)
        i. What is the basis for their inputs eg own example of success or failure
    b. Role of the CBOs in decision making
    c. Role of the scientists
    d. Role of the NGOs

Livelihood interventions
1.Chaff cutter
2.Sheep
3.Poultry
4.Custom hiring

18. Understanding CPRs and the dependency of the community on CPRs
    a. What are the equity issues in the CPR management
    b. Institutional dimention of the CPRs
    c. Conflicts involved in CPRs
    d. Does the community contribute towards management of CPRs
    e.
19. Scoring for the relative importance of various crop options
    a. What are the screening mechanisms for choosing a intervention option
    b. How the community has reacted to the new options proposed
    c. Any new skills required to be imparted for the new options
    d. Where are these skills coming from?
    e. What are the institutional options for the community depend upon for the new skills and knowledge
    f. Are there resourceful farmers in the area who can play a crucial role in transfer of knowledge
    g.
20. Intervention with the new options in crop planning
    a. What is the incremental cost for the new intervention strategy
    b. What are the implications on the labour relationship with the new interventions
    c. Intra familial relationships as result of new interventions
    d. What are the relative benefits for the additional costs
    e. Relationship of the crop strategies with the rest of the elements of the farming systems

21. Institutional mechanisms for anchoring the new initiatives
22. Entrepreneurial options in NRM
    a. Land less and NRM
    b. Common pool resources and open access resources to address the equity issues
    c. Small ruminants as instruments for livelihoods and better NRM and addressing the equity issue
    d. Free grazing v/s banning grazing
    e. Can livestock be incorporated into farming system
    f.
23. Planning for employment generation
24. Community decision making mechanisms for optimum crop planning
    a. Who should grow what
    b. Water intensive crops v/s dry crops

Livestock options exercised :

1. Understanding livestock in the context of equity issues in farming and the intervention strategies proposed.

1. Understanding the relative role of livestock in the local farming systems
2. what is the farmers understanding of the role of the livestock in farming systems
    a. draft purpose
    b. dung
    c. milk
    d. meat
    e. wool
    f. social status
    g. cash flow
    h. mobile assets
    i. source of investments

Livestock interventions
1.AI
2.Forage
3.Chaffing
4.back yard poultry
5. Supplements

3. Why are the present practices important
    a. Dung
        i. Used on the farm, dung cake preparation
        ii. Sold?
        iii. Composted?

iv. Plastering?
v. Biogas?

b. Milk and meet
c. Cash flow
    i. Understanding of the cost benefit scenario
    ii. Local markets for livestock and livestock products
d. Social status
e. Caste factors affecting the choices of species

2. AI Center

1. Impact of AI on poverty situation
    a. Productivity improved ?
    b. Impact on the local cattle population ?
    c. Reduced grazing pressure ?
    d. Impact on market
        i. milk
        ii. Milk products
        iii. Feed and fodder
    e.
2. Sustainability of operations
    a. Who will be responsible for operations post project period
    b. How the revenues will be generated

3. Feed and Forage

1. present status
2. what is planned
3. Scoring the food crops for fodder value
4. any shortages experienced – season wise
5. where do they buy fodder from
6. any entrepreneurs?
7. Feed scenario
    a. Local industry?
    b. What are the costs involved in importing from outside
    c. What are the feed ingredients produced in the area
    d. Cost of various feed ingredients

e. Any potential for local manufacture

3. Current grazing practices
    a. Sources for grazing and their management
        i. CPR –
        ii. PPR
        iii. Rights issues
    b. Is the fodder availability in the grazing lands is of good quality
    c. What is the grazing pressure – relative ranking
    d. Availability of fodder from various sources – relative ranking

4. Supplements
    a. Any supplements already used ?
    b. Kind of animals provided with supplements
    c. When supplements are provided
    d. Purchased and from where?
    e. Impact of supplements on productivity

5. Chaffing
    a. Is the system new to area
    b. Any local systems of fodder chaffing
    c. where is the technology from
    d. cost of technology and the skills required to manage the new technology
    e. Training requirement for managing the new system
    f. How the costs are recovered
    g. Who manages the facility
    h. Impact of new system on
        i. Reducing drudgery
        ii. Reducing wastage
        iii. Improving productivity

6. back yard poultry
    a. who are the beneficiaries
    b. Income generation ?

c. Food security
d. Cash flow scenario
e. Any problem with predators and how it is addressed
f. Any disease problems

6.Sheep

a. who are the beneficiaries
b. Income generation ?
c. Food security
d. Cash flow scenario
e. Any disease problems

7. Health camps
    a. What are the health management practices in the area
    b. Who are the service providers
    c. Role of Government dispensaries
    d. Traditional healers

Out put 4

Farm Mechanisation

1. Inventory of the present situation regarding tools and devices (baseline)
    1. Adequacy/efficiency in using the present system
    2. Sources of implements/services
        i. Talking to local blacksmiths
        ii. Traders
        iii. Carpenters
            1. source of wood
            2. purchased?
            3. wood preferences
            4. local skill level to meet the requirements
    3. costs /maintenance
        i. What provisions are available for meeting the costs
        ii. Normally loans are taken?
        iii. Life of the implements
        iv. Frequency of repairs and maintenance
        v. Livelihoods /artisanship depending on the local implementation manufacturing
    4. drudgery implications
        i. implements sharpening – who does and where, Costs?
        ii. Chances of injury
            1. Relative scoring against typical characterization of implements
    5. are there community owned systems
    6. sharing/hiring mechanisms in the community and the relative costs
4. Inventory of technologies available in the market
    a. List equipments based on the purpose and prepare relative scoring for these implements
5. Community management mechanisms put in place
    a. Do they work
    b. What are the apprehensions
    c. How the enterprise of the custom hire center is being managed
        i. Who controls the finances

ii. Who takes the decisions
iii. Who is held responsible for possible misuse
iv. Can this be investment opportunity for the future
v. Are there local initiatives already seen
vi. Where is the shelter for implements

6. Perceptions on the skills required for new technologies
   a. Are the new generation farmers showing different reactions compared to their parents
7. perceptions on labour displacement or out dating the skills
   a. what alternate labour markets are opening
   b. Surplus/deficit of labour availability during the peak seasons
   c. Are there any hostile reactions for introduction of machinery, by whom
8. Perceptions on the safety and comfort
   a. Any externalities created
   b. Any injuries/difficulties
   c. Is the technology gender sensitive
      i. Any modifications proposed to make the instruments friendly for women to operate
9. Perceptions on the productivity related parameters
   a. Reduction in input costs
   b. Labour saving
   c. Timely operations and time saving
   d. Precision in operations
   e. Differences observed in crop establishment and yields
   f. Growth related differences observed
10. What are the peoples perceptions on mechanization
   a. Size
   b. Utilities
   c. Material the implements are made of
   d. Life expectancy
   e. Costs
   f. Affordable hire charges – implement wise
   g. Crop specific implements
   h. Compatibility of the implements with the local cropping systems
11. Impediments in mechanization
   a. Finance

b. Skill levels/awareness
c. Gender related issues
d. Infrastructure limitations
    i. Eg: roads are narrow to carry tractor drawn implements

12. Dependency on external resources
    a. Diesel/petrol, sourcing, procurement and storing problems, availability issues
    b. Problems with electricity and how is it addressed
    c. Local entrepreneurship for dealing with the implements
    d. Service centers required
    e. Availability of spares

List case studies How the needs are felt in the community Narrate incidences Collect market data Talk to men, women, youth

13. How equity issues are addressed
    a. Impact on livelihoods
    b. Improved production options
    c. Provision for specialization
    d. New entrepreneurship
    e. Increased cropping intensity leading to increased employment
        i. What are the evidences
        ii. Case studies

14. Cost implications of the new technologies
    a. Finance
    b. Maintenance &repair
    c. Skill development
    d. Is insurance possible

15. New learnings
16. policy implications

Out Put 5

Understanding of enabling processes for both rural community motivation and service provision which are inclusive of various target groups of the poor improved and communicated.

a. Identification of stake holders
    a. Farmers
    b. Dev.. departments
    c. Input distributors
    d. Seed companies
    e. Government officials
    f. Universities
    g. Local leadership
b. Shortlisting of messages for communication
    a. How do we do this
        i. A workshop?
            1. earlier workshops/reports
        ii. Communication received from all the partners
c. Choice of media for communication
    a. Pamphlets
    b. Policy briefs
    c. Cassets/CDs
    d. Books

d. Preparation of drafts of the communication material
    a. Who will do what
    b. Mailing list preparation

e. Feedback received
    a. Processing

Regional Workshops held in Anantapur cluster

Regional Workshops held in Mahabubnagar cluster

Regional Workshops held in Tumkur cluster

Participants in regional Workshops (Tumkur)

Participants in regional Workshops(Mahabubnagar)

Participants in regional Workshops(Anantapur)

Views shared by the farmer Representatives, salahasamithi members etc,.

Participants in regional workshops

Project findings shared with the participants of NRSP Workshop on *Realizing Potential: Livelihoods, Poverty and Governance* held during 3-4 August 2004 in New Delhi

Photo exhibition during the one-day brainstorming workshop on *Rainfed agricultural technologies for different agro-eco regions of Andhra Pradesh (AP)*, held at CRIDA on Aug 24, 2004

Discussion of the project learnings with Dr Christian Roth, Project Manager, Australian Center for International Agricultural Research (ACIAR), Canberra, Australia

Section 7

Perceptions and Prospects

The project with its log frame focused on process as well as product outputs resulted in many useful reflections and lessons learnt. The most important outcome has been that participatory planning of the interventions in three clusters has resulted in complete ownership of the intervention programme by the people. In addition to the process documentation and terminal reporting from each of the outputs, the project partners made a number of observations during the implementation of the project which will be useful for any future initiatives to replicate the project outputs in a larger target area. The collective experiences of the project team members and villagers also resulted in a number of policy briefs which have potential to catalyze institutional and policy changes at the state and central level, provided that there is an effective follow-up by the partner institutes.

7.1. Project typology

One key issue that determines the effectiveness of the project and its outcome is the approach followed in the project design and implementation. Normally the projects run by the Government institutions lay more emphasis on the so-called "approved technical programme" which may or may not have been finalized with the participation of the stakeholders. Such projects have fixed interventions and precisely determined budget allocations within the overall project budget. On the other hand, the projects run by the NGOs are often "wide open" with no clearly defined work plan, poor linkage between the "start" and "end," making the output evaluation a little difficult. Such projects lay greater emphasis on motivating communities. The R 8192 project followed a different typology wherein there was a well defined log frame that listed the expected outputs but still allowed adequate room to accommodate the requirements and opinions of the stakeholders. The project was implemented with a prescribed area of emphasis viz., NRM. However, along the way, the constant dialogue with the villagers, that started from the initial PRA, helped in "dynamic programme planning" which took into consideration the farmers' own preferences and the experiences that were gained during the process of project implementation.

This flexibility in approach was one of the key factors in generating successful outputs and drawing several lessons even in a short project like this. The villagers in all 3 clusters who have been exposed to the state department programmes, which are quite monolithic and rigid, experienced and expressed this difference. In other words adoption of a "flexible yet well planned approach" in itself is one of the important achievements of the project, and an important contribution to improving the development process.

7.2. Institutional arrangements

Facilitating the communities to develop and put in place appropriate institutional arrangements in each of the clusters played an important role in implementing the project, and achieving the project intention of improving NR based rural livelihoods. There are many existing village level formal and non formal institutions and organizations in each cluster who are involved in the developmental activities. In this project, many of these institutions played an active role. However, none of these were supporting broad-based NR development. Since the project aimed at improved management of NRs and enhanced access to the poor, the communities and project partners jointly decided that it was necessary to form

new institutional arrangements to manage the project supported interventions and to reach the unreached. The most important institution has been the cluster level *Salaha Samithi* (village advisory councils). This institution of representative interest groups played a vital role in choosing the interventions, choosing the participating households, the process of implementation and in establishing linkages with the line departments

The *Salaha Samithis* completely owned the programme in all the clusters. For example through the custom hiring centres and contributions of participants each of the 3 SS could generate revolving funds which are acting as a seed capital for the further enhancement of the cluster development activities. Since a PRI member is one of the members of the SS, the possibility of conflict of interest between the PRI and SS was overcome. After working for 2 years, this cluster level institution of SS has gained enough confidence for sustaining the programmes even in the absence of donor funding. Interestingly, BIRD-K, the project-partner NGO, and the officials of the line departments have also responded positively to the constitution and functioning of the SS in all clusters. For example, in one of the clusters, BIRD-K has already initiated a new programme called "Navachetana" which will utilize the *Salaha Samithi* institution for coordinating the activities with the line departments.

In the past, because of the sectional and gender problems at the village level, many PRIs did not function objectively and as a result many parallel institutional bodies, self help groups (SHG), were created at the village level to represent the interests of women and weaker sections. In the last one decade, this has led to a weakening of the PRIs and hence the new amendments and guidelines of the Government of India to strengthen the PRI, including centralizing all development functions and all development funds at the village level with PRIs. Against this background of weakened PRIs, the *Salaha Samithi* institution has been an ideal compromise: it has reflected the views of the PRI, through the PRI representative to the SS and also taken care of the gender, section and group interest by its membership which included representatives from the different village groups.

As indicated above, BIRD-K has strongly committed for continuation of the *Salaha Samithi* concept. The functioning of the *Salaha Samithis* was closely watched by the representatives of the state departments of agriculture, animal husbandry and fisheries at the communication workshops, who appreciated the need for such independent institutions and promised all cooperation in strengthening the same by involving the SS in state sponsored schemes also. Based on the project experience, a strong policy brief with supportive evidence from the 3 clusters has to be generated and communicated to the state authorities about the continuation of such institutions in the interests of sustainable and improved NR-based livelihoods and the equitable sharing by the poor of usufructs from village CPRs.

7.3. Project reflection and learnings

The project, though of very short duration threw up many lessons both for the partner institutions, NGOs and the donors. Some reflections are:

- The flexible and need based programme design and implementation – a process innovation - was responsible for a better project outcome. Participatory programme planning for projects dealing with natural resources management on CPRs or PPRs is therefore strongly recommended.
- Capacity building through training and exposure visits was critical for better uptake and ownership of the programme by farmers.
- "*Salaha Samithi*" was an informal village level institutional innovation that was tried and worked successfully in the project. A strong policy brief needs to be

generated on the functioning of this institution, for communication to the state level authorities, so that the same approach can be adopted as an institutional framework for projects with similar goals.

- The project helped in bringing together national and international level research organizations, NGOs and village level institutions. This has brought a mind set change in the scientists who now realize the need for focusing on livelihood issues and how these affect the uptake of technical innovations, rather than merely generating technologies for increased agricultural production. This must surely reflect in the research institutes' activities and programmes in future.
- The involvement of the local agricultural universities who have a better understanding of the local agro-ecological situations was helpful in planning most appropriate interventions.
- While choosing interventions, the project team focused on location specific needs. For example in Anantapur cluster, surface water harvesting and its successful use for the groundnut crop gave confidence to the farmers on water harvesting technologies. A strong message of "living with surface water" was received by the farmers, particularly in this cluster where over-exploitation of ground water is causing problems.
- The "trench-cum-bund system" instead of contour bunds were more acceptable to farmers mainly because this system respects farmers' field boundaries. The water stagnation was more and survival of the trees planted on the bunds was better.
- Though the project allowed flexibility on interventions, intervention planning was still not adequately flexible. For example, in the livestock related interventions, the sheep units and backyard poultry were successful in some clusters but not in others. This was due to the differences in the socio-cultural and occupation-related problems with the landless. The lesson is that village level micro-planning needs to take the socio-cultural systems into consideration. It is recommended that involvement of a social scientist be made mandatory while implementing such projects.
- Across the clusters, the response (interest and uptake) was more from women and youth, but during the initial planning interactions and in the SS, women were under-represented. This indicates the need for greater attention to encouraging the involvement of these groups in project planning and implementation.
- The project succeeded in bringing a mind set change in the villagers on management of CPRs for the benefit of the village poor, at least in one village each in Mahabubnagar and Anantapur clusters. The tank bed cultivation in Mahabubnagar cluster is an excellent example of the productive use of an otherwise idle CPR for livelihood of the poor. Effective counseling of the village level institutions is essential for such approaches. The grass root NGOs need to play an important role in this. However, contrary to the expectations during project design, availability of CPRs in the project clusters was limited since most have already been "lost" through earlier land distribution activities.

- The transparent system adopted by the *Salaha Samithis* in choosing the participating farmers and in the implementation of interventions brought greater credibility to the project and was effective in avoiding conflicts within the villages.

- Equal importance attached to the social interventions as to the technological interventions is needed. The interventions in terms of formation of SS and capacity building contributed to the technology uptake
- The process outputs from the project could not be communicated to all the stakeholders due to the short duration and limited interaction with the policy makers. This needs follow up in future.
- Reflections from the Tumkur cluster indicate that the project should have focused on livelihood activity whether it is related to NRM or not.
- Greater involvement of line department officials in the project teams could have effectively mainstreamed the project process and project product outputs into the regular extension system of the district.
- The success of the custom hiring centers in all the clusters clearly indicated that if the choice of intervention is appropriate, farmers can be helped while making the activity commercially sustainable. Start-up capital is needed to set up CHCs and the accessibility of credit to interested entrepreneurs needs to be considered.
- Establishing good rapport with and gaining confidence of the community is the key to success of any development initiative. However, achieving this is a slow process. Inclusion of diverse social groups, as well as the transparency and flexibility already mentioned, was important to achieving both the initial acceptance of the project and its final outcome.

In conclusion, there are good prospects for adopting the lessons learnt/recommendations from this project in future projects with similar goals. The project outputs in terms of briefs and presentations at major national seminars have been well received. It seems very likely that, in the near future, these recommendations will be given more attention during the planning of a number of livelihood related projects that are coming up in India, including under National Agricultural Innovation Project (NAIP).