Impacts of the CFC-FAO-ICRISAT Livelihood Improvement Project in Asia

Region I - India

ICRISAT
Science with a human face

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CFC-FAO-ICRISAT Project
Global Theme on Crop Improvement

ICRISAT
Science with a human face
International Crops Research Institute for the Semi-Arid Tropics

Patancheru 502 324, Andhra Pradesh, India
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Acknowledgement

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We thank Foretell Business Solutions India Ltd. for undertaking the survey and eliciting information from project partners in five clusters in India. Several local partners helped us in carrying out this study in their respective areas: the Federation of Farmers' Associations (FFA); Marathwada Agricultural University, Parbhani; Sri Venkateshwara Veterinary University (SVVU), Tirupati; Krishi Vigyan Kendra, Beed; JK Seeds; and Janaki Feeds. We are also thankful to the officials of the State Bank of India (SBI) and the State Bank of Hyderabad (SBH) for their support to credit linkage activities in the study area.

We thank the field surveyors and investigators who assisted us in gathering data. The free and frank responses of the farming communities, particularly our survey respondents, were invaluable in reaching the objectives of this project.

Contents

Project at a Glance

Project title	Enhanced Utilization of Sorghum and Pearl Millet Grain in the Poultry Feed Industry to Improve the Livelihoods of Small-scale Farmers in Asia
Approval date	May 2005
Project duration	May 2005 to April 2008
No-cost extension	May 2008 to March 2009
Total project cost	USD 1.5 million
Operational area	India, China and Thailand
Major sector	Agriculture
Donor	Common Fund for Commodities, The Netherlands
Project monitoring Team	Food and Agriculture Organization
Implementing agency	Global Theme on Crop Improvement, ICRISAT, Patancheru, AP, India

Project Executing Agency

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) was responsible for the overall implementation and monitoring of the project including its financial component. Inputs and expertise relating to development and operation of the coalition of institutions were drawn from partner institutions. ICRISAT also facilitated the exchange of information (such as processes relating to coalition building and bulking, storage and marketing of grain), and took responsibility for initiating project activities in China and Thailand.

Project Team

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Chapter I: Introduction

1. Background to the Project

This study was carried out to assess the impact of a CFC-FAO-ICRISAT project titled 'Enhanced utilization of sorghum and pearl millet grain in the poultry feed industry to improve livelihoods of small-scale farmers in Asia' executed by ICRISAT in collaboration with local partners and stakeholders. The project is being implemented in three countries of Asia: India, China and Thailand. This study covers region I, India, where the project is being executed in three clusters in the state of Maharashtra and two clusters in the state of Andhra Pradesh.

The project mobilizes small-scale sorghum and pearl millet farmers with the aim of enhancing farm-level productivity and improving harvesting, storage handling and grain marketing practices. It also facilitates linkages between farmers on the one hand and seed and grain suppliers, credit agencies, poultry feed manufacturing companies and poultry producers on the other. The project provides infrastructure support to farmers by building warehouses in each cluster. The ultimate objective of the project is to increase farmers' income by 10%-15% at the end of three years of project interventions.

In the first year (2005) of the project, 250-300 farmers were selected as beneficiaries in each of the five clusters. During the second and third years, the number of villages and the number of participating farmers increased several fold.

Prior to implementation of the project, a baseline survey was conducted in the clusters to benchmark their socioeconomic characteristics. The major objective of the survey was to gather comprehensive data on all aspects of sorghum and pearl millet growing households which would serve as a template for comparison of project impacts after three to five years. Since the baseline study in 2005, various project activities have been implemented relating to crop production, input and credit linkages, training for integrated nutrient, pest and disease management, grading and scientific storage, bulking, output linkage, warehouse management, alternative income sources for warehouse sustenance, etc.

At the end of the three-year project period, when the project implementers withdraw their support, there arises a need to assess the benefits that have accrued to the intended beneficiaries. Such an exercise will also help us analyze the constraints to project implementation and draw up a roadmap for sustaining longer-term interventions.

2. Project Outputs

- Coalition of institutions implement the project activity
- Cultural practices/cultivars identified for sorghum and pearl millet for each of the target regions
- Constraints to input supply and product marketing chains identified; innovative systems of input supply and marketing chains identified and strengthened
- Effectiveness of project activities assessed and project's findings disseminated outside the target region
- Project management and monitoring system in place.

3. Objectives of Impact Assessment

Project Scorecard

The most important objective of the impact assessment exercise was to draw up a scorecard of the efforts that went into the planning and execution of interventions. Though impact assessment is important for any project, it is particularly so for one involving the collaborative efforts of numerous stakeholders at various stages. The final outcomes of such a project are the sum total of the efforts of all the collaborators. The present exercise was designed to measure the impacts of the project at the cluster level in the context of the roles played by the local partners.

Template for Future Studies

The insights gained from this impact assessment study are expected to throw light on all aspects of the project and make it a case study that is useful for planning, implementation and evaluation of future developmental studies by other institutions.

Sustainability

The study was designed also to throw light on the sustainability issues that are likely to arise when donors and implementing agencies cease their support. These issues can be assessed in the light of the overall impact of the project as well as the inputs supplied by the various stakeholders. For example, if the study found that the storage structures constructed by the project were indeed useful to the beneficiaries and that farmers did learn techniques of scientific storage, it would serve as evidence of sustainability.

Ensuring Community Participation, Trust and Self-confidence

Perhaps one of the most important, yet less recognized aspects of impact assessment is that it serves as feedback to the community itself. It shows the community the results of its own efforts, and demonstrates to the beneficiaries the fruits of their cooperation. The results encourage the community to sustain the project beyond its scheduled period and serve as an advertisement for the project among nonparticipating members of the community.

Scope of Impact Assessment

This impact assessment study was not envisaged as a measurement of the real welfare impacts at the district or village level. Rather, some quantifiable impacts were expected at the household level for a few key parameters, which when sustained can lead to an overall welfare impact at the village and community level. The benchmark for a 'before and after' comparison of key parameters was the baseline data. Additionally, nonparticipating farmers from the project villages and farmers from control villages were surveyed for a 'with and without' comparison. The overall scope of the exercise was to assess the project efforts in terms of a few quantifiable parameters and lay out a roadmap for the future.

4. Components of Impact Assessment

The study team adopted a three-tier approach to assessing impact. This included:

- Study of cluster-level indicators
- Household survey on income and social status
- Stakeholders' opinion analysis.

Cluster-level Indicators

At the first level, key interventions carried out under the project were highlighted and the number of beneficiaries quantified. These interventions and indicators were:

- Number of farmers participating in and benefiting from the project
- Area under the target crops (rainy-season sorghum and pearl millet) of the project
- Infrastructure created by the project; its utilization and benefits
- Training programs/visits conducted and number of impacted beneficiaries

- Training material developed and distributed
- Credit linkages established through financial institutions (banks and cooperatives)
- On-farm demonstrations of improved cultivars, crop management and their performance
- Input and output linkages established under the project
- Soils tested and results obtained
- Grain samples tested and determination of mycotoxin levels
- Effects of participation of women.

Household Survey on Income and Social Status

At the second level, a survey of the beneficiaries was carried out to measure the effects of project interventions on the following six dimensions:

- Technological dimension
- Input access
- Credit access
- Market access
- Economic dimension
- Knowledge and social dimension.

We did not include aspects like education level, housing, investments and asset formation as it was too early for those kind of impacts to be visible. Nevertheless, they will be flagged wherever appropriate for future assessment.

A brief description of the six dimensions included in our study is presented below.

Technological dimension. This included impacts due to learning new technologies of crop production such as seed treatment, micronutrient application, crop management of new cultivars, etc. Specifically, the study measured productivity improvement and reduction in the unit cost of production.

Input access. In this dimension, we assessed in particular effects produced by the use of improved inputs (especially seeds) accessed through linkages forged by the project with seed companies and universities.

Credit access. Similarly, we measured the benefits that accrued to farmers as a result of the credit linkages laid down by the project. These included reduction in interest rates, increments in investment capital and other longer-term benefits at the cluster level. The purpose was to take stock of the benefits of credit linkages in creating awareness about banking schemes and loan-processing procedures.

Market access. An important objective of the project was to enable bulk sales of produce by building the required infrastructure and market linkages. This would lead to higher price realization for the farmers' produce and savings in marketing and transaction costs. Measurement of key indicators such as marketing/transportation costs, prices realized for produce and comparison with baseline data constituted the scope of this dimension.

Economic dimension. The prime objective of the project was to increase the net returns for farmers. The economic dimension of this study measured the cumulative effect of the factors listed above in increasing the net returns for farmers.

Knowledge and social dimension. A short span of three years may not bring about overtly evident and complex social changes. However, this study assessed some changes in the beneficiaries' social status and knowledge in order to gain useful insights into the impacts of the project.

Stakeholders' Opinion Analysis

In the final tier of this impact assessment, the views and opinions of key stakeholders such as bankers, poultry farmers and feed manufacturers, PEA, project partners, farmers' associations, village leaders and consultants were analyzed to understand what each thought of the impact of the project. We also incorporated their suggestions on making the project sustainable in the long run.

Chapter II: Methodology

1.Methodology for Impact Assessment

Before beginning the survey, a workshop on impact assessment was organized at ICRISAT on 5 and 6 Nov 2007 involving the PEA, all the project partners, investigators and their supervisors to finalize the structured schedules for data collection and the methodology for the study. The following schedules were developed:

- Schedule for household-level impact assessment survey (rainy-season sorghum farmers)
- Schedule for household-level impact assessment survey (pearl millet farmers)
- Schedule on cluster-level indicators
- Schedule on stakeholders' opinion analysis
- Schedule for farmers' associations.

A survey methodology was adopted for each of the six dimensions of impact assessment outlined in Chapter I. For cluster-level indicators and stakeholders' opinion analysis, data was collected directly from the partners, the PEA and farmer representatives or through discussions. Data relating to area, production and productivity of the target crops was recorded on the basis of enumeration with project beneficiaries and scientifically executed crop-cutting experiments. The methodology for the household survey was more exhaustive.

In sum, this impact assessment study pinpoints the benefits derived from the project by beneficiaries, and places them in the context of their status at the start of the project. The key indicators used in the assessment were:

- Area under target crops
- Yield of target crops
- Quality of grain
- Input cost per unit of produce
- Prices realized and net returns
- Market surplus
- Marketing cost
- Market access and bargaining power
- Credit linkages
- Input linkages
- Formation of farmers' associations and capacity building of farmers.

2. Household Survey

Sampling methodology. In view of the diversity of the beneficiary population, stratified random sampling was done – as for the baseline survey – to ensure proportional representation of different landholding strata of households. The sample was stratified with the aim of giving equal representation to different sets of beneficiaries (categorized by the size of their landholding) in a village and proportional representation to all the villages within a cluster. At the second level, special care was taken to include minorities and underprivileged social groups in the sample. Similarly, the methodology ensured inclusion of opinion leaders and families headed by women.

Sample size. About 60% of the farmers in the sample of participating households in each cluster were those who had also been sampled for the 2005 baseline survey (Fig. 1). The remaining 40% were participants in the project in 2005 but not in the baseline survey. Additionally, within the sample of households, a small subsample of 20 was drawn to collect detailed data on the costs of cultivation. Members of the various management committees set up by the project were included in this sample.

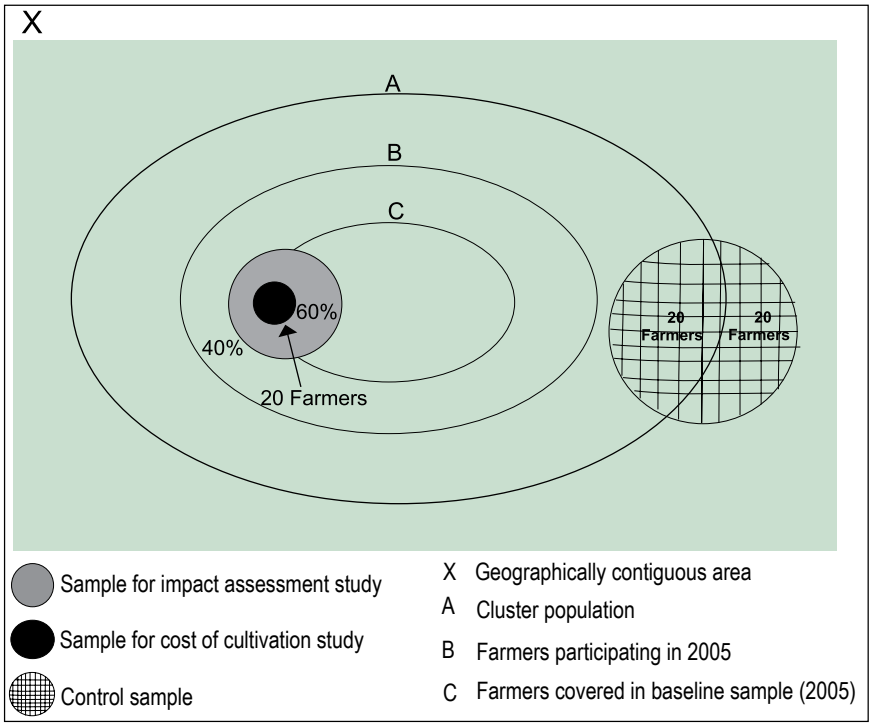

Figure 1. Sampling plan for the impact assessment study.

Table 1. Sample size across clusters.

Cluster	Sample size				Sample size for estimating cost of cultivation
	Sample from baseline (60%)	Sample from 2005 onwards (40%)	Control from project villages	Control from nonproject villages	
Palvai	60	43	22	20	20
Udityal	70	54	20	20	20
Rohatwadi	39	22	20	23	21
Anjanpur	42	59	20	20	20
Koke	44	41	20	20	21
Total	255	219	102	103	102

To enhance accuracy, the sample for this study was made 20% larger (Table 1) than the sample for the baseline survey in all clusters except Rohatwadi where a majority of farmers move to nearby sugar factories in search of work after the cropping season.

Control sample. To serve as control, one sample of 20 nonparticipating farm households was drawn from the project villages and another 20 from neighboring, nonparticipating villages. The control samples served to discern impacts due to the project from those due to nonproject factors.

3. Analysis

Other than simple tabulation, not much was done to analyze the data relating to cluster-level indicators. The emphasis was mainly on the type of interventions, their frequency and the number of beneficiaries.

Data from the household survey were subjected to simple statistical analyses to enable comparison of key indicators with the baseline (2004-05) data and of select parameters with the control sample.

The following are definitions of some of the terms used in the report that follows.

Project farmers. Farmers from within a project cluster who were included in the main sample for this study.

Control farmers. Nonparticipating farmers from project villages and those from nonparticipating, neighboring villages who were included in the control sample.

Baseline farmers. Farmers who were part of the baseline study conducted in 2005. [It must be noted that for a few of the parameters these results pertain

to the year 2004 because data were collected on a recall basis for the years previous to the launch of the project; for some parameters data pertaining to 2005 have been considered. Similarly, for a few variables in the household schedule, data from previous years were obtained on a recall basis from the respondents (project as well as control farmers). These data have been used for comparisons across samples in addition to comparison with baseline indicators.]

Consumption. The portion of foodgrain production that a sample household retains for its own consumption.

Other uses. Uses of foodgrain other than for consumption and sale. They may refer to use as seed, wages paid in kind, charity, etc.

4. Comparison of Costs and Returns

As said earlier, a small sample of 20 farmers was drawn from within the project farmers' sample in order to study the cultivation costs of the target crops – as was done in the 2005 baseline survey. In both cases, for comparison of costs and returns, it has been assumed that the cultivation costs calculated from the smaller sample can be used for the entire project farmers' sample. Thus, for the purpose of comparison, while the cost data were taken from the smaller 'cost of cultivation' sample, data on yields and returns were taken from the entire project/baseline sample. This served to minimize the efforts associated with data collection while at the same time enabling us to compare costs and returns for a larger sample and ensuring that the results were more representative of the entire project population.

Cultivation costs were taken exclusive of land rent and family labor, which Indian farmers tend not to treat as costs. This was thought to give a more realistic picture of returns as perceived by farmers.

5. Limitations of the Survey Methodology and Checks and Balances Adopted

The interview technique of data collection is considered to be an appropriate and time-tested method for a study of this nature. However, it is not without its limitations and constraints. Therefore, to overcome them, some checks and balances were included in the methodology. Some of the more common sources of error encountered during this study and the steps taken to overcome them are outlined.

Errors of omission. Surveyors may sometimes forget to ask respondents some of the questions or overlook a section of the questionnaire. Such errors were minimized by ensuring proper sequencing and grouping of questions in clearly defined sections and by carefully scrutinizing the questionnaires in situ through discussions with the PEA and the local partners.

Errors of confusion. Sometimes respondents may be confused by the questions or surveyors may not understand the responses. Such errors were minimized by training the survey team in a workshop conducted by the partners and the PEA and also in the field by the survey coordinators and the PEA. Wherever necessary, questionnaires were modified after testing them in the field.

Errors of false memory. These are errors made on account of the respondents' inability to recall data or information. Questions requiring memory recall were minimized but where this was unavoidable, investigators were trained to extract the most accurate information possible.

Errors of commission. These refer to errors arising out of respondents' attempts to deliberately mislead the survey team. For example, some respondents may report higher costs, lower incomes or fewer assets in anticipation of receiving more benefits from the project. This was by far the most difficult source of error encountered by this survey.

The study team minimized these errors by strictly following these steps:

- Accurately communicating the aims, objectives and constraints of the project and the study to the respondents
- Data relating to past agricultural practices were cross-checked with the in-group discussions held with farmers
- Cross-checking data with the baseline study (2005) and other studies carried out under the project
- Cross-checking data pertaining to prices and arrivals of various commodities from secondary sources such as the local Agriculture Product Marketing Committee (APMC)
- Collecting the most crucial information from reliable sources; for example, cost of cultivation data were taken from members of farmers' associations
- If any values deviated too much from the mean values despite the checks listed, they were excluded from the analysis.

Chapter III: Survey Findings

Andhra Pradesh: Palvai Cluster

The Palvai cluster is located near the town of Gadwal, which is about 210 km from ICRISAT Patancheru, and 100 km from the district capital Mahbubnagar. Gadwal is known for its dryland agriculture and handloom industry. The villages comprising the cluster are 8-10 km from Gadwal and fall in two mandals (local administrative units), Gadwal and Maldakal.

The climate of this area is arid or semi-arid with an average annual rainfall of 640 mm, about 75% of which is brought by the southwest monsoon. The rainfall here is 25% lower than the average for the state of Andhra Pradesh. Drought is a frequent phenomenon. The soils in these villages are of the red and black type with heavy to light texture. In some villages the soils are shallow and gravelly. The target crop for this cluster was pearl millet; however, in years when the monsoon arrives late, most of the farmers switch to castor.

1. Cluster-level Indicators

The cluster-level indicators enumerated in this section refer to project activities carried out at the cluster level and the number of farmers impacted by them. Our purpose here is to give an idea of the various project activities conducted before presenting their impact on farm households.

Number of Villages and Farmers

The interventions taken up under the project were instrumental in increasing the area of operation in the Palvai cluster during the three-year project period (Table 2). At commencement of operations in 2005, there were six villages in the project in this cluster, involving 375 farmers. More villages and farmers joined the project in subsequent years: three villages and 394 farmers in 2006, and a further three villages and 64 farmers in 2007. The reach of the project was extended with the support of coalition partners and farmers' associations.

Table 2. Number of participating villages and farmers in Palvai cluster.

	Number of villages			Number of farmers		
Year	Initial villages	New villages	Total	Initial farmers	New farmers	Total
2005	6	--	6	375	--	375
2006	6	3	9	---	394	769
2007	9	3	12	---	64	833

Table 3. Area, production and yield of pearl millet in Palvai cluster.

Year	Area (ha)	Production (t)	Yield (kg ha^{-1})
2005	168	151	899
2006	347	312	899
2007	420	504	1200

Table 4. Marketed surplus and price realization of pearl millet.

			Average price range (Rs kg^{-1})	
Year	Total production (t)	Marketed quantity (t)	Market price[1]	Price obtained by project farmers
2005	151	53	6.5-6.8	6.5-6.8
2006	312	142	6.5-7.4	7.0-7.4
2007	504	242	7.0-8.0	7.5-8.0

1. Prevailing price in the regulated market.

Crop Production

The area under pearl millet cultivation in this cluster increased during the project period from 168 ha in 2005 to 420 ha in 2007. Production rose from 151 tons to 504 tons with productivity increasing from 899 kg ha^{-1} to 1200 kg ha^{-1} (Table 3).

Grain Sales and Prices

Along with higher production, there was an increase in the marketable surplus of pearl millet. Prices obtained by farmers were higher too due to improved grain quality and bulk sales. The prices obtained by project farmers during 2006 ranged from Rs 7 kg^{-1} to Rs 7.4 kg^{-1} against the prevailing market price range of Rs 6.5 kg^{-1} to Rs 7.4 kg^{-1}. The higher price realization was thanks to the project farmers' bulking practice and direct sales in the market in a collective manner, which increased their bargaining power. In 2007, project farmers got 7.2% higher prices (Rs 7.5-8 kg^{-1}) through collective marketing (Table 4).

Training Programs

Table 5 presents the various training programs conducted during the project period in Palvai cluster, and Table 6 presents information on the types of training material distributed.

Demonstrations

On-farm demonstrations of production practices recommended for improved cultivars were conducted to provide a basket of options to farmers and improve their knowledge of scientific cultivation practices (Table 7).

Table 5. Training programs conducted in Palvai cluster.

Year	Training program	Venue	No, of participants		
			Male	Female	Total
2005	Improved production technologies of pearl millet	Palvai cluster villages	620	180	900
2006	Grain storage and warehouse management	Palvai cluster villages	30	8	38
	Pearl millet field day and exposure visits	Palvai	72	38	110
2007	Integrated crop production	Gonpadu	36	16	52
	Integrated crop production	Parucherla	36	29	65
	Integrated crop production	Pavanampalli	31	14	45
	Integrated crop production	Kakularam	49	6	55
	Farmer-banker meeting	Palvai warehouse	159	144	303
	Pearl millet field day	Pavanampally	101	54	155
	Visit to Mulknoor cooperative society by Chinese, Thai, and Indian farmers and scientists	Warangal	15	8	23
	Farmer-buyer dialogue, on-station training	Sri Venkateshwara Veterinary University, Rajendranagar,Hyderabad	26	4	30

Table 6. Training material developed and distributed to participants.

Year	Type of material	Title	No. of copies
2005	Bulletins	Improved production technologies of pearl millet for Andhra Pradesh	1,000
2006	Handouts/flyers	Grain storage and warehouse management	300
2007	Literature	Cultivation practices of pearl millet	1,000
	Posters	Seed treatment	1,000

Table 7. On-farm demonstration of production practices.

Year	Type of demonstration	Results	No. of farmers
2006	Plot 1: Full dose of macronutrients and full dose of micronutrients Plot 2: Full dose of macronutrients without micronutrients Plot 3: Half dose of macronutrients and full dose of micronutrients Plot 4: Half dose of macronutrients without micronutrients	In tests conducted on two pearl millet hybrids MLBH 308 and MLBH 267, highest yields obtained from plots treated with a half dose of macronutrients with or without micronutrients.	700-750
2007	Pearl millet (cultivar demonstration)	MLBH 308 found to be better than MLBH 267 in terms of productivity, yield and suitability/adaptability to local conditions.	800-850

Table 8. Results of soil samples tested in Palvai cluster.

Year	No. of samples tested	Parameters tested	Results
2006	51	Soil type: Sandy loam, clay; pH: Acidic, medium, alkaline; Organic carbon: Low, medium, high Available nutrients: Major nutrients: P, K Micronutrients: Zn, Mn, Cu	Most of the soils were sandy loam with medium to alkaline pH Organic carbon was low in most of the soils. Except K, other nutrient levels were 'high' within their acceptable ranges Lower than the critical limits

The demonstrations underlined the importance of macro-and micronutrient application, and farmers learnt how correction of nutrient imbalances could lead them to better yields. In 2007, the project demonstrated the performance of new cultivars under improved production practices. The results showed that MLBH 308 was better than MLBH 267 and more suitable for the region.

Soil Analysis

Efficient nutrient management requires scientific analysis of the soil to detect nutrient deficiencies, corrections of which can then be recommended to farmers. This activity was carried out at Palvai in 2006 and the findings are reported in Table 8.

Organic carbon and potassium (K) levels were found to be low in the soils of Palvai. Farmers were therefore advised better nutrient practices.

Grain Quality

Grain samples collected from farmers were scientifically assessed for grain quality. Field as well as stored grain samples were subjected to mycotoxin analysis. The results showed that grains from the Palvai cluster were safe, containing toxin levels well within the acceptable range (Table 9).

2. Survey Results

General Socioeconomic Aspects

The average age of the heads of household in the project farmer sample was 45 years, and 43 years in the control sample (Table 10). This was not a large difference, and both samples reflected adequate farming experience. The average irrigated landholding was a little higher for the control sample (2.60 ha) than for project farmers (2.26 ha) most of whom fell in the small and marginal farmer categories. However, the average nonirrigated landholding was higher

Table 9. Grain sample analysis for mycotoxins.

Year	No. of samples tested	Parameters tested	Results/
2006-07	66 field samples, 77 storage samples	Aflatoxin and fumonisin	Only one storage sample recorded aflatoxin level above the acceptable range (30 µg kg^{-1})

Table 10. General socioeconomic aspects of Palvai survey respondents.

Variable	Project farmers	Control farmers
Average age (years)	45	43
Average irrigated landholding (ha)	2.26	2.6
Average nonirrigated landholding (ha)	2.93	2.23
Average total landholding (ha)	3.28	2.67
Nonliterate heads of household (%)	61	74
No. of dependents	6	6
No. of dependents in the 3-17 age group	2	2
No. of schoolgoing dependents	2	2
Backward class (BC) households (%)	84	85

in the project farmer sample. Literacy levels were poor in this cluster: 74% of the control farmers and 61% of the project farmers were nonliterates.

In both samples, households had an average of 6 dependents, with 2 of them (both schoolgoing) in the age group of 3-17 years. About 84% of the project farm households and 85% of the control farm households belonged to underprivileged groups known in India as Backward Classes (BC).

As per the baseline study of 2005, only about 11% of the project farmers in the Palvai cluster were engaged in a subsidiary occupation which was their major enterprise in addition to farming/crop production These occupations included running a small business, dairy farming, contractorship, employment as village guard, and sheep-rearing. This trend was evident in the assessment study too: crop production was predominantly the major occupation in the Palvai cluster; farmers with subsidiary occupations constituted only 7% of the project sample.

Area Under Pearl Millet

The area under pearl millet increased in this cluster during the project period, as indicated by cluster-level indicators. In this section, we assess this effect in terms of changes in the cropping pattern at the cluster level and increase in pearl millet cropped area per household at the household level.

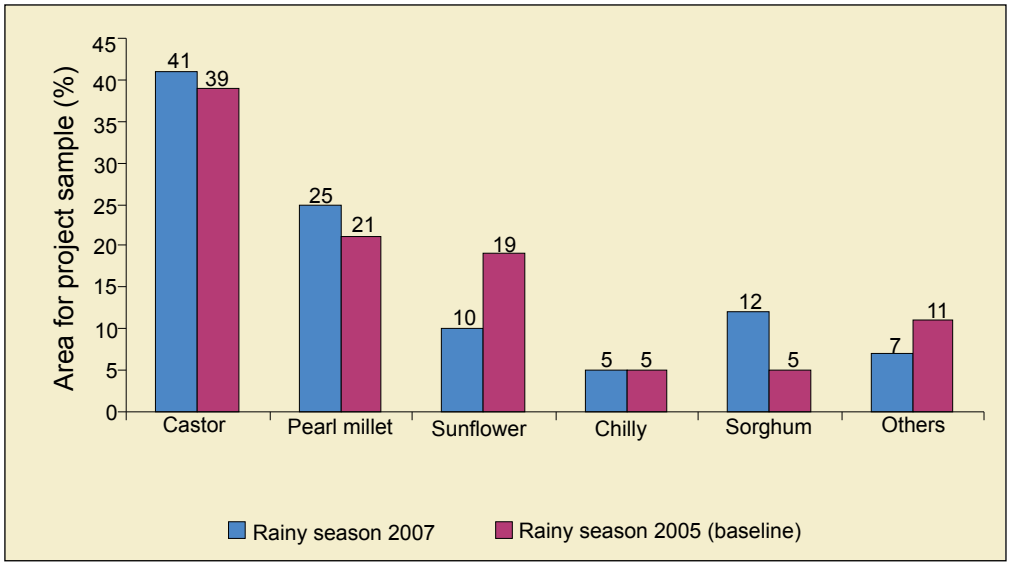

Figure 2. Changes in the cropping pattern in Palvai cluster, 2005-2007.

As reported by project farmers, there was an increase in pearl millet area in Palvai cluster during the three-year project period. The sorghum area increased too, although it was not a target crop in this cluster. This could be due to the

awareness generated by the project. Crops whose areas increased in Palvai (Fig. 2) were pearl millet (from 21% in 2005 to 25% in 2007), sorghum (from 5% to 12%) and castor (from 39% to 41%).

Pearl millet area per household increased marginally for both project as well as control samples. Among control farmers, this increase was consistent since 2004 (Table 11) but not so for project farmers. Further analysis of the control data indicated that the increase was greater among farmers within the project cluster who had been selected for the project but had opted out. In the case of control farmers from outside the project villages, the area under pearl millet was more or less constant over the four years.

Table 11. Average area (ha) of pearl millet per household.

Year	Project farmers	Control farmers
2004	0.64	0.65
2005	0.63	0.66
2006	0.65	0.70
2007	0.66	0.72

This indicates that farmers from project villages put more area under pearl millet encouraged by the activities even if they had not formally enrolled themselves for the project. The recent high prices of pearl millet in the market may have been another motivating factor.

Production and Product Utilization

The average yield of pearl millet in this cluster (Table 12) almost doubled for project farmers (1,360 kg ha^{-1}) since the baseline study (660 kg ha^{-1}). Yields for project farmers were significantly higher than for control farmers (1,028 kg ha^{-1}). As for byproducts (crop residue), farmers obtained 1-2 cartloads ha^{-1} higher yields over the baseline results and control.

Project farmers perceived an improvement in grain and fodder quality during the project period (Table 13). However, in 2005, they perceived a reduction in fodder quality while at the same time reporting improved grain quality. This was because of the first-time use of the pearl millet hybid MLBH 308, which had lower fodder acceptability. On the other hand, control farmers did not perceive any significant improvement in grain and/or fodder quality during the project period. The higher quality of project farmers' grain was reflected in the higher prices they obtained.

Pearl millet production per household among Palvai project farmers increased from 420 kg in 2004 to 867 kg in 2007 (Table 14). This was on account of a marginal increase in the pearl millet area per household and a marked increase in productivity. Control farm households achieved a less significant increase despite a greater Control farm households achieved a less significant increase despite a greater increase in area (Table 15).

Table 12. Pearl millet crop and fodder yields.

Yield	Project farmers	Control farmers	2004 (baseline)
Grain yield (kg ha^{-1})	1,360	1,028	660
Fodder yield (cartloads ha^{-1})	6.17	5.13	4.3

Table 13. Farmers (%) reporting high grain and fodder quality.

	Project farmers		Control farmers	
Year	Grain quality	Fodder quality/ palatability	Grain quality	Fodder quality/ palatability
2004	6	44	7	38
2005	20	33	5	33
2006	38	44	7	29
2007	50	56	5	36

Table 14. Production, utilization and sale of pearl millet grain by project farmers.

Aspect	2004	2005	2006	2007
Average production per household (kg)	420	700	736	867
Consumption (% of production)	69	64.62	54.53	51.70
Other uses (% of production)	0.31	0.12	0.09	0.37
Sales (% of production)	30.69	35.26	45.38	47.93
Average sale price (Rs kg^{-1})	6.02	6.77	7.37	7.83
Modal months of sale	Oct	Oct	Oct, Nov	Oct, Nov
Type of market	Regulated	Regulated	Regulated	Regulated

Table 15. Production, utilization and sale of pearl millet grain by control farmers.

Aspect	2004	2005	2006	2007
Average production per household (kg)	501	571	631	680
Consumption (% of production)	72.2	72.2	68.42	65.2
Other uses (% of production)	0.3	0.3	0.3	0.2
Sales (% of production)	27.5	27.5	31.27	34.6
Average sale price (Rs kg^{-1})	6.06	6.62	7.08	7.43
Modal month of sale	Oct	Oct	Oct	Oct
Type of market	Regulated	Regulated	Regulated	Regulated

Among project farmers, consumption of pearl millet grain fell from 69% of production to 51%. For control farmers the decline was less sharp: from 72% of production to 65%.

Project and control farmers both sold their produce in regulated markets; however, project farmers bulked their produce and sold it collectively in 2006 and 2007, and by so doing secured a price and cost advantage over control farmers, who sold individually.

Average fodder production per household increased for project as well as control farmers, in keeping with grain production. Consequently, the amount of surplus fodder increased too. However, sales did not go up and, in fact, marginally decreased for project farmers, indicating that farmers prefer to keep the surplus for their own cattle rather than sell it. The average sale price of fodder increased for both samples (Tables 16 and 17)

Table 16. Fodder utilization among project farmers.

Aspect	2004	2005	2006	2007
Average production per household (cartloads)	3.65	3.54	3.82	3.98
Used as cattle feed (% of production)	92	92	93	93
Sales (% of production)	8	8	7	7
Average sale price (Rs cartload^{-1})	326	416	460	520

Table 17. Fodder utilization among control farmers.

Aspect	2004	2005	2006	2007
Average production per household (cartloads)	2.92	2.78	3.29	3.85
Used as cattle feed (% of production)	88	90	89	89
Sales (% of production)	12	10	11	11
Average sale price (Rs cartload^{-1})	379	432	454	518

Seed Systems

The project brought about several changes in the seed systems in vogue in this cluster. There was increased adoption of hybrids and improved cultivars. Project farmers moved away from dependency on own saved seed (informal seed system) toward purchase from shops (formal) or utilization of seed supplied by this project. These changes are represented in Figures 3 and 4.

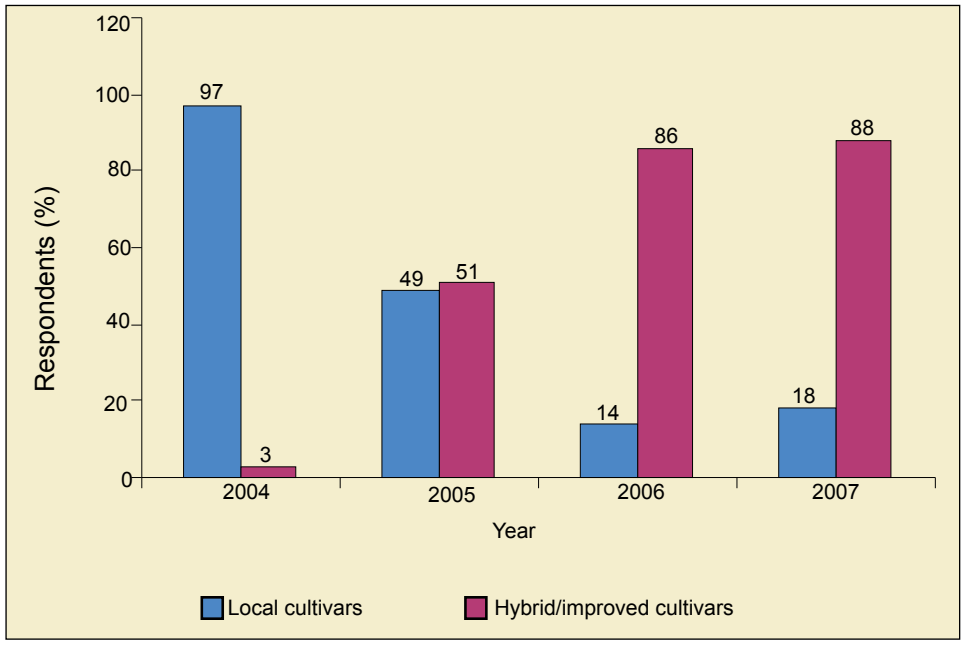

Figure 3. Cultivar utilization by project farmers.

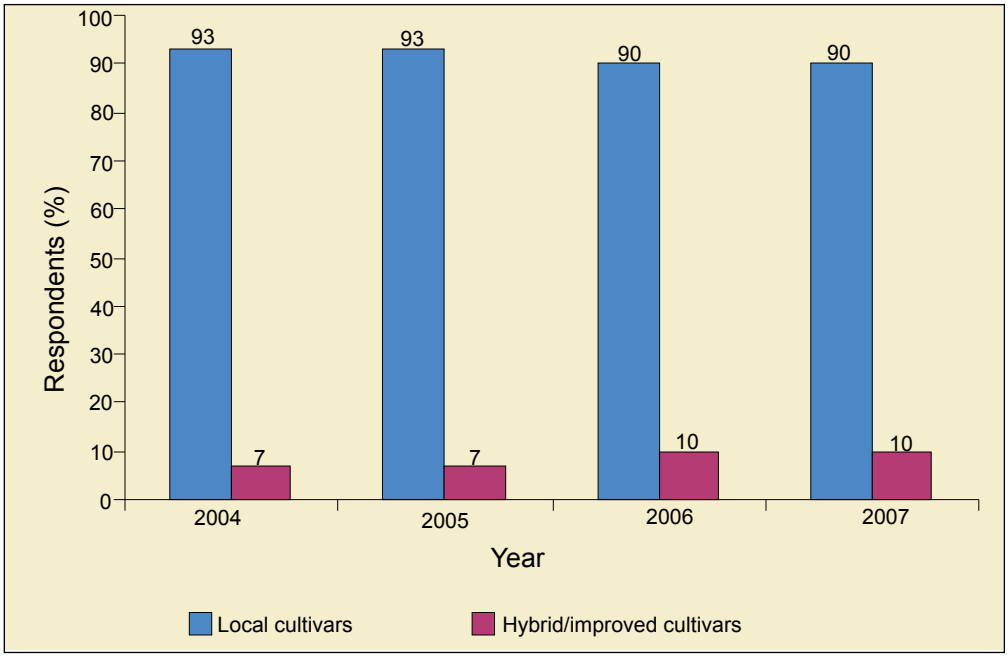

Figure 4. Cultivar utilization by control farmers.

Prior to the project, in 2004, 97% of project farmers used to prefer local varieties/cultivars of pearl millet. Since the project began, they began to adopt improved cultivars or hybrids such as MLBH 308: about 51% sowed hybrid/improved seeds in 2005 and as many as 88% in 2007. On the other hand, adoption of hybrids/improved cultivars remained low among control farmers (10%).

Purchase of improved seed from project sources (through input linkages with seed companies and ICRISAT) increased from 46% in 2005 to 83% in 2007. At the same time, use of saved seeds declined from 20% in 2004 to a negligible level in 2007 (Table 18). Among project farmers, seed purchases from private seed shops gradually decreased from 80% in 2004 to 3% in 2006 and 8% in 2007. Purchase from seed companies increased to 83% on the strength of linkages forged by the project. There was little change in the seed sources used by control farmers.

Just as grain prices rose during the project period, so did seed costs, both for hybrid/improved cultivars as well as local cultivars. However, from 2005 onward, project farmers incurred less cost on hybrid/improved cultivar seeds than control farmers by virtue of their access to input linkages (Table 19).

Table 18. Proportion of farmers (%) using different sources of seed.

	Project farmers			Control farmers	
Year	Saved seed	Seed shop	ICRISAT/seed companies	Saved seed	Seed shop
2004	20	80	0	40	55
2005	15	39	46	40	52
2006	11	3	82	52	38
2007	1	8	83	40	45

Table 19. Seed cost[1] (Rs ha^{-1}) incurred by farmers in Palvai cluster.

	Project farmers		Control farmers	
Year	Hybrid/improved cultivars	Local cultivars	Hybrid/improved cultivars	Local cultivars
2004	270	30	270	30
2005	169	33	270	33
2006	169	35	293	35
2007	225	40	339	40

1. Average cost of seed requirement for 1 ha at an average seed rate of 6.25 kg ha^{-1}.

Credit Linkage Benefits

Establishment of credit linkages was one of the important objectives achieved by the project (Table 20). This intervention targeted small and marginal farmers and sought to draw their credit preferences away from informal sources to formal sources with lower interest charges. A majority of participants in the project borrowed from formal sources.

Banks were the major sources of credit for project farmers. A few project participants borrowed from self-help groups (SHGs), but there was little borrowing from private moneylenders: only about 10% of the project farmers revealed they still depended on moneylenders.

Palvai project farmers borrowed an average of Rs 18,375 per household at an interest rate of 7% from the State Bank of India. They incurred transaction costs (traveling, photocopying of documents and getting no-dues certificates, etc.)

Table 20. Utilization of credit linkages set up by the project.

Credit variable	Project farmers	Control farmers
Major credit source	Banks	Private moneylenders
Average borrowing per household (Rs)	18,375	13,500
Interest rate (% per year)	7	36
Other costs	Rs 190 per transaction	-

of Rs 190 per farmer. On the other hand, a majority of control farmers continued to obtain loans from private moneylenders at high rates of interest.

Market Intelligence and Marketing Costs

The project spread awareness among farmers about the marketing aspects of pearl millet grain, emphasizing in particular the importance of marketing produce collectively rather than individually. Accordingly, collective marketing proved advantageous to project farmers in reducing transportation and labor costs as well as placing them in a better negotiating position in relation to prospective buyers. These changes are reflected in Table 21.

About 76% of the project farmers – and only about 60% of the control sample – received commodity price information from the nearest market. A majority (75%) of project farmers believed that bulk or collective marketing was better than individual marketing.

The assessment survey found an increase in marketing costs during the project period on account of higher transportation and commission costs due to the rising value of grain (Table 22). However, Palvai farmers who adopted bulk marketing benefited from cost efficiencies accruing from bulk transportation. Additionally, they realized higher prices in the market due to their greater bargaining power.

Table 21. Access to and use of market information.

Variable	Project farmers	Control farmers
Farmers obtaining price information (%)	76	60
Major source of information	Market	Market
Farmers whose marketing decisions were influenced by information (%)	100	100
Farmers preferring bulk/collective marketing to individual marketing (%)	75	-

Table 22. Marketing costs incurred (Rs bag^{-1} of 100 kg) by project farmers.

	Costs incurred by project farmers		
Marketing activity	2004	2007[1]	2007[2]
Bagging	4	4	4
Transportation cost	9	20	15
Commission (3% of value)	15	24	24
Labor charges (loading, weighing and unloading)	2	4	4
Other costs[3]	13	12	9
Total	43	65	56

1. Direct sale in market.
2. Collective sale.
3. Include farmers' travel, primary winnowing, and services in the market.

Table 23. Grain storage practices by project farmers.

Year	Farmers adopting storage (%)	Storage duration (months)	Reason for storing	Common storage method
2005	58	15	Consumption	Gunny bags
2006	61	15	Consumption, sale	Gunny bags
2007	66	14	Consumption, sale	Gunny bags

Storage

The project resulted in higher grain surpluses per household, which is reflected in the grain storage details of project farmers presented in Table 23.

The proportion of project farmers storing their grain increased marginally from 58% in 2005 to 66% in 2007. The proportion of grain used for consumption fell in Palvai cluster, a fact that is consistent with the slight increase in the proportion of farmers storing their produce. Further, the purpose for which they stored grain showed signs of change: where the aim of storage was predominantly consumption in 2005, it was both consumption and sale in 2006 and 2007. While residences continued to be the preferred place of storage, some farmers did utilize the infrastructure provided under the project.

Knowledge

As detailed in the section on cluster-level indicators, project farmers were instructed and informed about various aspects of crop production and marketing. This study assessed the impact of project activities in terms of knowledge gained in areas like crop production, credit linkages, farmers' association building, etc. Farmers' knowledge in these areas was ranked on a five-point scale, and the results were classified as 'good', 'average' and 'low' (Fig. 5). Though all project farmers did gain knowledge from the project, the gains varied according to the knowledge area.

About 85% of the project farmers made 'good' knowledge gains on aspects of crop production and 70% found storage-related information very useful. Overall, knowledge acquired through the project tended to be more prominent in areas such as crop production, storage, bulking and handling of grain, credit institutions, bulk marketing and association building. On other aspects such as micronutrient application, disease and pest management, and input management knowledge gains were 'average' or 'low'.

Farmers' Perception and Feedback

This study also assessed the farmers' perception of project activities and their feedback on benefits from its various components.

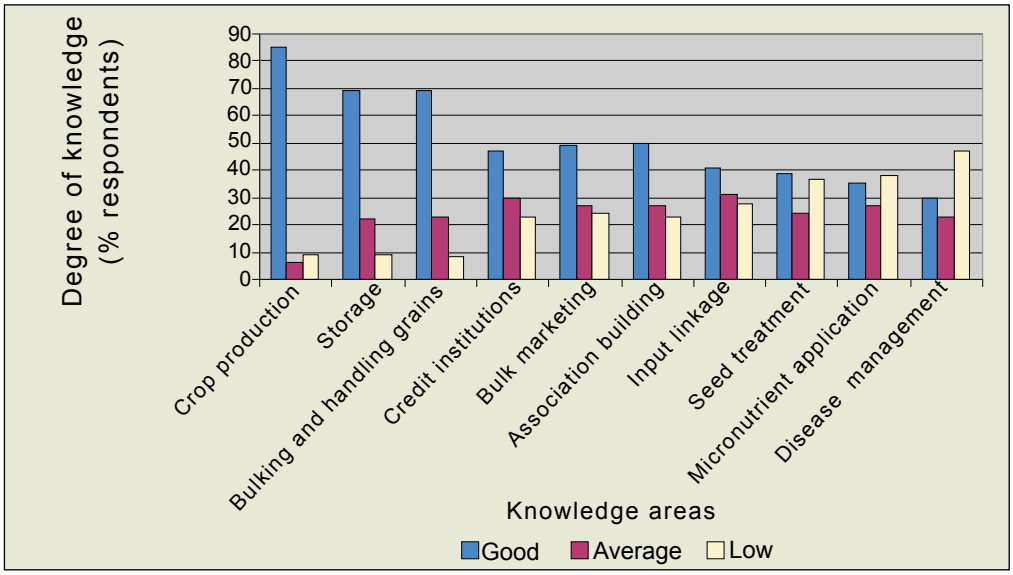

Figure 5. Knowledge acquired by farmers through project activities.

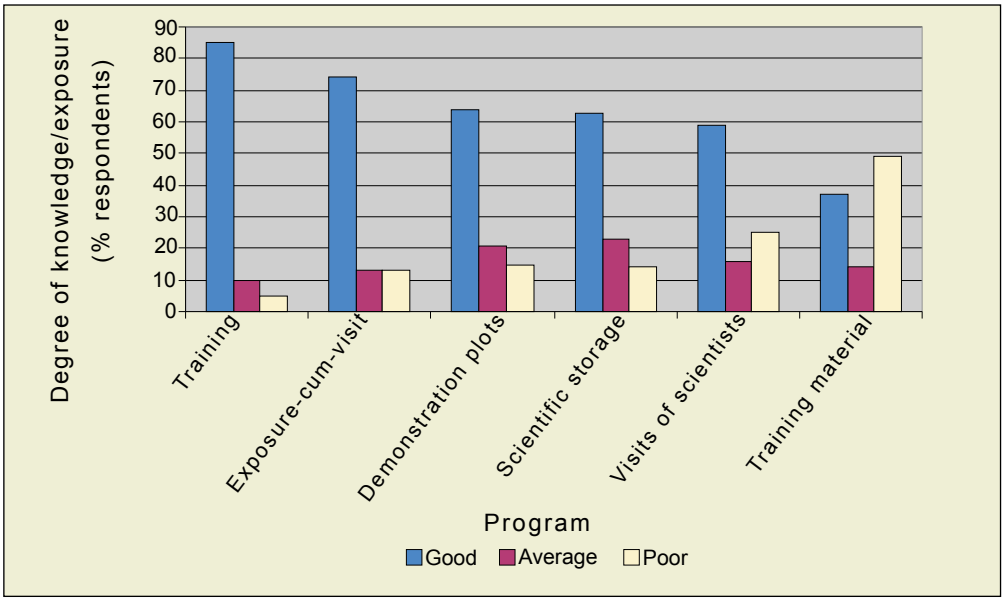

Figure 6. Farmers' perception of project activities.

The findings indicate that project activities received a good response from a majority of participants (Fig. 6). However, the technical aspects of some of the training material seemed to have presented some difficulties to them, particularly to nonliterate farmers.

Table 24 indicates the proportion of project farmers who perceived benefits from various components of the project. About 88% of the respondents reported benefits from the crop production component of the project. This was followed by 75% support for farmers' associations formed under the project. Other components benefited 71%-72% of the respondents.

Further, each component was divided into several subcomponents and the farmers' response to them was assessed (Tables 25 to 28).

Table 24. Benefits of project initiatives.

Project component	Project farmers who perceived benefits (%)
Crop production	88
Farmers' associations	75
Bulking and storing of grain and construction of storage structures	72
Bulk/joint marketing of grain	71
Credit linkages	72

Table 25. Benefits of improved crop production technologies.

Benefit	Percentage of total respondents (93)
Increased yield	85
Improvement in grain quality	18
Increased area under crop	10
Improvement in fodder quality/palatability	8

Table 26. Benefits of setting up farmers' associations.

Benefit	Percentage of total respondents (78)
Better negotiating power	88
Increased empowerment/leadership opportunities	9
Sense of self-confidence and independence	4

Table 27. Effect of bulk/joint marketing of grain.

Benefit	Percentage of total respondents (74)
Reduction in marketing costs	96
Enhanced bargaining power	5
No dependence on commission agents for cash payment	1

Table 28. Benefits of credit linkages.

Benefit	Percentage of total respondents (77)
Reduction in interest rates	87
Fewer problems in obtaining credit from banks	10
Less processing time for bank loans	4

Of all aspects of crop production technology dealt with by this project, increased yield was considered the most important by a majority (85%) of respondents. The other aspects were not considered very important by most of them.

The project farmers who reported benefits from farmers' associations identified better price negotiating power vis-a-vis industrial buyers, poultry farmers and feed manufacturers as the single most important benefit they received from the association. It helped them secure better prices by facilitating bulk sales, and increased their bargaining power in the local market too now that they had an alternative selling channel.

About 96% of the farmers who said they benefited from the bulking and joint marketing initiatives of the project ranked reduction in marketing costs as their biggest benefit. A very small proportion of them gave importance to other aspects of bulking.

Reduction in their interest rate burden was cited as a key benefit by about 87% of the respondents claiming to have benefited from the project's credit linkage initiatives. About 10% gave more importance to the fewer loan-processing problems they now encounter.

Overall Opinion of Project Farmers

- The training programs helped farmers learn more about crop management and production efficiency.
- Increased yield, quality of grain and fodder and bulking of produce got them higher prices.
- Bulking helped them avoid distress sales and reduced their dependency on commission agents for cash payments.
- Field demonstrations of production practices such as timely application of fertilizer made a marked difference to productivity.
- Knowledge gained on crop production, input linkages and credit and output linkages was a significant benefit from the project.
- A few farmers felt that seed distribution should be done well in advance so that they would not have to buy from private shops.

Table 29. Costs of pearl millet cultivation (Rs ha^{-1}) in Palvai cluster.

Cost	Material	Labor	Others	Total	Family labor
Land preparation		1,531		1,531	766
FYM application/animal penning	544	150		694	150
Sowing	281	717		998	358
Seed treatment					
Fertilizer application	1,654	100		1,754	100
Intercultural operations		853		853	853
Plant protection		-	-	-	-
Weeding		655		655	655
Irrigation		-	-	-	-
Protecting crop from birds		500		500	500
Harvesting		926		926	463
Threshing		175	534	709	175
Marketing			1,113	1,113	
Fixed costs (land rent)			1,713	1,713	
Total	2,479	5,607	3,360	11,446	4,020
Total excluding land rent				9,734	
Total excluding land rent and family labor				5,715	

- Small and marginal farmers felt that the project made them more confident.
- Overall, farmers felt they had benefited from the project and appreciated the timely execution of all objectives.

Economics of Cultivation

The real impact of the project can be understood only when enhanced grain and fodder yields and market and credit linkages are assessed in terms of their impact on the costs of, and returns from, cultivation of pearl millet. Results of this analysis are presented in Table 29.

The average total cost of cultivation in Palvai cluster was Rs 11,446 ha^{-1}. Labor costs made up 49% of this. If fixed costs such as land rent and the contribution of family labor were not taken into account, the total cost of cultivation would amount to Rs. 5,715 ha^{-1}.

Land preparation and FYM application were the biggest components (24%) of the total variable cost of cultivation of pearl millet in Palvai cluster (Fig. 7). They were followed by fertilizer application (18%). Labor costs were a major part of each of these components.

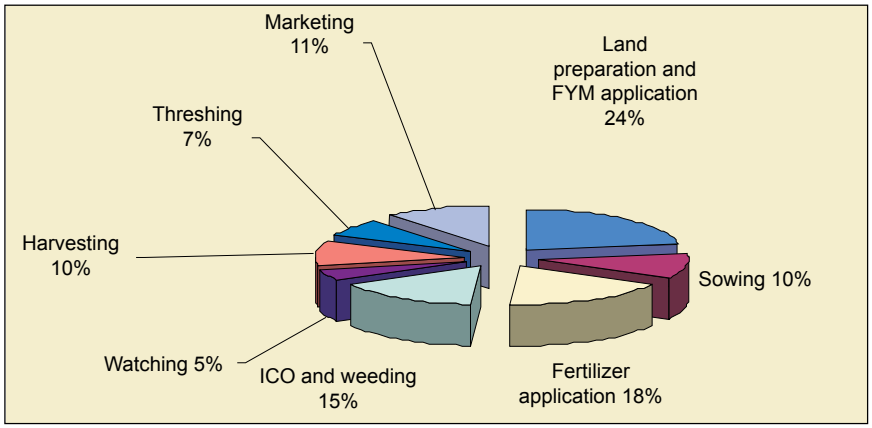

Figure 7. Components of total variable cost of pearl millet cultivation.

Costs of cultivation went up in Palvai cluster during the three-year project period, mainly on account of higher costs of labor and inputs such as fertilizers and improved seeds. On account of higher yields, costs that are related to the quantity of output (such as harvesting, threshing and transportation) have gone up too.

We also observe a substantial increase in yields (Table 30): 106% in grain yield and 43% in fodder yield. This is accompanied by sizeable increases in the prices of grain (42%) and fodder (51%). Returns from grain have gone up by about three times and returns from fodder have more than doubled.

Table 30. Comparison of cost of production and returns with baseline data.

Costs, yield prices, returns	Baseline sample (2004)	Project sample (2007)	Increase (%)
Cost of cultivation (Rs ha^{-1}) excluding land rent and contribution of family labor	4,260	5,715	34
Grain yield (kg ha^{-1})	660	1,360	106
Fodder yield (cartloads ha^{-1})	4.3	6.17	43
Price obtained for grain (Rs kg^{-1})	5.5	7.83[1]	42
Price obtained for fodder (Rs $cartload^{-1}$)	345	520[1]	51
Return from grain (Rs ha^{-1})	3,630	10,649	193
Return from fodder (Rs ha^{-1})	1,484	3,208	116
Gross return (Rs ha^{-1})	5,114	13,857[2]	171
Net return (Rs ha^{-1})	854	8,142	854
Benefit:Cost ratio	1.2	2.4	-

1.There is no significant difference in net returns and benefit - cost ratio when calculated at 2004 constant price for grain and fodder.

2. Decomposition of contribution to gross returns indicates that the increase in grain yields contributed 44%, grain price 17.6%, fodder yields 7.4%, fodder price 8.6%, and the rest due to interaction effects.

Consequently, gross return has increased by 170% and net return has gone up substantially. There is also a marked improvement in the benefit:cost (B:C) ratio, which improved from 1.2 to 2.4. Broadly understood, a farmer who was earning Rs 1.2 after incurring a cost of Rs 1 in 2004 (baseline) was now (in 2007) able to earn Rs 2.4 per rupee spent.

Thus a doubling of grain yield and a 43% increase in fodder yield coupled with 42% and 51% increases in grain and fodder prices respectively substantially increased the net returns to pearl millet project farmers.

Andhra Pradesh: Udityal Cluster

The Udityal cluster is located about 9 km from the town of Shadnagar in Mahbubnagar district of Andhra Pradesh, India. Shadnagar is about 60 km from the state capital of Hyderabad. The villages surveyed in this study fall in Balanagar and Nawabpet mandals.

These villages lie in an arid to semi-arid area which receives 75-100 cm of rainfall annually, most of it brought by the southwest monsoon. Drought is a common phenomenon. The shallow, rocky and not-too-fertile soils are of the black and red type. The target crop for this cluster was rainy-season sorghum.

1. Cluster-level Indicators

In this section we look at the cluster-level indicators impacted by the CFC-FAO-ICRISAT project in Udityal cluster and the characteristics of that impact.

Number of Villages and Farmers

The project started operations in 7 villages with 333 farmers in 2005. Over the next three years, its activities succeeded in encouraging more villages and farmers to participate. Three villages and 406 farmers joined the project in 2006 followed by another three villages in 2007, making a total of 13 villages with 905 participating farmers (Table 31).

Crop Production

During its three-year period, the project resulted in increases in the cultivated area of the target crop, rainy-season sorghum, and grain production as well as productivity. Sorghum area increased from 184 ha in 2005 to 455 ha in 2007 (Table 32). Crop production rose from 119 tons to 364 tons and average productivity from 647 kg ha^{-1} to 800 kg ha^{-1}.

Table 31. Number of participating villages and farmers in Udityal, 2005-2007.

Year	Villages			Number of farmers		
	Initial villages	New villages	Total	Initial farmers	New farmers	Total
2005	7	-	7	333	-	333
2006	7	3	10	-	406	739
2007	10	3	13	-	166	905

Table 32. Area, production and yield of rainy-season sorghum.

Year	Area (ha)	Production (t)	Yield (kg ha^{-1})
2005	184	119	647
2006	354	283	799
2007	455	364	800

Table 33. Marketed surplus and price realization of rainy-season sorghum.

Year	Total production (t)	Marketed quantity (t)[1]	Average price range (Rs kg^{-1})	
			Market price[2]	Price obtained by project farmers from bulk sale to poultry feed industry
2005	119	17.1	6.5-6.8	6.5-6.8
2006	283	48.1	5.00-5.20	6.35-6.50
2007	364	83.7	5.00-6.00	6.00-6.30

1. Includes bulk sales to poultry feed industry and direct sales in the market.
2. Prevailing price in the regulated market.

Grain Sales and Prices

Project interventions led to an increase in the marketable surplus of sorghum in this cluster. Project farmers received better prices for their produce as grain quality had improved and project-established linkages enabled bulk sales to industrial buyers.

In fact, project farmers realized better prices than those prevailing in the local market (Table 33).

Training Programs

Several training programs were conducted in the Udityal cluster to disseminate information and knowledge among project farmers on various aspects of crop production, input and credit access and marketing (Table 34). Printed training material, prepared in consultation with experts and farmers themselves, was distributed among the participants. Supply of instructional material increased

Table 34. Training programs conducted in Udityal cluster.

Year	Training program	Venue	No. of participants		
			Male	Female	Total
2006	Improved production technologies of sorghum and pearl millet in Udityal, Mahbubnagar, Andhra Pradesh.	Nine programs conducted at various locations in Udityal cluster	786	110	896
	Grain storage and godown management	Udityal	28	12	40
2007	Farmers-buyers dialogue	Rajendra Nagar (Hyderabad)	26	6	32
	Integrated crop production	Kamsanpalli	37	15	52
	Integrated crop production	Nerelapalli	45	21	66
	Integrated crop production	Chokkampet	41	17	58
	Integrated crop production	Raghapur	43	11	54
	Sorghum field-level discussion	Udityal	67	14	81
	Bankers-farmers meeting	Udityal	49	28	77
	Training program on safe and scientific storage of bulk grain, management of mycotoxins and book keeping requirements for Andhra Pradesh farmers	Udityal	61	19	80
	Cross-learning visit of Chinese, Thai and Indian farmers, and scientists' interaction	Udityal	71	17	88

Table 35. Training material developed and distributed to participants.

Year	Type of material	Title	No. of copies
2005	Bulletins	Improved production technologies of sorghum for Andhra Pradesh	1,500
2006	Handouts/flyers	Grain storage and godown management	500
2007	Literature Posters	Cultivation practices of sorghum Seed treatment	1,000 1,000

from 1500 copies to 2000 during the project period, a fact which reflects increased participation by farmers (Table 35).

Demonstrations

The project conducted on-farm demonstrations to stress the importance of adopting scientific sorghum cultivation practices. Experiments were conducted with different sorghum hybrids, and it was demonstrated to farmers that CSH 16 was better than JKSH 528 in terms of productivity, local adaptability and mold resistance (Table 36)

Table 36. On-farm demonstrations of improved sorghum production practices.

Year	Type of demonstration	Results	No. of farmers
2007	Plot 1: Full dose of macronutrients and full dose of micronutrients Plot 2: Full dose of macronutrients without micronutrients Plot 3: Half dose of macronutrients and full dose of micronutrients Plot 4: Half dose of macronutrients without micronutrients	Two sorghum hybrids, CSH 16 and JKSH 528, tested. Highest yield obtained from plots with a full dose of macronutrients and a full dose of micronutrients.	800-900
	Sorghum cultivar demonstration	CSH 16 better than JKSH 528 in terms of productivity, quality and mold resistance	800-900

Soil Analysis

In soil tests conducted in 2006 to detect any nutrient deficiencies, it was found that levels of organic carbon and macronutrients such as P and K were low in this cluster. Project farmers were advised appropriate corrective practices (Table 37).

Grain Quality

Scientific analysis of grain samples, drawn from the field as well as storage, found that all but a few of them were safe, and contained toxin levels well within the acceptable range (Table 38).

Table 37. Results of soil samples tested in Udityal cluster.

Year	No. of samples	Parameters tested	Results
2006	53	Soil type: Sandy loam, clayey type pH: Acidic, medium, alkaline. Organic carbon: low, medium, high Available nutrients: Macronutrients: P, K Micronutrients: Zn, Mn, Cu	A majority of soils were sandy loam with medium to acidic pH Organic carbon was low in majority of soils Except P and K, other nutrients were found 'high' within their acceptable ranges

Table 38. Grain sample analysis for mycotoxins.

Year	No. of samples tested	Parameters tested	Results
2006-07	30 field samples and 30 farm storage samples	Aflatoxin and fumonisin	4 field samples and 4 storage samples showed aflatoxin above the acceptable range (30 µg kg^{-1}) 4 field samples and 5 storage samples showed fumonisin above the acceptable range (100 µg kg^{-1})

Table 39. General socioeconomic aspects of Udityal respondents.

Variable	Project farmers	Control farmers
Average age (years)	47	46
Average irrigated landholding (ha)	1.42	1.46
Average nonirrigated landholding (ha)	1.80	1.87
Average total landholding (ha)	2.12	1.93
Nonliterate heads of household (%)	94	65
Average no. of dependents	6.5	6
No. of dependents in the 3-17 age group	2	3
No. of schoolgoing dependents	2	2
Backward Class (BC) households (%)	72	100

2. Survey Results

General Socioeconomic Aspects

In this section, we present the broad socioeconomic aspects of the project and control samples (Table 39). The respondent heads of household in the Udityal cluster were by and large experienced farmers with an average age of 47 years among project farmers and 46 years among control farmers. Small farmers dominate the cluster with the average total landholding among project farmers being only 2.12 ha, and 1.93 ha among control farmers. The average size of nonirrigated landholdings was larger than that of irrigated landholdings.

The majority of households in Udityal were headed by nonliterate individuals; however, their proportion was higher among project farmers (94%) than control farmers (65%). Also, project farmers tended to have more dependents (6.5) than their control counterparts (6). They had an average of 2 dependents in the 3-17 age group, both schoolgoing. This indicates an awareness of the importance of educating children.

A majority of farm households in this cluster belonged to the Backward Classes, with 100% of the control sample belonging to this class of society. As per the baseline data of 2005, only about 7% of project farmers had subsidiary occupations. That trend was evident in this study too: heads of household engaged in subsidiary occupations were only 3% of the sample. These occupations mainly consisted of running shops or trading in agricultural goods.

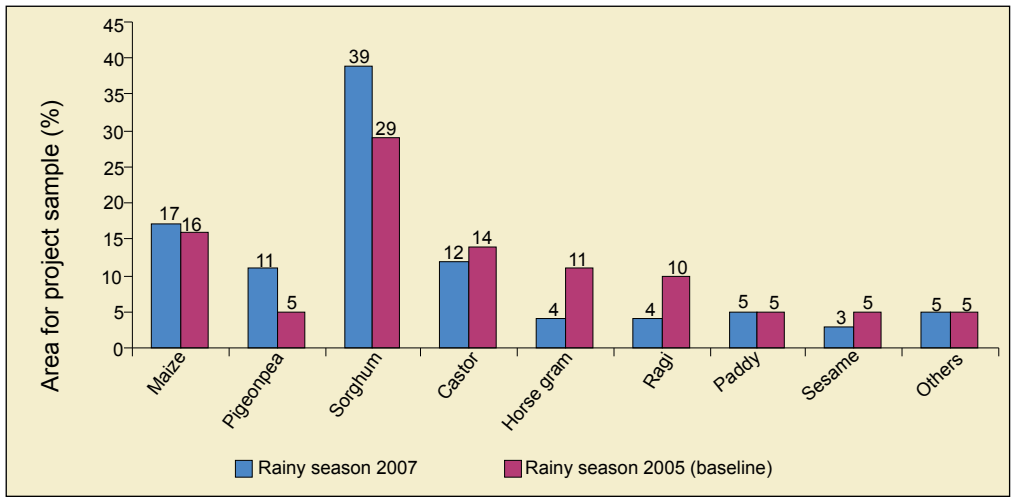

Figure 8. Changes in the cropping pattern of project farmers, 2005-2007.

Area Under Rainy-season Sorghum

As we have seen in the previous section on cluster-level indicators, the area under rainy-season sorghum increased significantly during the project period in Udityal cluster. Concurrently, there were other changes in the cropping pattern at the household level and in the sorghum area per household (Fig. 8). For instance, there was a marginal increase in the area of maize and pigeonpea (crops which are intercropped with rainy-season sorghum), and there was a decrease in the area under castor, horse gram and sesame.

The average area under sorghum per household remained almost static for control farmers during 2004-07 but increased from 0.73 ha (2004) to 0.79 ha (2007) among project farmers (Table 40). Project farmers attributed this to the support provided by the input and credit linkages laid down by the project. In particular, the supply of seeds of improved cultivars and hybrids through the project may have been an encouraging factor in this development.

The average yield of sorghum for project farmers was 975 kg ha^{-1} compared to yields reported in the baseline study (563 kg ha^{-1}) and was significantly higher than for control farmers (789 kg ha^{-1}). Similarly, their average fodder yield was 1.4 cartloads ha^{-1} better than the baseline result (Table 41).

Production and Product Utilization

An increasing proportion of project farmers perceived an improvement in grain and fodder quality through the project period (Table 42). This perception of quality improvement was not as strong among control farmers. Farmers realized better prices in the market due to the improved quality of their grain and fodder.

A closely associated parameter of rainy-season sorghum grain quality is mold incidence. Project farmers (56%) reported increased incidence of mold in sorghum grain in 2005 on account of nonfavorable weather conditions (Table 43). However, mold incidence was considerably reduced in subsequent years. This was a likely impact of the project which emphasized cultivation of mold-resistant cultivars and harvesting at the right stage of physiological maturity. In contrast, there was little change in mold incidence in sorghum samples taken from control farmers.

Analysis of the utilization of sorghum grain in Udityal cluster showed that the average production of sorghum per project-farmer household increased from 385 kg in 2004 to 748 kg in 2007 (Table 44), partly on account of a marginal increase in the sorghum area per household and partly due to a marked increase in productivity. Average production for control farm households increased too, mainly on account of productivity improvement (Table 45).

Table 40. Average area of rainy-season sorghum (ha) per household.

Year	Project farmers	Control farmers
2004	0.73	0.58
2005	0.73	0.55
2006	0.77	0.57
2007	0.79	0.57

Table 41. Sorghum grain and fodder yields in Udityal cluster.

Yield	Project farmers	Control farmers	2004 (baseline)
Grain yield (kg ha^{-1})	975	789	563
Fodder yield (cartloads ha^{-1})	6.4	5.8	5

Table 42. Percentage of farmers reporting higher grain and fodder quality.

	Project farmers		Control farmers	
Year	Grain quality	Fodder quality/ palatability	Grain quality	Fodder quality/ palatability
2004		8	13	28
2005	14	19	18	18
2006	35	39	27	14
2007	71	65	39	39

Table 43. Mold incidence in sorghum grain.

	Samples affected by mold (%)	
Year	Project farmers	Control farmers
2004	34	40
2005	56	45
2006	30	45
2007	25	40

Table 44. Production, utilization and sale of rainy-season sorghum grain by project farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	385	546	693	748
Consumption (% of total production)	85	85	82	75
Other uses (% of total production)	0.5	0.6	1	2
Sales (% of total production)	14.5	14.4	17	23
Average sale price (Rs kg^{-1})	4.25	5.25	6.4	6.20
Modal month of sale	Oct	Oct	Oct	Oct
Type of market	Regulated	Regulated	Regulated and direct sales through project	Regulated and direct sales through project

Table 45. Production, utilization and sale of rainy-season sorghum grain by control farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	394	394	430	460
Consumption (% of total production)	92	89	91	88
Other uses (% of total production)	3	6	3	4
Sales (% of total production)	5	5	6	8
Average sale price (Rs kg^{-1})	4.25	5	5.4	5.3
Modal month of sale	Oct	Oct	Oct	Oct
Type of market	Regulated	Regulated	Regulated	Regulated

Among project farmers, the proportion of grain consumption gradually came down from 85% to 75% of production while decreasing only marginally for control farmers. This can be attributed to increased production per household.

During the initial period of the project, farmers continued to sell their produce in the nearest regulated market or to intermediaries operating in the village. After 2006, they began to sell in regulated markets or directly to poultry feed manufacturers which resulted in better price realization of Rs 6.2 kg^{-1} in 2007 compared with Rs 4.25 kg^{-1} in 2004.

As a consequence of higher fodder production per household, the amount of surplus fodder increased too. However, sales of surplus fodder did not go up dramatically as they had with surplus grain. Farmers continued to prefer keeping excess fodder for their own cattle rather than sell it (Tables 46 and 47). At the same time, there was no significant increase in the price of fodder.

Seed Systems

Several changes came about in the seed supply systems serving Udityal cluster during the project period. This is reflected in the use of seed of hybrids and improved cultivars. Farmers now depend less on informal seed systems such as own saved seed and rely more on formal systems such as seed shops, and especially, access the seed linkages established by the project.

Prior to this project, 100% of Udityal project farmers, due to lack of awareness of hybrid/improved cultivars, used to prefer seeds of local varieties of sorghum. Encouraged by the performance of hybrid/improved cultivars, as demonstrated by the project, about 48% of them sowed hybrid/improved seeds in 2005. This increased further to 80% in 2006 and 2007 (Fig. 9). This was a significant achievement of the project.

Table 46. Fodder utilization by project farmers.

Variable	2004	2005	2006	2007
Average production per household (cartloads)	3.3	3.8	4.3	5.1
Used as cattle feed (% of production)	85	90	90	83
Sale (% of production)	15	10	10	17
Average sale price (Rs $cartload^{-1}$)	394	450	484	460

Table 47. Fodder utilization by control farmers.

Variable	2004	2005	2006	2007
Average production per household (cartloads)	3.3	3.4	4	4.6
Used as cattle feed (% of total production)	92	94	92	90
Sales (% of production)	8	-+6	8	10
Average sale price (Rs $cartload^{-1}$)	400	450	450	465

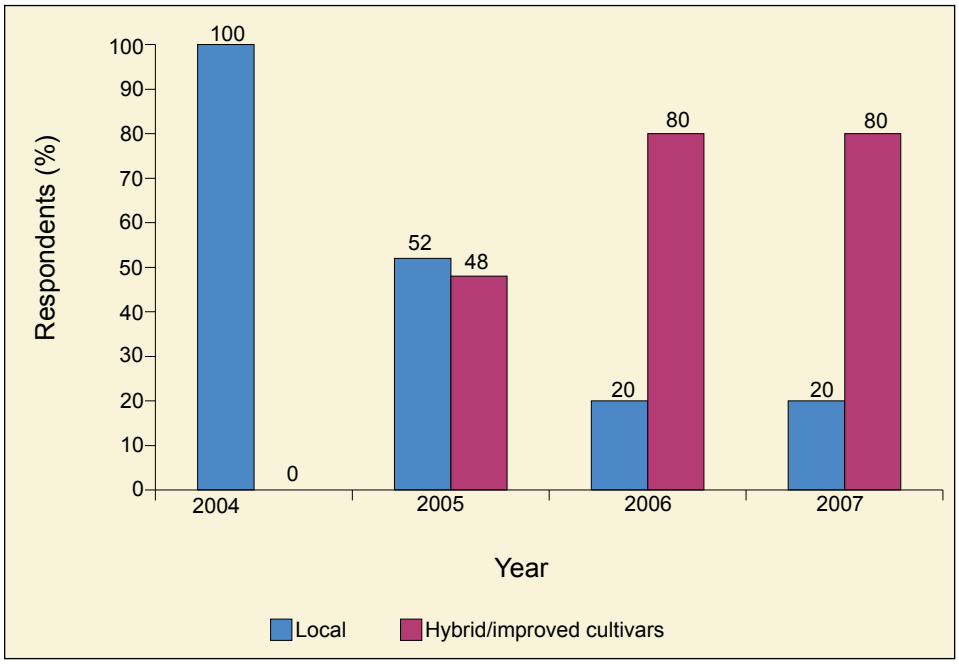

Figure 9. Improved cultivar utilization among project farmers.

In the case of control farmers too there was an increase in the use of hybrid/improved cultivars but dependence on local cultivar seeds continued (Fig. 10). Further, use of local cultivars was 100% among control farmers drawn from nonproject villages; use of hybrid/improved cultivar seeds was seen only among control farmers residing within project villages. This indicates that the awareness programs conducted by the project influenced farmers' seed decisions even if they were not formal participants.

From 2005 onward, the proportion of project farmers accessing improved sorghum seed through the project (linkage of seed companies and ICRISAT) increased from 41% to 80% in 2007 (Table 48). At the same time, use of own saved seeds came down from 84% in 2004 to 19% in 2007. Seed purchase from shops also gradually decreased, becoming marginal in 2007. Among control farmers there was not much change in the seed supply system used.

Seed cost – of both hybrid/improved cultivars and local varieties – witnessed an increase concurrent with the rise in prices of grain. However, improved seed costs incurred by project farmers were less than costs sustained by control farmers on account of discounts available to the former through project linkages (Table 49).

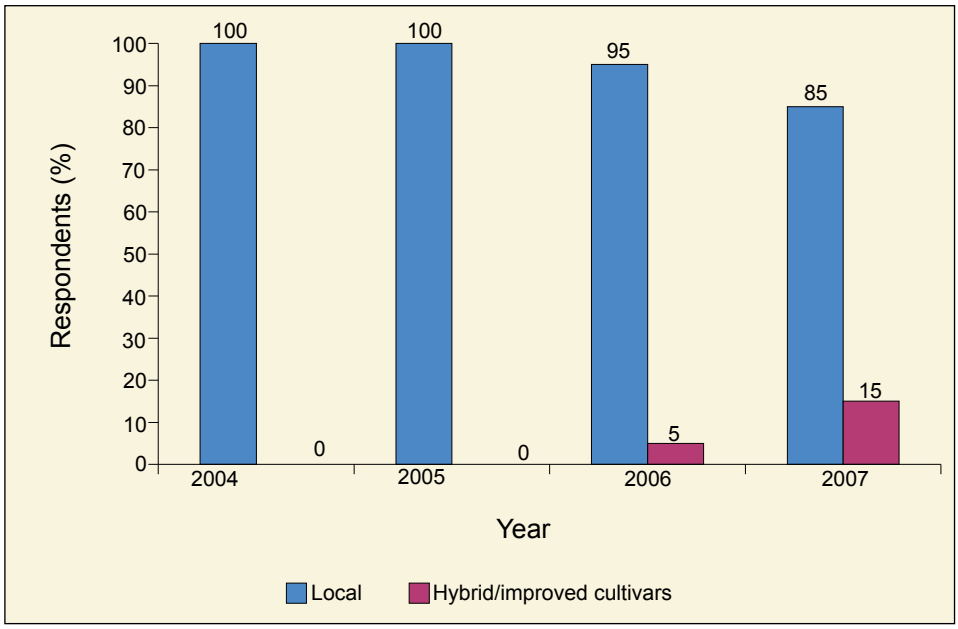

Figure 10. Improved cultivar utilization by control farmers.

Table 48. Proportion of respondents (%) using various seed sources in Udityal.

	Project farmers			Control farmers	
Year	Own saved seeds	Seed shop	ICRISAT/seed companies	Saved seeds	Seed shop
2004	84	16	0	82	18
2005	46	13	41	82	18
2006	15	7	78	82	18
2007	19	1	80	81	19

Credit Linkage Benefits

One of the important objectives of the project was to spread awareness among farmers about credit facilities available in the formal sector, and to lay down linkages to give farmers access to low-interest loans from institutionalized lending agencies. This objective was achieved to a significant extent.

The major source of credit for project as well as control farmers in Udityal cluster was banks. While a few farmers borrowed from cooperative institutions, borrowing from private moneylenders was rare. The average loan taken by a project farmer in this cluster was Rs 14,201 (Table 50) at an interest rate of 7% from the State Bank of India. Transactional expenses incurred by a control

Table 49. Seed costs[1] (Rs ha^{-1}) incurred by sorghum farmers.

	Project farmers		Control farmers	
Year	Hybrid/improved cultivars	Local	Hybrid/improved cultivars	Local
2004	476	75	476	75
2005	216	88	541	88
2006	281	100	585	100
2007	325	110	671	110

1. Average cost of seed requirement for 1 ha at an average seed rate of 6.25 kg ha^{-1}.

Table 50. Utilization of credit linkages set up by the project.

Credit variable	Project farmers	Control farmers	Net benefit
Major source	Banks	Banks	
Average borrowing per household (Rs)	14,201	16,063	-
Interest rate (% per year)	7	7	-
Other costs (Rs per transaction)	106	175	69 (25.66%)
Remarks	Low interest rate, timely availability through project	Delay, lengthy procedures	Timely availability of adequate loans

farmer amounted to Rs 175 while his project counterpart spent only Rs 106, a saving of about 26%. Project farmers also felt that by participating in the project they benefited in terms of gaining access to adequate loans and saving time.

The baseline survey of 2005 had reported that about 95% of the sample borrowed from private moneylenders and about 65% from banks. Lengthy procedures and nonavailability of timely loans in the formal credit system tended to discourage small and marginal farmers, leaving them to depend on local moneylenders. However, the majority of project farmers in Udityal have now been linked with nationalized banks and need no longer turn to private moneylenders.

Market Intelligence and Marketing Costs

About 62% of the project farmers obtained price information from the nearest market whereas only 40% of the control sample did so (Table 51). About 55% of the project farmers did not participate in bulk marketing since they were in need of immediate cash and sold the produce in the regulated market. The ruling market price in 2007 was Rs 5.30 kg^{-1} and the average bulk price Rs 6.23 kg^{-1}, a premium of Rs 0.83 kg^{-1}, or 15.7%.

Table 51. Access to and use of market information.

Variable	Project farmers	Control farmers
Farmers obtaining price information (%)	62	40
Major source of information	Market	Market
Farmers whose marketing decisions were influenced by information (%)	100	100
Farmers preferring bulk/collective marketing over individual marketing (%)	45	-
Farmers obtaining higher prices due to bulk sales (%)	42	-
Market price (Rs kg^{-1} in 2007)	5.30	5.30
Bulk sales price (Rs kg^{-1} in 2007)	6.23	

Table 52. Marketing costs incurred (Rs bag^{-1} of 100 kg) by project farmers.

	Costs incurred by project farmers		
Marketing activity	2004	2007[1]	2007[2]
Bagging	3	5	5
Transportation cost	15	20	Borne by industry
Commission (3% of value)	20	18	
Labor charges (loading, weighing and unloading)	4	4	4
Other costs[3]	14	14	9
Total cost bag^{-1}	56	61	18

1. Direct sale in market.
2. Bulk marketing.
3. Includes farmers' travel, primary winnowing, and services in the market.

Concurrently, marketing costs increased since 2004 on account of the increase in transportation costs as well as the value of grain, which in turn led to a spurt in commission costs. Nevertheless, it is clear that farmers who bulk marketed their produce received greater cost efficiencies (Table 52) than farmers who sold individually.

Storage

Since there was a higher grain surplus being produced per household during the project period, grain storage assumed importance. However, in Udityal, the proportion of project farmers resorting to grain storage fell from 98% in 2005 to 87% in 2007 on account of immediate postharvest sales by some farmers as prices were then ruling high in the market (Table 53). The predominant method of storage here, as in Palvai, was in gunny bags although some farmers did use the infrastructure built by this project.

Table 53. Grain storage practices by project farmers.

Year	Farmers adopting storage (%)	Average duration of storage (months)	Modal reason for storage	Modal method of storage
2005	98	12	Consumption	Gunny bags
2006	90	12	Consumption and sale	Gunny bags and warehouse
2007	87	12	Consumption and sale	Gunny bags and warehouse

Knowledge

Assessment of the farmers' knowledge gain from the project indicated that crop production and storage-related aspects were the two areas in which they learnt the most (Fig. 11). About 95% of the project farmers learnt information related to crop production through the project and 61% gained knowledge about modern storage methods. The other areas where there was 'good' knowledge gain was on bulking and handling of grains and disease management; learning was 'average' for the other aspects of the project.

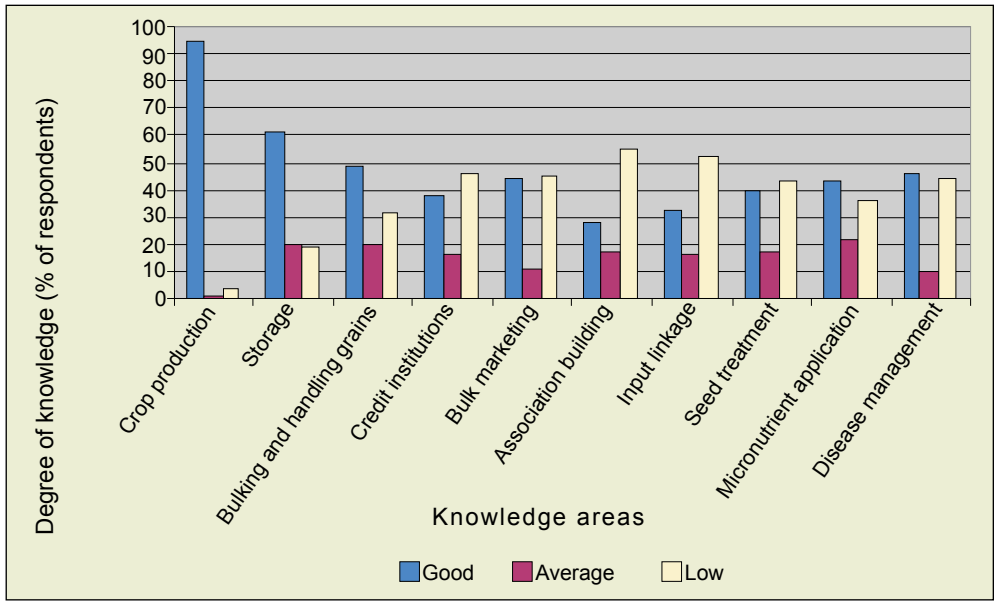

Figure 11. Knowledge acquired by farmers through project activities.

Farmers' Perception and Feedback

The farmers' feedback on the project's benefits was also assessed in this study (Fig.12). Of the several activities conducted by the project, training programs (97%), exposure-cum-visits (81%), demonstrations (65%), scientific storage practices (71%) and visits of scientists (77%) received a 'good' response from the majority of respondents. About 44% of the project farmers, however, returned a 'poor' verdict on the training material supplied to them, perhaps on account of the difficulties it presented to nonliterate farmers.

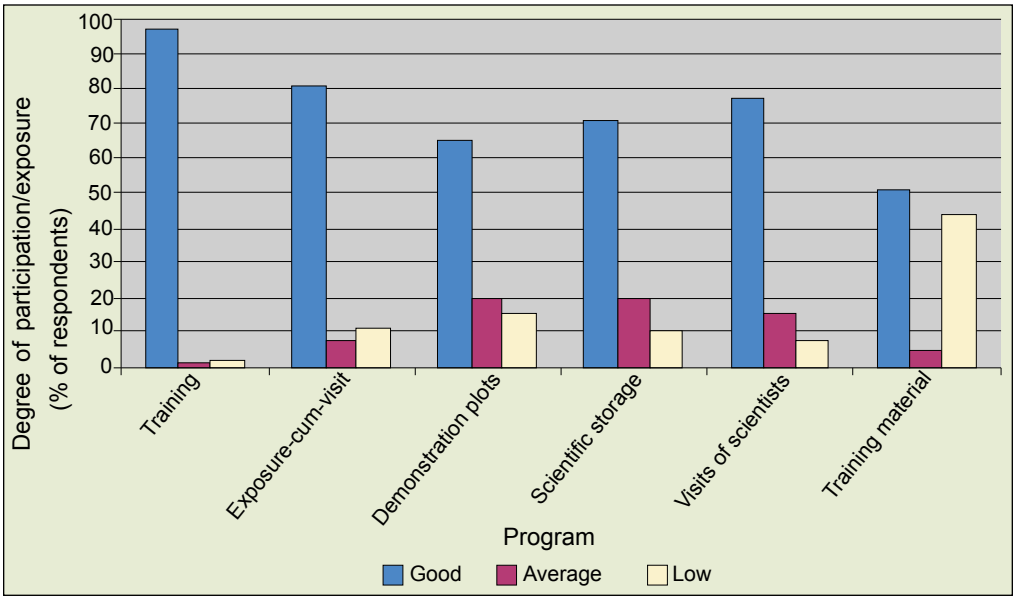

Figure 12. Farmers' perception of project activities.

Similarly, farmers' perception of benefits received from different components of the project varied (Table 54). Formation of farmers' associations was the most beneficial component with 86% of the respondents benefiting from it. This was followed by crop production (82%), credit linkages (78%) and bulking and storage structure construction (78%). Bulk/joint marketing of grain was not far behind with 71% support from farmers.

In a further analysis of specific benefits gained from within these components, 67% of the 93 farmers who benefited from the crop production component of the project said increased yield was the biggest positive result (Table 55). This was followed by the benefit of increased area under sorghum (26%). The farmers saw little perceptible change in grain or fodder quality.

Table 54. Benefits of project initiatives.

Project component	Project farmers who perceived benefits (%)
Crop production	82
Farmers' associations	86
Bulking and storing of grain; construction of storage structures	78
Bulk/joint marketing of grain	71
Credit linkages	78

Table 55. Benefits of improved crop production technologies.

Benefit	Percentage of total respondents (93)
Increased yield	67
Increased area under crop	26
Improvement in grain quality	5
Improvement in fodder quality/palatability	2

Table 56. Benefits of farmers' associations.

Benefit	Percentage of total respondents (97)
Better negotiating power	69
Increased empowerment/leadership opportunities	23
Sense of self-confidence and independence	8

About formation of farmers' associations, 69% of the farmers (Table 56) said this component had taught them better price negotiating skills when dealing with industrial buyers. About 23% felt that the project provided them empowerment/ leadership opportunities.

Of the 88 farmers who claimed to have benefited from the bulking and storage infrastructure built by the project, 86% said the biggest benefit of this activity was the better prices they received from industrial buyers than would have been available to them in the domestic market in 2006 and 2007 (Table 57). Only 10% of this group felt that they benefited from knowledge of safe grain-storage and grain-handling practices disseminated by the project. The other benefits – protection from distress sales and enhancing the role of women in bulking and storage activities – were not perceived as important by a majority of the farmers.

About 86% of the farmers in this group said bulking had reduced their cost of marketing (Table 58). For about 9%, freedom from dependence on commission agents was a more important benefit, and 5% gave prime importance to enhancement of their bargaining power.

Table 57. Benefits of bulking and storage infrastructure built by the project.

Benefit	Percentage of total respondents (88)
Better prices for produce	86
Knowledge of safe storage and handling of grain	10
Protection from distress sales	3
Enhanced role for women in storage and bulking activities	1

Table 58. Benefits of bulk/joint marketing of grain.

Benefit	Percentage of total respondents (80)
Reduction in marketing costs	86
No dependence on commission agents	9
Enhanced bargaining power and more sales channels	5

Table 59. Benefits of credit linkages established under the project.

Benefit	Percentage of total respondents (88)
Reduction in interest rates	71
Reduction in loan processing time	21
Fewer problems in obtaining credit	5
Availability of credit for horticulture, land development, education, etc.	3

Interest rate reduction on account of the credit channels opened up by the project was considered a key benefit by 71% of the respondents in the group which supported the project's credit linkage initiatives (Table 59). Reduction in loan processing time was judged the most important benefit by 21% of respondents in this group. Only a few respondents (3%) received loans for horticulture/land development purposes as the credit linkages developed by the project are still in an initial stage.

Overall Opinion of Project Farmers

Udityal project farmers in general gave very positive feedback to the project. The following are some of the key opinions expressed by a majority of them:

- Seeds facilitated by the project enabled farmers to get higher yields. They hoped that the supply linkages with seed companies would be sustained in the coming years.
- Most of the project farmers supported the project's special concern for small and marginal farmers.
- About 89% of the respondents said laying down credit linkages was a key activity of the project. Access to formal credit systems freed small and marginal farmers from dependence on moneylenders. There was good

support for cooperative action on credit linkages, which drastically reduced their loan-processing costs and time.

- The concept of warehouse storage, bulking of grain and output linkages with industrial buyers helped farmers realize better prices than before.
- A few farmers expressed the need for inclusion of harvesters and threshers among the facilities provided by the project.
- Farmers wanted the project to be continued and extended to other crops.
- A majority of the project farmers felt that cooperative action was a key lesson they had learnt from the project.

Economics of Cultivation

The average cost of cultivation for Udityal, calculated for a subsample of 20 respondents, was Rs 10,150 ha^{-1} (Table 60). Of the other costs, labor took the largest share of about 55% followed by material (about 25%) from the total cost of cultivation. Excluding the fixed costs such as land rent and family labor, costs of cultivation came to Rs. 5,509 ha^{-1}.

A breakup of the total variable cost of sorghum cultivation (Fig.13) shows that fertilizer application constituted about 20% of the cost – due to increased fertilizer prices during the season – followed by land preparation and FYM application.

Table 60. Costs of cultivation (Rs ha^{-1}) of rainy-season sorghum in Udityal cluster.

Costs	Material	Labor	Others	Total	Contribution of family labor
Land preparation		997		997	498
FYM application/animal penning	404	44		448	44
Sowing	347	929		1,276	464
Seed treatment	-	-	-	-	-
Fertilizer application	1,784	63		1,846	63
Intercultural operations		584		584	584
Plant protection		540		540	540
Weeding					
Irrigation		596		596	596
Protection from birds		1,256		1,256	628
Harvesting		599		599	599
Threshing			758	758	
Marketing			625	625	
Fixed costs (land rent)			625	625	
Total	2,534	5,607	2,008	10,150	4,016
Total excluding land rent				9,525	
Total excluding land rent and family labor				5,509	

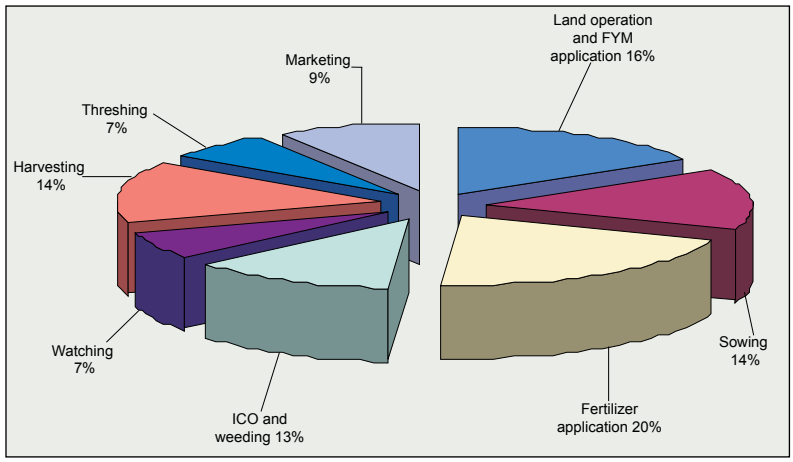

Figure 13. Components of the total variable cost of rainy-season sorghum.

As in Palvai, the total cost of cultivation increased over the project period in Udityal, mainly on account of an increase in the costs of labor and inputs, primarily fertilizers and usage of improved seeds and increased usage of fertilizers.

However, there was a substantial increase in grain yield (23%) and fodder yield (28%). Higher productivity coupled with higher prices contributed to increased returns; gross returns were higher by 95% and net returns by 220%. There was a marked improvement in the B:C ratio: from 1.3 to 1.6 (Table 61). In other words, the farmers of Udityal are now getting 30 paise more per rupee invested than they used to get at the beginning of the project.

Table 61. Comparison of production costs and returns with baseline data.

Variable	Baseline sample (2004)	Project sample (2007)	Increase (%)
Cost of cultivation (Rs ha^{-1}) excluding land rent and contribution of family labor	3,515	5,509	57
Grain yield (kg ha^{-1})	563	975	73
Fodder yield (cartloads ha^{-1})	5	6.4	28
Prices obtained for grains (Rs kg^{-1})	5	6.2	24
Price obtained for fodder (Rs $cartload^{-1}$)	357	460	29
Returns from grain (Rs ha^{-1})	2,815	6,045	115
Returns from fodder (Rs ha^{-1})	1,785	2,944	65
Gross return (Rs ha^{-1})	4,600	8,989	95
Net return (Rs ha^{-1})	1,085	3,480	220
B:C ratio	1.3	1.6	-

1.There is no significant difference in net returns and benefit - cost ratio when calculated at 2004 constant price for grain and fodder.

2. Decomposition of contribution to gross returns indicates that the increase in grain yields contributed 46.9% grain price 15.4%, fodder yields 11.4%, fodder price 11.7%, and the rest was due to interaction effects.

Maharashtra: Rohatwadi Cluster

The Rohatwadi cluster is located in Patoda mandal of Beed district in the state of Maharashtra. It is about 40 km from the town of Beed and 25 km from Patoda. The main village in this cluster, Rohatwadi, lies on the highway connecting these two towns; the rest of the villages are located in the interior. This region has a rough terrain characterized by hillocks and small lakes. Accessibility is difficult.

The summers are hot and the winters cold. Most of the rainfall here comes from the southwest monsoon, which favors cultivation of varied crops. The soils range from red to black. The heavy black soils retain good quantities of moisture, which makes it favorable to the cultivation of crops such as sorghum and pearl millet – the project's target crops for this cluster – though the rains cease early.

Sugarcane is an important crop in and around this cluster. After the sorghum harvest, many farmers from this cluster go to adjacent districts to work as sugarcane cutters and earn additional income.

1. Cluster-level Indicators

Number of Villages and Farmers

Through the three years of this project (2005-07) in Rohatwadi, the number of villages participating in it, as well as the number of farmers, increased considerably (Table 62).

Expansion of the project area was a challenge for the Krishi Vigyan Kendra, Beed, as accessibility is a major constraint in this cluster. Nevertheless, the project was extended to 12 villages in 2007 (up from 5 in 2005) with 677 farmer participants (up from 241 in 2005).

Table 62. Number of participating villages and farmers in Rohatwadi cluster.

	Number of villages			Number of farmers		
Year	Initial villages	New villages	Total	Initial farmers	New farmers	Total
2005	5	-	5	241	-	241
2006	5	3	8	241	271	512
2007	8	4	12	512	165	677

Table 63. Area, production and yield of pearl millet in Rohatwadi cluster.

Year	Area (ha)	Production (t)	Yield (kg ha^{-1})
2005	241	313	1,299
2006	409	532	1,301
2007	782	1,016	1,299

Table 64. Marketed surplus and price realization of pearl millet grain.

			Average price range (Rs kg^{-1})	
Year	Total production (t)	Marketed quantity (t)	Market price[1]	Price obtained by project farmers
2005	313	147	5.10-5.71	5.71
2006	532	261	5.20-6.71	6.71
2007	1,016	488	6.50-7.07	7.07

1. Prevailing price in the regulated market.

Crop Production

There was also a substantial increase in the area and production of pearl millet (Table 63). The area under pearl millet cultivation increased from 241 ha in 2005 to 782 ha in 2007. Production increased from 313 tons to 1,016 tons at an average productivity of about 1,300 kg ha^{-1}.

Grain Sales and Prices

Farmers used the infrastructure developed by the project and the joint marketing efforts initiated by it to realize better prices for their produce in the local market, and while doing so, minimized their transportation, labor and other marketing costs (Table 64).

Training Programs

In addition to organizing several training programs (Table 65), the project enlisted the participation of local self-help groups in project activities, which ensured significant participation by women. Relevant literature, produced in the local language by KVK, Beed, was given to the participants (Table 66).

Table 65. Training programs conducted by the project.

Year	Training program	Venue	No. of participants		
			Male	Female	Total
2005	Production technologies of pearl millet	Rohatwadi	25	7	32
	Improved production technologies of sorghum and pearl millet	Rohatwadi, Anjanpur	135	28	163
	Collection of samples for aflatoxin, mycotoxin content	Rohatwadi	61	15	76
	Training and demonstration	Anjanpur, Rohatwadi	32	15	47
	Pest and disease control in pearl millet	Rohatwadi	78	18	96
2006	Training and demonstration	Anjanpur, Rohatwadi	32	15	47
	Pest and disease control in pearl millet	Rohatwadi	78	18	96
2007	Integrated crop production	Bansal	97	34	131
	Integrated crop production	Ghatewadi	105	45	150
	Awareness program for SHGs[1] on project activities	Rohatwadi, Wadzari, Domri, Naigaon	56	94	150
	Contingency farm operations for drought management	Bensur, Devachikothi, Wadzari	234	-	234
	Integrated crop production	MAU[2]-Parbhani	9	-	9
	Pear millet field day	Pavanampally	101	54	155
	SHGs-bankers meet	KVK[3], Beed	124	43	177
	On-farm crop production training	Rohatwadi, Ghatewadi, Naigaon	234	36	570
	Pearl millet field day	Bensur	96	-	96
	International training on mycotoxin management	ICRISAT	3	-	3
	Training on issue of KCC[4]	Anjanpur, Rohatwadi	62	12	74
	SHGs' involvement in seed distribution	Rohatwadi	60	23	83
	Strengthening of SHGs for project activities	Rohatwadi	63	31	94

1. SHGs = Self-help groups.
2. MAU = Marathwada Agricultural University.
3. KVK = Krishi Vigyan Kendra.
4. KCC = Kisan credit card.

Table 66. Training material developed and distributed to participants.

Year	Type of material	Title	No. of copies
2005	Project information booklet	Ashiatil alpbhudharak shetkaryanche jivanman unchavanyakarita kukut khadyasathi jwari va bajari cha vapar (Marathi)	100
	Folder	Production technologies of sorghum and pearl millet (Marathi)	500
2006	Flyer	Kukut khadyamadhe jwari ani bajriche uopayog (Marathi)	100
	Flyer	Jwari aflatoxin niyantran (Marathi)	100
	Booklet/literature on sorghum	Kharif jwariche sudharit lagwad tantradnyan (Marathi)	200
	Flyer	Kharif jwar lagwadiche sudharit tantradnyan (Marathi)	200
	Flyer	Jwari lagawadikarita shifarish kelele sudharit va sankarit van (Marathi)	200
	Flyer	Kukut khadyamadhe jwari ani bajriche uopayog (Marathi)	200
	Flyer	Jwari aflatoxin niyantran (Marathi)	200
	Booklet/literature on pearl millet	Bajri lagwadiche sudharit tantradnyan (Marathi)	500
	Booklet/literature on grain quality management	Dhanyachi shashrokt sathavnuk va dhanya godamache vavasthapan (Marathi)	500
2007	Booklet/literature on mycotoxin management	Jwarivaril burashi va mycotoxinche vyavasthapan (Marathi)	250
	Booklet	Experiences of KVK (English)	100

Demonstrations

Rohatwadi cluster farmers benefited in large numbers from demonstrations conducted by the project on improved pearl millet cultivation practices (Table 67).

Soil Analysis

About 105 soil samples were tested in the Rohatwadi cluster in 2006 for various parameters such as macro and micronutrients, pH and electrical conductivity. The results showed that there was nitrogen deficiency in these soils. Micronutrient levels too were low in some samples (Table 68). Farmers were informed about the results and given recommendations to correct the deficiencies.

Grain Quality

Toxic content in the grain affects the market price: grain with zero toxicity fetch a high price. In order to assess grain quality, about 50 grain samples from the 2006-07 crop were collected from farmers and tested. Toxicity levels were found to be within the acceptable range (Table 69).

Table 67. On-farm demonstrations of pearl millet production practices.

Year	Type of demonstration	Results	No. of farmers
2006	184 frontline demonstrations on use of improved varieties/hybrids in comparison with local cultivars	18%-22% yield increase over farmers' local cultivar	1,400
	3 on-farm trials on integrated nutrient management and use of micronutrients	51.98% yield increase over farmers' practice	250
2007	161 frontline demonstrations on use of improved varieties/hybrids in comparison with local cultivars	20%-33% yield increase over farmers' local cultivar	1,800
	6 on-farm trials on integrated nutrient management and use of micronutrients	59.22% yield increase over farmers' practice	400

Table 68. Soil samples analyzed and results obtained in Rohatwadi cluster.

Year	No. of samples	Parameters tested	Results
2006	105	pH: Acidic, medium, alkaline Available nutrients: Major nutrients N, P, K Micronutrients: Fe, Mn, B Electrical conductivity	Majority of the soils were coarse soils with a normal pH of about 7 P and K levels were 'high' Fe, Mn, B range were low to medium Normal

Table 69. Grain sample analysis for mycotoxins.

Year	No. of samples tested	Parameters tested	Results
2006-07	50	Aflatoxin and fumonisin	No samples tested positive for toxic content

2. Survey Results

General Socioeconomic Aspects

The average age of the respondents in the Rohatwadi cluster was 49 years for control farmers and 50 years for project farmers (Table 70). As in the other clusters, both samples had experienced but not-too-old farmers. The control sample had a significantly higher average total landholding than the project sample. This was due to the fact that villages with farmers having small holdings were selected for the project. Both samples had more nonirrigated land than irrigated land. Compared to the other clusters in this study, Rohatwadi respondents, particularly control farmers, had a higher proportion of literate people. Though the total number of dependents was higher for control farmers, both samples had the same number of dependents in the age group of 3-17 years. These young dependents were all schoolgoing in both samples.

Table 70. General socioeconomic aspects of Rohatwadi cluster.

Variable	Project farmers	Control farmers
Average age (years)	50	49
Average irrigated landholding (ha)	1.21	1.48
Average nonirrigated landholding (ha)	1.97	3.65
Average total landholding (ha)	2.39	4.15
Nonliterate heads of households (%)	53	33
Average no. of dependent family members	6	8
Total no. of dependents in the 3-17 age group	3	3
Total no. of schoolgoing dependents	3	3
Backward class (BC) households (%)	38	40
Households engaged in subsidiary occupations (%)	50	40

The baseline survey of 2005 reported that about 56% of the sample here tended to have subsidiary occupations. The main such occupation was employment in sugarcane cutting operations in and around Rohatwadi. The other such additional vocations included wood-cutting, shop-keeping, dairy farming, tailoring, goat-rearing, employment in hotels and agricultural labor.

Area Under Pearl Millet

The rainy-season cropping pattern in Rohatwadi has shifted toward pearl millet, mainly on account of this project, and toward cotton on account of higher prices. As a result, the sorghum area has shrunk from 18% to 2% (Fig. 14).

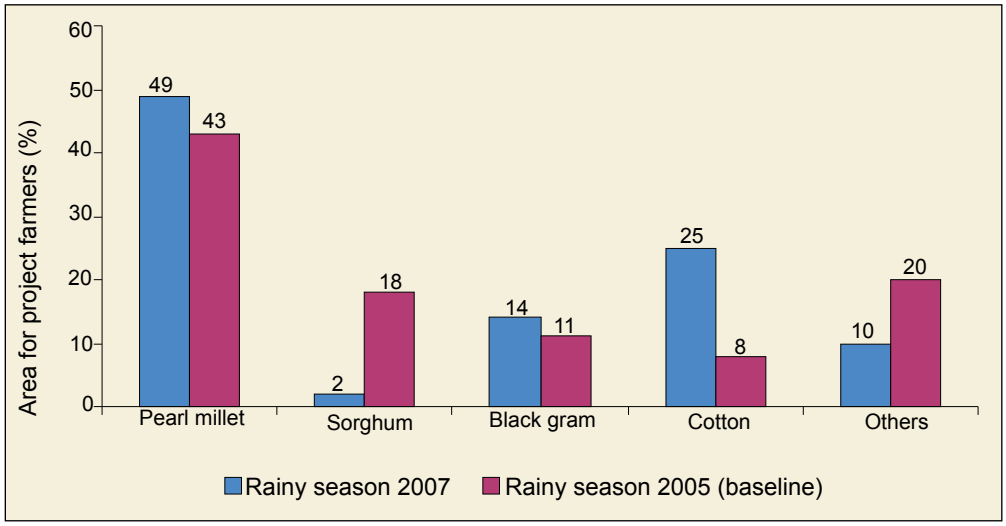

Figure 14. Changes in the cropping pattern in Rohatwadi cluster.

Table 71. Average area of pearl millet (ha) per household.

Year	Project farmers	Control farmers
2004	0.92	1.00
2005	0.97	1.02
2006	0.96	1.00
2007	0.96	0.99

At the household level, pearl millet area increased marginally from 0.92 ha in 2004 to 0.96 ha in 2007 for project farmers while remaining almost constant at the 1 ha level for control farmers (Table 71).

Production and Product Utilization

Project farmers in this cluster witnessed a moderate yield increment from 1,312 kg ha^{-1} to 1,322 kg ha^{-1}. However, the yield levels of control farmers remained slightly lower at 1,298 kg ha^{-1} (Table 72). Similarly, fodder yield (1,071 bundles ha^{-1} for project farmers) witnessed only a slight improvement over the baseline result (1,017 bundles ha^{-1}). Fodder yield for control farmers remained at 929 bundles ha^{-1}.

Both project farmers and control farmers perceived an improvement in grain and fodder quality over the project period. This perception was greater among project farmers than control farmers (Table 73).

For project farmers, average household production of pearl millet increased from 1,025 kg in 2004 to 1,085 kg in 2007 (Table 74). This is a small improvement compared to results obtained in other clusters. There was a slight reduction in

Table 72. Pearl millet crop and fodder yields in Rohatwadi cluster.

Aspects	Project farmers	Control farmers	2004 (Baseline)
Average pearl millet yield (kg ha^{-1})	1,322	1,298	1,312
Fodder yield (bundles ha^{-1})	1,071	929	1,017

Table 73. Proportion of farmers (%) reporting high grain and fodder quality.

	Project farmers		Control farmers	
Year	Grain quality	Fodder quality/palatability	Grain quality	Fodder quality/palatability
2004	19	21	17	11
2005	19	25	14	8
2006	63	62	25	25
2007	63	63	38	28

Table 74. Production, utilization and sale of pearl millet grain by project farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	1,025	1,031	1,072	1,085
Consumption (% of total production)	54	53	51	50
Other uses (% of total production)	0	0	0	2
Sales (% of total production)	46	47	49	48
Average sale price (Rs kg^{-1})	4.9	5.71	6.71	7.07
Modal months of sale	Dec, Jan	Dec, Jan	Dec, Jan	Jan, Feb
Type of market	Regulated	Regulated	Regulated	Regulated

Table 75. Production, utilization and sale of pearl millet grain by control farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	1,007	1,005	1,028	1,056
Consumption (% of total production)	53	58	61	53
Other uses (% of total production)	0	0	0	0
Sales (% of total production)	47	42	39	47
Average sale price (Rs kg^{-1})	4.63	5.1	5.2	6.5
Modal months of sale	Dec, Jan	Dec, Jan	Dec, Jan	Nov, Dec
Type of market	Regulated	Regulated	Regulated	Regulated

consumption during the project period with a corresponding increase in sales. The average sales price obtained by project farmers was Rs 6.71 kg^{-1} in 2006. In contrast, control farmers received only Rs 5.20 kg^{-1} in the same year (Table 75). This advantage accrued to project farmers because they sold their produce during the off-season, as encouraged by the project.

Fodder production increased, for both project and control farmers, in Rohatwadi during the project period. The proportion of fodder production sold by project farmers increased by 5% with a concurrent reduction of 5% in fodder fed to cattle (Table 76). Fodder sale among control farmers remained comparatively lower (Table 77).

Table 76. Fodder utilization by project farmers.

Variable	2004	2005	2006	2007
Average production per household (bundles)	1,037	1,193	1,201	1,225
Used as cattle feed (% of total production)	100	100	95	95
Total sales (% of production)	0	0	4	5
Average sale price (Rs $bundle^{-1}$)	1.01	1.18	1.23	1.42

Table 77. Fodder utilization by control farmers.

Variable	2004	2005	2006	2007
Average production per household (bundles)	988	1163	1172	1236
Used as cattle feed (% of production)	100	100	100	98
Total sales (% of production)	0	0	0	2
Average sale price (Rs bundle^{-1})	1.00	1.01	1.12	1.26

Seed Systems

In Rohatwadi, all pearl millet farmers use hybrid/improved cultivars. Participants in the project received seed at discounted prices while others purchased them from local shops.

The proportion of project farmers buying seeds from private shops fell steeply from 96% in 2004 to 42% in 2007 (Table 78). At the same time, use of seeds supplied through the Marathwada Agricultural University (MAU) and seed companies under the aegis of this project rose from 2006 onward. On the other hand, control farmers continued to depend largely on private seed shops.

Project farmers also benefited from having to incur less cost on seed than control farmers in 2006 and 2007 as a direct consequence of the input linkages established by the project (Table 79).

Table 78. Proportion of respondents (%) using various seed sources in Rohatwadi.

	Project farmers		Control farmers	
Year	Private seed shop	University/seed companies	Seed shop	University/seed companies
2004	96	4	100	0
2005	98	2	93	7
2006	47	53	94	6
2007	42	58	91	9

Table 79. Seed cost[1] (Rs ha^{-1}) incurred by farmers in Rohatwadi.

Year	Project farmers	Control farmers
2004	505	500
2005	543	530
2006	456	542
2007	441	555

1. Average cost of seed requirement for 1 ha at an average seed rate of 6.25 kg ha^{-1}.

Credit Linkage Benefits

Prior to the project, the major sources of credit in Rohatwadi cluster were the village moneylenders and the banks in Patoda. The moneylenders used to charge a heavy interest rate of Rs 3-5 per month per Rs 100 borrowed. In addition, the borrowers would have to pledge their valuables or land records as security.

That scenario, however, changed in 2007 with the project creating awareness in the cluster about institutional credit facilities. That year, banks and cooperative institutions became the main source of finance for both project and control farmers. Project farmer households borrowed an average of Rs 16,500 and control farmer households Rs 16,000 (Table 80). Attempts were made to reduce borrowing costs for project farmers by linking them directly with the banks but the facility did not materialize in 2007 due to internal problems associated with the partner bank. The bank promised that in the next season it would not only increase the quantum of loans disbursed by it but also significantly reduce the transaction costs for project farmers.

Market Intelligence and Marketing Costs

The project farmers of Rohatwadi obtained price information from the local market, friends and traders, whereas control farmers mostly consulted traders (Table 81). Several project participants stored their produce in warehouses and sold it in the local market during the off-season. This fetched them a premium.

Marketing costs increased during the project period on account of rising transportation costs as well as commission costs due to the rise in the value of pearl millet grain (Table 82).

Table 80. Utilization of credit linkages set up by the project.

Variable	Project farmers	Control farmers
Major loan source	Banks, cooperative institutions	Banks, cooperative institutions
Average borrowing (Rs)	16,500	16,000
Interest rate (% per year)	Banks: 7%; cooperative lenders: 12.5%	Banks: 7%; cooperative lenders: 12.5%
Other costs (Rs per transaction)	Banks: Rs 20: cooperative lenders: Rs 300	Banks: Rs 212; cooperative lenders: Rs 300
Remarks	Low interest rate, timely loans	Low interest rate, lengthy procedures

Table 81. Access to and use of market information.

Variable	Project farmers	Control farmers
Farmers obtaining price information (%)	63	39
Major source of information	Local market, friends and traders	Local traders
Farmers whose marketing decisions were influenced by information (%)	100	100

Table 82. Marketing costs incurred (Rs bag^{-1} of 100 kg) by project farmers.

	Costs incurred by project farmers	
Marketing activity	2004	2007[1]
Bagging	2	5
Transportation cost	35	35
Commission (3% of value)	15	21
Labor charges (loading, weighing and unloading)	3	4
Other costs[2]	9	4
Total cost	64	69

1. Direct sale in market.
2. Includes farmers' travel, primary cleaning, and services at market

Table 83. Grain storage practices by project farmers.

Year	Farmers adopting storage (%)	Average durationof storage (months)	Modal reason for storage	Modal method of storage
2005	77	9	Consumption	Gunny bags
2006	70	8	Consumption, sale	Gunny bags
2007	67	9	Consumption, sale	Gunny bags

Storage

The proportion of pearl millet grain consigned to storage by Rohatwadi project farmers decreased from 77% (2005) to 67% (2007). Although the duration of storage remained firm at nine months, the modal reason for storage showed a shift from consumption to sale. Thus, at the cluster level we see a change in storage behavior from singularly consumption to consumption and sale (Table 83).

Knowledge

The areas of maximum knowledge gain, as cited by Rohatwadi project farmers in their feedback, were farmers' association building and crop production, bulking and handling, and storage and seed treatment. Though they did also benefit from the other components of the project such as credit linkage, input linkage, micronutrient application and disease management, the gains were comparatively less (Fig. 15).

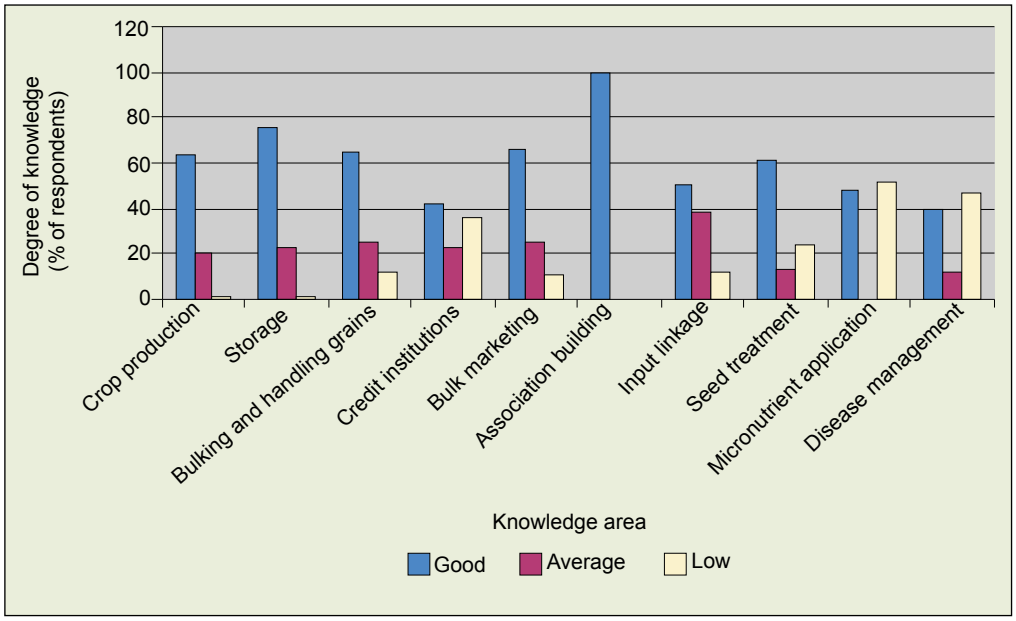

Figure 15. Knowledge acquired by farmers through project activities.

Farmers' Perception and Feedback

All the participatory activities organized by this project were rated as 'good' by a high proportion of respondents. Of these, visits by scientists were rated so (Fig. 16) by the highest proportion of project farmers (97%), followed by scientific storage practices (68%), exposure-cum-visits (66%), demonstration

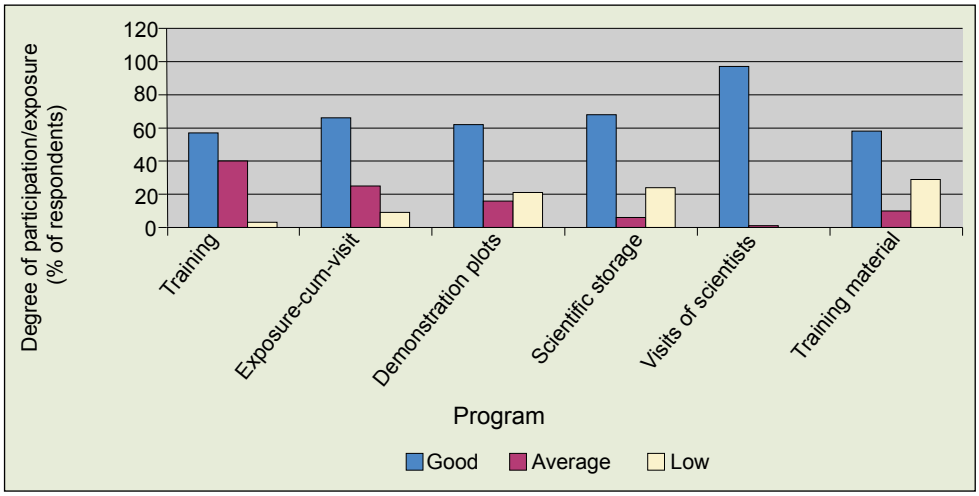

Figure 16. Farmers' perception of project activities.

plots (62%) and training and training material (58%). However, about 29% of farmers rated the impact of training material as 'low', perhaps on account of the high expectations they had.

The study assessed farmers' perception of benefits accruing to them from different components of the project. About 85% of them said the crop production component held the most benefits to them followed by formation of farmers' associations (82%). Bulking and storing and credit linkages were the other important components that were cited as beneficial by the respondents. (Table 84).

Of the 56 farmers who cited crop production as beneficial, all said improvement in grain quality was to them the most significant benefit as it had enabled them to realize better prices in the market. This was followed by 97% support for fodder quality as a benefit and 95% for increased yield (Table 85).

Table 84. Farmers' feedback on project components.

Project component	Project farmers who perceived benefits (%)
Crop production	85
Farmers' associations	82
Bulking and storing of grain and construction of storage structures	47
Bulk/joint marketing of grain	31
Credit linkages	40

Table 85. Benefits of improved crop production technologies.

Benefit	Percentage of total respondents (56)
Improvement in grain quality	100
Improvement in fodder quality/palatability	97
Increased yield	95
Increased area under crop	43

Regarding activities relating to formation of farmers' associations, all the respondents who benefited from them said gaining negotiating leverage in the market was the most significant benefit to them, followed by leadership opportunities, self-confidence and independence.

About 32 respondents felt that they had benefited from activities related to bulk grain handling and storage structure construction. All of them felt so because they got better prices and were saved from having to resort to distress sales. In addition, they had learnt about safe handling of grain from the training programs organized by the project.

Table 86. Effect of bulk/joint marketing of grain.

Benefit	Percentage of total respondents (21)
Reduction in marketing costs	100
Enhanced bargaining power	100
No dependence on commission agents	98

All the 21 respondents who said they were beneficiaries of bulk marketing activities supported by the project also said they had benefited from reduction in marketing costs, improved bargaining skills and independence from commission agents (Table 86).

Overall Opinion of Project Farmers

- Most of the project farmers said the over 50% discount on seed costs facilitated by the project's input linkages encouraged them to take up cultivation of pearl millet.
- The project provided a chain of benefits to participating farmers ranging from sowing to marketing.
- Project infrastructure such as warehouses and dryers enabled farmers to store produce of crops other than pearl millet too, which fetched them a better price in the market.
- The farmers' association established in this cluster was confident of selling commodities in bulk on its own in future leveraging the knowledge gained from this project.
- The majority of project farmers expressed interest in the continuation of the project with other target crops.

Economics of Cultivation

The total cost of cultivation in Rohatwadi was Rs 10,536 ha^{-1} per household. Labor costs accounted for most (57%) of this total (Table 87), as was the case with the other clusters. The total cost of cultivation excluding land rent and family labor was Rs 5,425 ha^{-1}.

Of the total variable costs of pearl millet cultivation at Rohatwadi, (Fig. 17) land preparation and FYM application accounted for the highest share (23%) followed by intercultural operations and weeding (16%).

Table 87. Costs of cultivation (Rs ha^{-1}) of pearl millet in Rohatwadi cluster.

Cost	Material	Labor	Others	Total	Contribution of family labor
Land preparation		1,529		1,529	764
FYM application/animal penning	708	88		795	88
Sowing	442	839		1,281	419
Fertilizer application	1147	100		1,247	100
Intercultural operations		961		961	961
Weeding		574		574	574
Protection from birds		833		833	833
Harvesting		942		942	471
Threshing		150	547	697	150
Marketing			927	927	
Fixed cost (land rent)			750	750	
Total	2,297	6,015	2,224	10,536	4,361
Total excluding land rent				9,786	
Total excluding land rent and family labor				5,425	

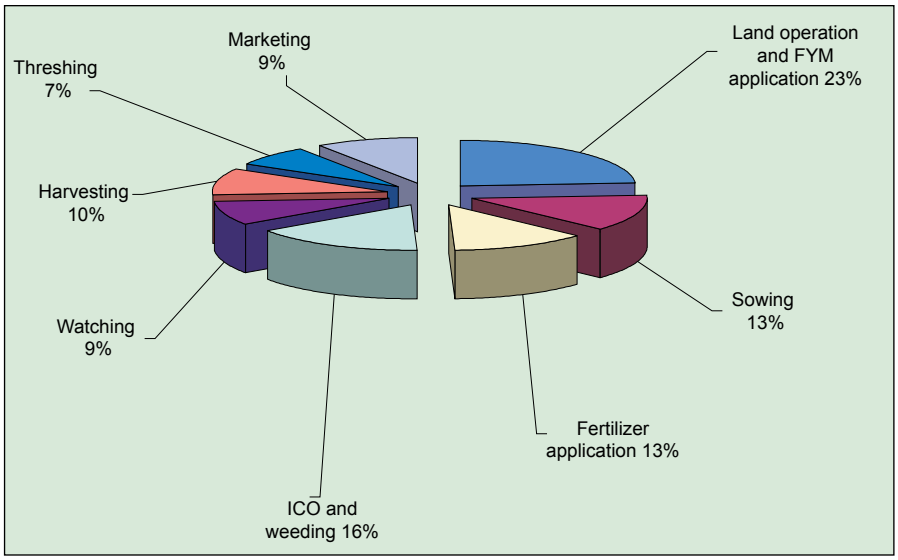

Figure 17. Components of the total variable cost of pearl millet.

Costs of cultivation increased by 28% over the project period in Rohatwadi (Table 88), mainly due to the rise in labor and input costs. On the other hand, we observe a substantial increase in the prices of grain (41%) and fodder (42%). However, the increase in grain and fodder yields was not as significant as in other clusters.

Table 88. Comparison of production costs and returns with baseline data.

Variable	Baseline sample (2004)	Project sample (2007)	Increase (%)
Cost of cultivation (Rs ha^{-1}) excluding land rent and family labor	4,247.5	5,425	28
Grain yield (kg ha^{-1})	1,312	1,322	1
Fodder yield (bundles ha^{-1})	1,017	1,071	5
Gran price realization (Rs kg^{-1})	5	7.07	41
Fodder price realization (Rs $cartload^{-1}$)	1	1.42	42
Return from grain (Rs ha^{-1})	6,560	9,346	42
Return from fodder (Rs ha^{-1})	1,017	1,521	50
Gross return (Rs ha^{-1})	7,577	10,867	43
Net return (Rs ha^{-1})	3,329	5,442	63
B:C ratio	1.78	2	-

1.There is no significant difference in net returns and B C R when calculated at 2004 constant price for grain and fodder.

2. Decomposition of contribution to gross returns indicates that the increase in grain yields contributed 1.5%, grain price 82.5%, fodder yield 1.3%, fodder price 13%, rest due to interaction effects.

Better price realization boosted gross return by 43% and net return by 63%. There was also a marked improvement in the B:C ratio, from 1.78 to 2. However, the improvement in returns in Rohatwadi was more due to grain and fodder price increases than productivity improvement. Nevertheless, even if the yields of grain and fodder had been lower by 20%, the net return would be Rs 3269, ie, comparable to the returns reported by the baseline study.

Maharashtra: Anjanpur Cluster

The Anjanpur village cluster is located in Beed district in Marathwada region of Maharashtra. These villages fall in Ambajogai mandal, and lie about 15 km from the town of Ambajogai and 50 km from the town of Latur.

Temperatures here fall to a minimum of 12^0C during December and January and rise to a maximum of 40-45^0C during summer. Cold waves sweep this area during November, December and January. The monsoon arrives during the second week of June and brings rains until September. Soils in this cluster are thin-layered but heavy in texture. They are vertisols, well-suited for cotton cultivation. The project's target crop in this cluster was rainy-season sorghum.

1. Cluster-level Indicators

Number of Villages and Farmers

As in the other clusters, the numbers of villages and project farmers participating in the project gradually increased during the three years of the project. In its last year, 2007, 18 villages and 1,248 farmers participated in the project (Table 89).

Table 89. Number of participating villages and farmers in Anjanpur cluster.

Year	Number of villages			Number of farmers		
	Initial villages	New villages	Total	Initial farmers	New farmers	Total
2005	6	-	6	320	-	320
2006	6	3	9	320	385	705
2007	9	9	18	705	543	1,248

Table 90. Area, production and yield of rainy-season sorghum.

Year	Area (ha)	Production (t)	Yield (kg ha^{-1})
2005	179	268	1,497
2006	872	1,308	1,500
2007	1,158	2,432	2,100

Crop Production

The area, production and yield of rainy-season sorghum increased substantially during the project period (Table 90). While area under sorghum cultivation rose from 179 ha in 2005 to 1,158 ha in 2007, production increased by about nine times.

Grain Sales and Prices

Anjanpur farmers secured a substantial premium over market prices by bulking their produce. For instance, in 2006, project farmers sold large quantities of sorghum grain to three industrial buyers, Janki Feeds, VHL and ITC at a price of Rs 6.88 kg^{-1}, which was about Rs 1.50 kg^{-1} higher than the then prevailing local market price (Rs 5.38 kg^{-1}) (Table 91). However, in 2007, market prices of good quality sorghum grain produced under the project increased substantially, and farmers sold the grain in the local market.

Table 91. Sorghum marketed surplus and price realization in Anjanpur cluster.

Year	Total production (t)	Marketed Quantity (t)[1]	Average price range (Rs kg^{-1})	
			Market price[2]	Price obtained by project farmers who sold under bulking to the poultry feed industry
2005	179	138	4.46	-
2006	872	689	5.38	6.88
2007	1,158	926	6.78	-

1. Includes bulk sales to poultry feed industry and direct sales in the market.
2. Prevailing price in the regulated market.

Training Programs

Several training programs were conducted for the benefit of project farmers in Anjanpur cluster (Table 92). Participants were given training material (Table 93) prepared in the local language, Marathi, by the local project partner, Krishi Vigyan Kendra, Beed.

Table 92. Training programs conducted in Anjanpur cluster.

			Number of participants		
Year	Training program	Venue	Male	Female	Total
2005	Control of pests and diseases in sorghum	Anjanpur	33	12	45
	Aflatoxin training	ICRISAT	2	-	2
	Farmers' rally	KVK[1]	985	280	1,265
	Collection of samples for aflatoxin and mycotoxin content	Anjanpur	65	17	82
	Poultry farmers' meeting	ANGRAU[2]	7	--	7
	Sorghum ear head drying	MAU[3]	12	--	12
2006	Safe storage	MAU	11	--	11
	Bioproducts of sorghum, pearl millet	Anjanpur	--	52	52
	Bulking, grading and storage of grain	KVK	62	18	80
	Project partner meeting on poultry feed	VHL[4] Hyderabad	5	--	5
	Training on pest and disease control in sorghum	Anjanpur	123	52	175
2007	Training on issue of KCC[5]	Anjanpur, Rohatwadi	62	12	74
	Training on safe storage of grain	Anjanpur	30	21	51
	SHGs'[6] involvement in seed distribution	Anjanpur	70	37	107
	Strengthening of SHGs for project activities	Anjanpur	201	93	294
	Contingency farm operation for drought management	Anjanpur	15	6	21
	Meeting of SHGs for seed procurement and distribution	Anjanpur	220	104	324
	Integrated crop production	Dipewadgaon	68	21	89
	Integrated crop production	Paithan	72	12	84
	Grading for grain mold	Sangaon, Paithan	56	-	56
	Grading for grain mold	Kolpimpri, Thatboargaon	66	15	81
	Two sorghum field days	Dipewadgaon, Shripathawadi	480	63	543
	Awareness program on project activities for SHGs	Sangaon, Paithan, Kanadi, Shripathwadi	89	184	273

1. KVK = Krishi Vigyan Kendra.
2. ANGRAU = Acharya NG Ranga Agricultural University.
3. MAU = Marathwada Agricultural University.
4. VHL = Venkateshwara Hatcheries Limited.
5. KCC = kisan credit card.
6. SHG = Self-help group.

Table 93. Training material developed and distributed through the project.

Year	Type of material	Title	No. of copies distributed
2005	Project Information Booklet	Ashiatil alpbhudharak shetkaryanche jivanman unchavanyakarita kukut khadyasathi jwari va bajari cha vapar (Marathi)	100
	Folder	Production technologies of sorghum and pearl millet (Marathi)	500
2006	Flyer	Kukut khadyamadhe jwari ani bajriche uopayog (Marathi)	100
	Flyer	Jwari aflatoxin niyantran (Marathi)	100
	Booklet/literature on sorghum	Kharif jwariche sudharit lagwad. tantradnyan (Marathi)	200
	Flyer	Kharif jwar lagwadiche sudharit tantradnyan (Marathi)	200
	Flyer	Jwari lagawadikarita shifarish kelele sudharit va sankarit van (Marathi)	200
	Flyer	Kukut khadyamadhe jwari ani bajriche uopayog (Marathi)	200
	Flyer	Jwari aflatoxin niyantran (Marathi)	200
	Booklet/literature on pearl millet	Bajri lagwadiche sudharit tantradnyan (Marathi)	500
	Booklet/literature on grain quality management	Dhanyachi shashrokt sathavnuk va dhanya godamache vavasthapan (Marathi)	500
2007	Booklet/literature on mycotoxin management	Jwarivaril burashi va mycotoxinche vyavasthapan (Marathi)	250
	Booklet	Experiences of KVK (English)	100

Demonstrations

On-farm demonstrations conducted at Anjanpur showed to the participants how they could benefit from substantial yield increases in comparison with control farmers (Table 94). About 2,200 farmers participated in the demonstrations conducted farmers in 2006. This figure went up to 3,000 in 2007.

Soil Analysis

About 331 soil samples were analyzed for nutrient deficiencies in this cluster in 2006. Among the major nutrients, P and K were found to be of medium levels and micronutrients such as Fe, Mn and B were found to be deficient (Table 95). Farmers were advised appropriate nutrient management practices for rainy-season sorghum.

Table 94. On-farm demonstrations conducted under the project in Anjanpur cluster.

Year	Type of demonstration	Results	No. of farmers
2006	138 frontline demonstrations on use of improved sorghum varieties/hybrids in comparison with local cultivars	20-25% yield increase over farmers' local cultivar; fodder yields high	1,800
	3 on-farm trials on integrated nutrient management and use of micronutrients	41.2% yield increase over farmers' practices	400
2007	543 frontline demonstrations on use of improved sorghum varieties/hybrids in place of local cultivars	50-6% yield increase over farmers' local cultivar; fodder yields high	2,300
	6 on-farm trials on integrated nutrient management and use of micronutrients	61.4% yield increase over farmers' practice	700

Table 95. Results of soil samples tested in Anjanpur cluster.

Year	No. of samples/plots	Parameters tested	Results
2006	331	Soil type: Sandy loam, clay type	The majority of soils were medium black with
		pH: Acidic, medium, alkaline	neutral to alkaline (7.5 to 8.5) pH
		Available nutrients:	Levels of major nutrients except P and K were high
		Macronutrients: N, P, K	within their acceptable ranges.
		Micronutrients: Fe, Mn, B	Micronutrient levels were low to medium
		Electrical conductivity	Normal for these soils

Table 96. Grain sample analysis for mycotoxins.

Year	No. of samples tested	Parameters tested	Results
2006-07	7 field samples	Aflatoxin, fumonisin	No samples found toxic; all samples within acceptable range

Grain Quality

Seven grain samples were tested for mycotoxins in Anjanpur during 2006-07. Toxicity levels were found to be well within the acceptable range (Table 96). This may have been due to the care taken by farmers to harvest the crop at the right maturity stage as advised by the local project partners, and also due to the good weather that prevailed over this region through much of the project duration.

2. Survey Results

General Socioeconomic Aspects

The average age of project farmers at Anjanpur was 45 years and that of control farmers 50 years (Table 97). Average total landholding was 3.65 ha among project farmers and 4.87 ha among control farmers, which is reflective of the fact that farmers with lower holdings were enrolled in the project. Also,

Table 97. General socioeconomic aspects of Anjanpur respondents.

Variable	Project farmers	Control farmers
Average age (years)	45	50
Average irrigated landholding (ha)	2.9	2.84
Average nonirrigated landholding (ha)	1.6	3.19
Average total landholding (ha)	3.65	4.87
Nonliterate heads of household (%)	22	18
Average no. of dependents	6	7
Dependents in the 3-17 age group	3	2
No. of schoolgoing dependents	3	2
Backward Class (BC) households (%)	3	2
Households engaged in subsidiary occupations (%)	12	10

average irrigated landholding was higher among project farmers. About 20% of the farmers of Anjanpur were nonliterates with illiteracy marginally higher among project farmers.

Interestingly, while control farmers had larger families (by one member), there were more young members in project farmer households. All the dependents within the 3-17 age group in both samples were receiving education.

There was no major change in the occupational structure of project farmers in comparison with the baseline study. While 18% of the farmers in the baseline sample were engaged in subsidiary occupations like trading, sugarcane cutting, dairy operation, sheep-rearing and salaried work like teaching, factory labor, etc, 12% of the project sample reported such subsidiary occupations.

Area Under Rainy-season Sorghum

There has been an increase in the areas of sugarcane (27%) and cotton (21%) in Anjanpur cluster since the baseline study (Fig.18), perhaps on account of farmers moving away from soybean to other cash crops. Increased water availability from canals has encouraged the shift toward sugarcane. In such a scenario, the sorghum area has held its own during this period, albeit with a marginal decline.

The average area of rainy-season sorghum per household for project farmers (0.63 ha) remained more or less the same during 2004-2007 (Table 98) while showing a decrease from 0.80 ha to 0.73 ha for control farmers. Assured industrial demand facilitated by the project linkages seems to have encouraged project farmers to persist with sorghum while control farmers shifted to other crops, mainly sugarcane.

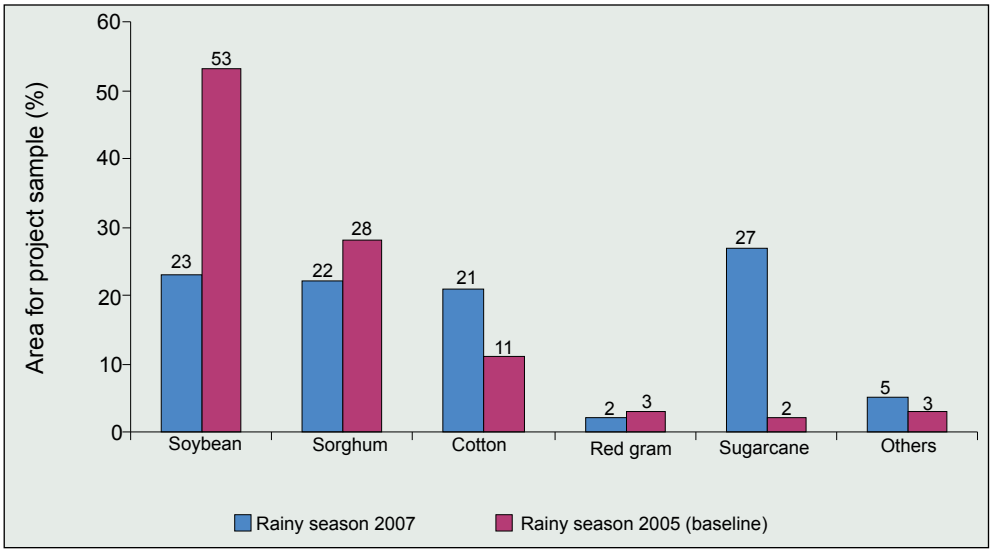

Figure 18. Changes in the cropping pattern in Anjanpur cluster, 2005-07.

Production and Product Utilization

Average yields of sorghum project farmers (Table 99) showed an increase (1,967 kg ha^{-1}) since the baseline study (1,650 kg ha^{-1}), an increment that can be attributed to quality seeds and guidance by the project. Supporting this indication, sorghum yields for project farmers were higher than for control farmers (1,850 kg ha^{-1}). Similarly, fodder yields too increased by 137 bundles ha^{-1} for project farmers during the project period.

Both project and control farmers perceived an improvement in grain and fodder quality (Table 100). However, this perception was greater among project farmers than control farmers.

Table 98. Average area of rainy-season sorghum (ha) per household.

Year	Project farmers	Control farmers
2004	0.63	0.80
2005	0.62	0.82
2006	0.63	0.76
2007	0.62	0.73

Table 99. Sorghum grain and fodder yields.

Yield	Project farmers	Control farmers	2004 (baseline)
Grain yield (kg ha^{-1})	1,967	1,850	1,650
Fodder yield (bundles ha^{-1})	1,454	1,432	1,317

Table 100. Proportion of farmers (%) reporting improvement in grain and fodder quality.

	Project farmers		Control farmers	
Year	Grain quality	Fodder quality/palatability	Grain quality	Fodder quality/palatability
2004	11	12	7	14
2005	18	22	9	7
2006	32	29	20	18
2007	62	55	41	30

Project farmers reported higher mold incidence in 2006 on account of nonfavorable weather. This was considerably reduced in 2007 on account of the awareness created by the project (Table 101). Mold incidence dipped for control farmers too in 2007 owing to favorable weather.

Average production of sorghum per household increased from 1,040 kg in 2004 to 1,166 kg in 2007 among project farmers (Table 102). The increase for control farmers was marginal (Table 103).

Table 101.Mold incidence in sorghum grain.

	Samples affected by mold (%)	
Year	Project farmers	Control farmers
2004	11	20
2005	13	16
2006	17	27
2007	8	11

Table 102. Production, utilization and sale of rainy-season sorghum by project farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	1,040	1,050	1,111	1,166
Consumption (% of production)	24	22	21	19.5
Other uses (% of production)	1	1	1	0.5
Sales (% of production)	73	77	79	80
Average sale price (Rs kg^{-1})	4.14	4.46	5.38	6.78
Modal months of sale	Dec, Jan	Dec, Jan	Dec, Jan	Oct, Nov
Type of market	Regulated	Regulated	Regulated and bulk marketing	Regulated

Table 103. Production, utilization and sale of rainy-season sorghum by control farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	1,079	1,097	1,187	1192
Consumption (% of production)	32	29	27	26
Other uses (% of production)	1	1	1	1
Sales (% of production)	67	70	72	73
Average sale price (Rs kg^{-1})	4.04	4.42	5.00	6.58
Modal months of sale	Dec, Oct	Dec, Oct	Dec, Oct	Oct, Dec
Type of market	Regulated	Regulated	Regulated	Regulated

The project sample recorded a slight reduction in consumption over the years and, concurrently, an increase in the sale of grain to 80% of production in 2007, which was higher than sales by control farmers.

The average sale price obtained by project farmers was Rs 5.38 kg^{-1} in 2006 as compared with only Rs 5.00 kg^{-1} for control farmers. This premium was due to bulk marketing facilitated by the project enabling farmers to sell directly to industrial buyers.

Fodder production for both project and control farmers increased in Anjanpur (Tables 104 and 105). However, sales remained low in both samples. Project farmers obtained better prices for their fodder in 2007 than control farmers, probably on account of better quality.

Table 104. Fodder utilization by project farmers.

Variable	2004	2005	2006	2007
Average production per household (bundles)	725	762	749	905
Used as cattle feed (% of production)	89	91	87	92
Sales (% of production)	11	9	11	8
Average sale price (Rs $bundle^{-1}$)	2.92	3.40	3.71	3.75

Table 105. Fodder utilization by control farmers.

Variable	2004	2005	2006	2007
Average production per household (bundles)	928	950	901	1,054
Used as cattle feed (% of production)	92	98	85	95
Sales (% of production)	8	2	15	5
Average sale price (Rs $bundle^{-1}$)	2.98	3.54	3.75	3.46

Seed Systems

On account of project interventions, there was a significant disparity between project and control farmers in the seed sources they accessed. Project farmers drastically reduced use of seed from private shops from 97% in 2004 to 36% in 2007 (Table 106). Simultaneously, use of seed accessed through project linkages with private seed suppliers and the university went up from 16% in 2005 to 64% in 2007. Owing to the popularity of these seed, control farmers' dependence on private seed shops decreased too.

As in the other clusters, project farmers spent more than control farmers on accessing quality seed on the strength of input support from the project (Table 107).

Table 106. Proportion of respondents (%) accessing seed from various sources.

	Project farmers		Control farmers	
Year	Private seed shops	University/seed companies	Private seed shops	University/seed companies
2004	97	3	91	9
2005	84	16	84	16
2006	74	26	86	14
2007	36	64	79	21

Table 107. Seed costs[1] (Rs ha^{-1}) incurred by respondents.

Year	Project farmers	Control farmers
2004	456	527
2005	537	581
2006	552	612
2007	546	625

1. Average cost of seed required for 1 ha at an average seed rate of 6.25 kg ha^{-1}.

Credit Linkage Benefits

Banks and cooperative societies were the main sources of finance in this cluster (Table 108). Project farm households borrowed an average of Rs 26,636 each and control farmers Rs 25,130. The interest rates paid by project farmers worked out to 7% per annum while control farmers paid 12.5% as they tended to rely more on cooperative lending institutions. Project farmers were in an advantageous position as they were linked with nationalized banks by the project.

Table 108. Utilization of credit linkages set up by the project.

Credit variable	Banks and cooperative institutions	
Major source	Project farmers	Control farmers
Average borrowing (Rs)	26,636	25,130
Interest rate (% per year)	7.00	12.5
Other costs (Rs per transaction)	199	210
Remarks	Low interest rate, time constraint	Low interest rate, time constraint

As per the baseline findings, these farmers' main sources of credit used to be moneylenders and banks in Ambajogai. Many farmers had to pay a high rate of interest to moneylenders – as high as Rs 4-5 per month per Rs 100 borrowed. Since the project began, only a few farmers approached moneylenders for credit.

Market Intelligence and Marketing Costs

About 68% of the project and control respondents got their information on sorghum prices from the market (Table 109). While project farmers consulted the farmers' association about industry prices for their produce, the market was the sole source of information for control farmers. Project farmers realized Rs 6.88 kg^{-1} from bulk marketing while control farmers received Rs 6.21 kg^{-1} from individual market sales. Therefore, about 68% of project farmers perceived bulk marketing as better than individual marketing.

The increase in marketing costs sustained by project farmers in 2007 compared to 2004 was on account of the increase in transportation costs as well as grain prices, which as a corollary resulted in an increase in commission costs (Table 110). However, farmers who participated in bulk marketing efforts received greater cost efficiencies due to reduced transportation and commission costs.

Storage

After the construction of the project warehouse, the storage behavior of project farmers changed from storage at home for consumption and sale purposes to storage in the warehouse for sale (Table 111). However, farmers continued to store grain at home for household consumption.

Table 109. Access to and use of market information.

Particulars	Project farmers	Control farmers
Farmers obtaining price information (%)	68	68
Major source of information	Market, farmers' association	Market
Farmers whose marketing decisions were influenced by information (%)	100	100
Farmers preferring bulk/collective marketing over individual marketing (%)	68	-
Farmers who obtained higher prices due to bulk sales (%)	42	-
Market price (Rs kg^{-1})	6.55	6.21
Bulk sales price (Rs kg^{-1})	6.88	-

Table 110. Marketing costs incurred (Rs bag^{-1} of 100 kg) by project farmers.

	Cost incurred by project farmers		
Marketing activity	2004	2007[1]	2006[2]
Bagging	3	4	5
Transportation cost	25	26	Borne by industry
Commission (3% of value)	15	21	Nil
Labor charges (loading, weighing and unloading)	3	3	4
Other costs[3]	8	8	9
Total cost bag^{-1}	54	62	18

1. Direct market sale.
2. Bulk marketing.
3. Includes farmers' travel, primary cleaning, and services in the market.

Table 111. Grain storage practices by project farmers.

Year	Farmers adopting storage (%)	Average duration of storage (months)	Modal reasons for storage	Modal method of storage
2005	53	12[1]	Consumption, sale	Gunny bags
2006	52	1[2]	Sale	Gunny bags
2007	50	1[2]	Sale	Gunny bags

1. Storage at home.
2. Storage in warehouse.

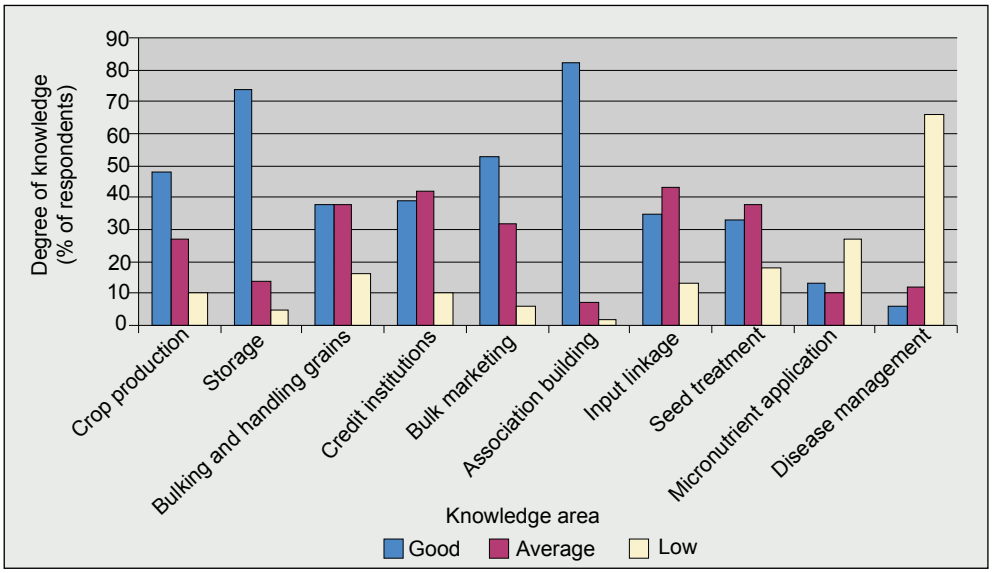

Figure 19. Knowledge acquired by farmers through project activities.

Knowledge

Project farmers said they had learned much from the crop production, storage, bulk marketing and association building activities of the project (Fig. 19). Learning on other project components was rated 'average'. A few other aspects like disease management and micronutrient application were rated 'low' as they already knew much about these aspects through their interaction with the scientists of KVK, Beed.

Farmers' Perception and Feedback

Visits of scientists (87%), followed by training (49%), demonstration plots (47%) and training material (44%) were the project activities rated as beneficial by

a majority of project respondents (Fig. 20) in the Anjanpur cluster. However, about 48% of them rated activities relating to scientific storage as 'poor'. A majority of project farmers said visits by scientists helped them solve many crop production-related problems.

Similarly, farmers' perception of benefits received from different components of the project varied (Table 112). A majority of project farmers in this cluster said the components relating to farmers' association (93%) and crop production (92%) were beneficial to them, followed by bulking and infrastructure (61%), credit linkage (57%) and bulk marketing (55%).

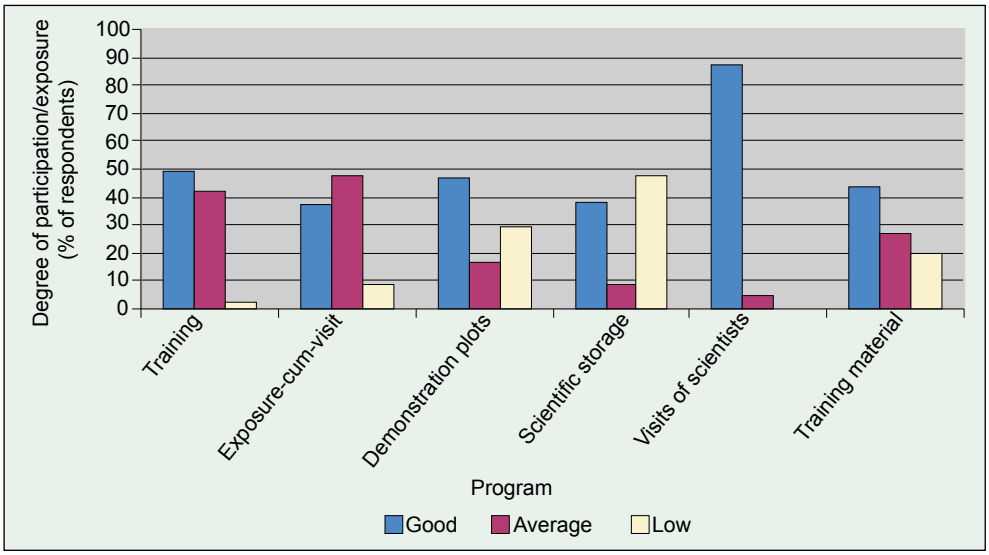

Figure 20. Project farmers' perception of project activities.

Of the farmers who reported benefits from the crop production aspects of the project, a majority cited all aspects of it, ie, increased area, yield enhancement and improvement in grain and fodder quality (Table 113).

Almost all the project farmers who said they had benefited from farmers' association building said better price negotiation, empowerment and promoting a sense of self-confidence were the tangible benefits that accrued to them (Table 114).

The baseline study had found that distress sales were one of the major constraints of farmers in the Anjanpur cluster. In our study, all the beneficiaries of the project's bulking and storage initiatives said not having to make distress sales was the most important benefit of this component. All of them also said they were now getting better prices for their grain (Table 115).

Table 112. Benefits of project initiatives to project farmers.

Project component	Project farmers who perceived benefits (%)
Crop production	92
Farmers' association	93
Bulking and storing of grain and construction of storage structure	61
Bulk/joint marketing of grain	55
Credit linkages	57

Table 113. Benefits of improved crop production technologies.

Benefit	Percentage of total respondents (85)
Improvement in grain quality	100
Increased yield	96
Improvement in fodder quality/palatability	96
Increased area under crop	95

Table 114. Benefits of setting up farmers' associations.

Benefit	Percentage of total respondents (86)
Better negotiating power	100
Increased empowerment/leadership opportunities	100
Sense of self-confidence and independence	99

Table 115. Benefits of project infrastructure.

Benefit of bulking and storing of grain and construction of storage structure	Percentage of total respondents (56)
Better prices	100
Not having to make distress sales	100
Knowledge of safe storage and grain handling practices	80
Enhanced role of women in storage and bulking activities	95

Construction of storage structures and bulking initiatives reduced marketing costs for project farmers, and gave them bargaining power and freedom from dependence on commission agents (Table 116).

Interest rate reduction and problem-free bank credit were considered the key benefits by a majority of the respondents who welcomed the credit linkages laid down by the project. About 96% of these beneficiaries gave higher weightage to reduction in loan-processing time. Moreover, a significant proportion of respondents in this group said availability of loans for horticulture/land development purposes was a key benefit for them (Table 117). This response was not common among the other clusters.

Overall Opinion of Project Farmers

A majority of the project farmers in Anjanpur felt that the project had brought in a change for sorghum growers.

Table 116. Benefits of bulk/joint marketing of grain.

Benefit	Percentage of total respondents (51)
Reduction in marketing costs	100
Enhanced bargaining power	100
No dependence on commission agents for cash payment	92

Table 117. Benefits of credit linkages established by the project.

Benefit	Percentage of total respondents (53)
Fewer problems in obtaining bank credit	100
Lower interest rates	98
Less processing time for bank loans	96
Availability of credit for other purposes: horticulture, land development, education, etc.	91

- Most of them expressed satisfaction about the seed discount of up to 50% given to them through linkages with seed suppliers. This made rainy-season sorghum more appealing to them.
- Prior to the inception of the project, these farmers used to depend mainly on moneylenders for credit despite the high interest rates. As a result of this project intervention, dependence on moneylenders has decreased with banks stepping in with lower interest rates.
- Farmers reported that they gained knowledge of protection against storage pests through this project.
- Rainy-season farmers increased their returns from the crop, which encouraged them to maintain their area under sorghum cultivation during the project period. Other farmers in this region shifted to cash crops.
- Regular visits by scientists spread knowledge and instilled confidence.
- Empowering women farmers/SHGs through the project was another excellent objective achieved.
- A few farmers in this cluster welcomed the opportunity to study the crop production technologies used abroad.

Economics of Cultivation

The total cost of cultivation per household in Anjanpur was Rs 12,295 ha^{-1} to which labor made the highest contribution of 47% (Table 118). The cost of cultivation excluding land rent and family labor was Rs 7,044 ha^{-1}.

Table 118. Costs of cultivation (Rs ha^{-1}) in Anjanpur cluster.

Cost	Material	Labor	Others	Total	Family labor
Land preparation		1,445		1,445	723
FYM application/animal penning	557	125		682	125
Sowing	590	661		1,251	331
Seed treatment					
Fertilizer application	1591	100		1,691	100
Intercultural operations		861		861	861
Plant protection					
Weeding		550		550	550
Irrigation					
Protection from birds		444		444	444
Harvesting		1,386		1,386	693
Threshing		175	1,077	1,252	175
Marketing				1,483	
Fixed cost			1,250	1,250	
Total	2,738	5,747	2,327	12,295	4,001
Total excluding land rent				11,045	
Total excluding land rent and family labor				7,044	

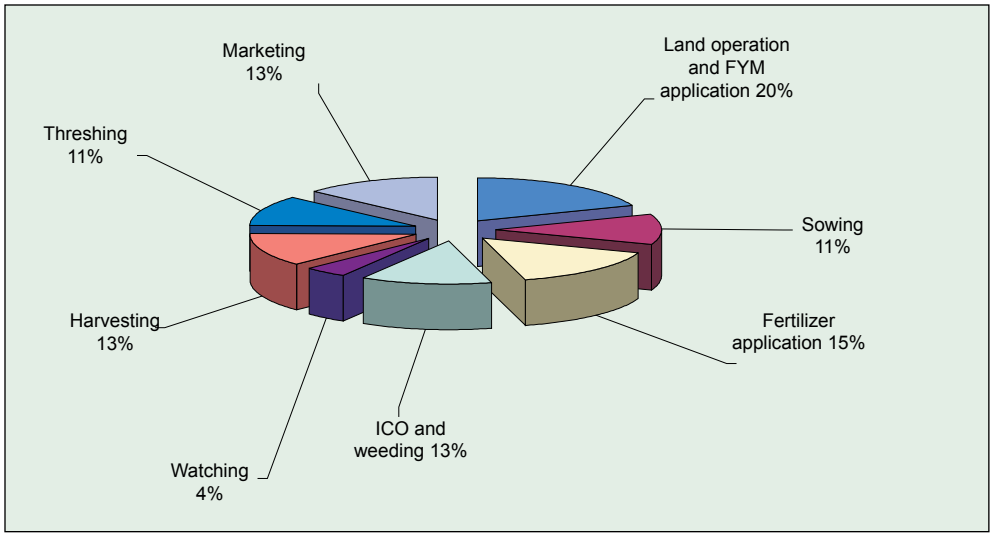

Figure 21. Components of the total variable cost of sorghum cultivation in Anjanpur cluster.

Land preparation and FYM application made the highest contribution of 20% to the total variable cost (Fig. 21) followed by fertilizer application (15%). This result is consistent with other clusters.

Table 119. Comparison of production costs and returns with baseline results.

Variable	Baseline sample (2004)	Project sample (2007)	Increase (%)
Cost of cultivation (Rs ha^{-1}) excluding land rent and family labor	4,790	7,043	47
Grain yield (kg ha^{-1})	1,650	1967	19
Fodder yield (bundles ha^{-1})	1,317	1,454	10
Prices realized for grain (Rs kg^{-1})	4	7	70
Prices realized for fodder (Rs $bundle^{-1}$)	3	4	44
Return from grain (Rs)	6,600	13,336	102
Return from fodder (Rs)	3,951	6,281	59
Gross return (Rs)	10,551	19,618	86
Net return (Rs)	5,761	12,575	118
B:C ratio	2.2	2.79	-

1.There is no significant difference in the net returns and B C R when calculated at 2004 constant price for grain and fodder.

2. Decomposition of contribution to gross returns indicates that the increase in grain yields contributed 1.5%, grain price 82.5%, fodder yields 1.6%, fodder price 13%, and the rest due to interaction effects.

There was a 47% increase in the cost of cultivation during 2004-08 in Anjanpur cluster (Table 119), mainly due to escalation in the cost of labor and major inputs. On the other hand, there was only a marginal increase in grain and fodder fields. However, this is balanced by a substantial increase in the prices of grain (70%) and fodder (44%).

This boosted gross return for the project sample by 86% and net return by 118%. There was thus a marked improvement in the B:C ratio from 2.20 to 2.79, giving the farmers an additional 59 paise for every rupee invested compared to the returns in 2004.

Even if both grain and fodder yields were lower by 20%, net returns in Anjanpur would still be Rs 8,625 ha^{-1}, ie, about 1.5 times the baseline return.

Maharashtra: Koke Cluster

The Koke cluster of villages is located in Marathwada region of Maharashtra. They fall in Jintur mandal of Parbhani district, roughly 20-25 km from the towns of Jintur and Parbhani.

This cluster has a typical monsoon climate characterized by cold winters and hot summers. Temperatures rise to 41^0C in May and fall to 11^0C in the winter months. This region receives most of its rainfall from the southwest monsoon due to which crop cultivation is active during June-September. There are an average of 8.65 hours of sunshine. The soils here are classified as vertisols

with high water-holding capacity favoring cultivation of cotton and sorghum. The target crop of this project for this cluster was rainy-season sorghum.

1. Cluster-level Indicators

Number of Villages and Farmers

Cooperation between the Project Executing Agency (ICRISAT) and the local partner Marathwada Agricultural University (MAU), Parbhani, enabled expansion of the project. The project began in this cluster with 4 villages and 313 farmers in 2005. Three more villages and 770 farmers joined the project in 2006 and another three villages and 289 farmers in 2007 (Table 120).

Crop Production

There was an increase in acreage, production and productivity of rainy-season sorghum in Koke between 2005 and 2007 (Table 121). Acreage increased sharply from 240 ha in 2005 to 621 ha in 2007 largely due to the influence of the project and due to the participation of more farmers. Consequently, overall production increased although yields fell marginally.

Grain Sales and Prices

Farmers marketed large quantities of grain and benefited from improved marketing efforts facilitated by the project (Table 122). Bulk marketing to industrial buyers in 2006 fetched project farmers Rs 6.45 kg^{-1} compared to the rate of Rs 5.90 kg^{-1} prevailing in the local market. Project infrastructure facilitated safe bulking of produce and sale to industrial buyers. However, in 2007, the local market price touched an all-time high of Rs 10 kg^{-1}, and a majority of farmers preferred to sell their produce locally.

Table 120. Number of villages and farmers participating in the project in Koke cluster, 2005-07.

	Number of villages			Number of farmers		
Year	Initial villages	New villages	Total	Initial farmers	New farmers	Total
2005	4	-	4	313	-	313
2006	4	3	7	313	770	1,083
2007	7	3	10	1,083	289	1,372

Table 121. Area, production yield of rainy-season sorghum in Koke cluster.

Year	Area (ha)	Production (t)	Yield (kg ha^{-1})
2005	240	480	2,000
2006	516	935	1,812
2007	621	1,116	1,797

Table 122. Marketed surplus and price realization of rainy-season sorghum.

Year	Total production (t)	Marketed quantity (t)[1]	Average price range (Rs kg^{-1})	
			Market price[2]	Price obtained by project farmers who bulk sold to the poultry feed industry
2005	480	216	4.90	-
2006	935	468	5.90	6.45
2007	1,116	580	7.80-10.00	-

1. Includes bulk sales to the poultry feed industry and direct sales in the local market.

2. Prevailing price in the regulated market.

Training Programs

Farmers were exposed to various production and post-production practices of rainy-season sorghum cultivation (Table 123) in the training programs conducted by the project. These programs included training on ear head drying methods, bulking, storage, grading of grain and management of grain mold. Participation by women farmers increased over the years.

The training programs were supplemented with training material to evoke the interest of participants and serve as ready reference after training (Table 124). This material was in the local language. Farmers reported that the training material helped them improve their production practices.

Table 123. Training programs conducted by the project.

Year	Training program	Venue	Number of participants		
			Male	Female	Total
2005	Training and demonstration on use of ear head dryers	Koke	60	2	62
2006	Bulking, grading, storage and marketing of farm produce	MAU[1], Parbhani	79	1	80
2007	Integrated crop production	Koke	85	16	101
	Integrated crop production	Nandkheda	65	22	89
	Integrated crop production	Karadgaon	73	11	84
	Grading for grain mold	Nandkheda	30	-	30
	Grading for grain mold	Sanpuri	35	-	35
	Sorghum field day	Nandkheda	102	32	134
	Exposure visits				
	Cross-learning visit of Chinese, Thai and Indian farmers and scientists	Koke, Nandkheda, Anjanpur	10	5	15

1. MAU = Maharashtra Agricultural University.

Table 124. Training material, all in Marathi, developed and distributed to participants.

Year	Type of material	Title	No. of copies
2005	Project information booklet	Ashiatil alpbhudharak shetkaryanche jivanman unchavanyakarita kukut khadyasathi jwari va bajari cha vapar	1,000
2006	Booklet/literature on sorghum	Kharif jwariche sudharit lagwad tantradnyan	2,500
	Flyer	Kharif jwar lagwadiche sudharit tantradnyan	2,000
	Flyer	Jwari lagawadikarita shifarish kelele sudharit va sankarit van	2,000
	Flyer	Kukut khadyamadhe jwari ani bajriche uopayog	1,000
	Flyer	Jwari aflatoxin niyantran	1,000
	Booklet/literature on sorghum	Bajri lagwadiche sudharit tantradnyan	2,500
	Booklet/literature on grain quality management	Dhanyachi shashrokt sathavnuk va dhanya godamache vavasthapan	1,000
2007	Booklet/literature on mycotoxin management	Jwarivaril burashi va mycotoxinche vyavasthapan	2,500

Table 125. On-farm demonstrations held in Koke cluster.

Year	Type of demonstration	Result	No. of farmers
2005	Frontline demonstration on the use of improved varieties/hybrids in place of local cultivars	Improved cultivars recorded higher grain and fodder yield	250
2006	5 frontline demonstrations on the use of improved varieties/hybrids in place of local cultivars	Improved cultivars recorded higher grain and fodder yield	700
	3 micronutrient trials	Use of micronutrients in soil increased grain and fodder yield significantly	600
2007	34 frontline demonstrations in farmers' fields to demonstrate use of improved production technologies	Use of improved varieties/hybrids along with integrated nutrient management/pest and disease management increased production with good quality grain and fodder	1,100

Demonstrations

Demonstrations conducted in Koke cluster as part of the project were helpful in guiding farmers on the use of high-yielding varieties and correcting the micronutrient imbalance (Table 125).

Soil Analysis

The soils in Koke cluster were analyzed for various parameters like soil type, pH and electrical conductivity, and macro and micronutrient levels in 2006 (50 samples) and 2007 (52 samples).

The results (Table 126) show that soils in the cluster are deficient in a few major and micronutrients such as phosphorus, zinc and iron. Participant farmers were accordingly advised to correct the nutrient deficiency.

Grain Quality

About 92 grain samples from this cluster were tested for toxic content during 2006-07. Only one tested for aflatoxin levels above the acceptable range (Table 127), indicating that sorghum grain produced in Koke are by and large free of harmful toxins.

2. Survey Results

General Socioeconomic Aspects

The average age of the heads of households in the project sample was 44 years (Table 128) and that of the control sample 47 years. The average total landholding (Table 129) was slightly higher for the control sample (0.62 ha) although the project sample had higher average nonirrigated area. In contrast with the other clusters, all farmers in Koke were literate.

Table 126. Results of soil samples tested in Koke cluster.

Year	No. of samples/plots	Parameters tested	Results
2006	50	Soil type pH and electrical conductivity	Soils slightly alkaline; electrical conductivity within safe limits
		Organic carbon, calcium carbonate	Organic carbon and calcium carbonate levels 'low' to 'high'
		Macronutrients: N, P, K Micronutrients: Fe, Zn, Mn, Cu	Soils well supplied with K, Mn and Cu but deficient in P, Zn and Fe
2007	52	Soil pH and electrical conductivity	Soils slightly alkaline with electrical conductivity within safe limits
		Organic carbon, calcium carbonate	Organic carbon and calcium carbonate levels 'low' to 'high'
		Macronutrients: N, P, K Micronutrients: Fe, Zn, Mn, Cu	Soils well supplied with K, Mn and Cu but deficient in P, Zn and Fe

Table 127. Grain sample analysis for mycotoxin.

Year	No. of samples	Parameters tested	Results/conclusions
2006-07	92	Aflatoxin and fumonisin	One field sample recorded aflatoxin above the acceptable range (30 µg kg^{-1})

Table 128. General socioeconomic aspects of Koke cluster respondents.

Variable	Project farmers	Control farmers
Average age (years)	44	47
Average irrigated landholding (ha)	2.21	3.31
Average nonirrigated landholding (ha)	3.51	3.44
Average total landholding (ha)	4.43	4.60
Nonliterate heads of households (%)	0	0
Average no. of dependents	6	6
Dependents in the 3-17 age group	2	2
No. of schoolgoing dependents	2	2
Backward Class (BC) households (%)	20	20

Table 129. Average area (ha) of rainy-season sorghum per household.

Year	Project farmers	Control farmers
2004	0.52	0.64
2005	0.52	0.63
2006	0.51	0.60
2007	0.54	0.61

There were an average of 6 dependents per household in both samples, two of them being in the age group of 3-17 years, both schoolgoing. Only 20% of the respondents in both samples belonged to underprivileged sections called the Backward Classes in India. Only a few respondents in both samples had subsidiary occupations; farming was the major occupation of the respondents of Koke.

Area Under Rainy-season Sorghum

The area under rainy-season sorghum cultivation in this cluster remained more or less the same as recorded in the baseline study. However, farmers reduced the pigeonpea area and increased the area under cotton (Fig. 22), which indicates that their interest turned to cash crops from 2005 to 2007.

We observed a gradual increase in sorghum acreage per household among project farmers and a concurrent decrease among control farmers. Though the average area per household decreased slightly among project farmers too in 2006, it increased again in 2007. The reason behind the decline in acreage of control farmers was their preference for cash crops like cotton.

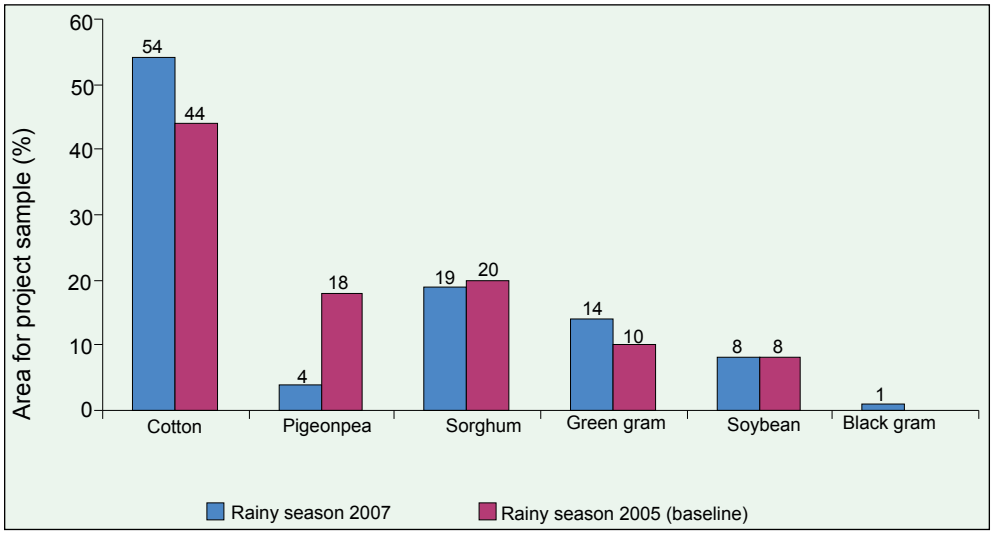

Figure 22. Changes in the cropping pattern in Koke cluster.

Table 130. Rainy-season sorghum crop and fodder yields.

Yield	Project farmers	Control farmers	2004 (baseline)
Grain yield (kg ha^{-1})	1,840	1,772	1,100
Fodder yield (bundles ha^{-1})	1,600	1,500	1,077

Production and Product Utilization

The average yield of rainy-season sorghum for project farmers increased from 1,100 kg ha^{-1} in the baseline study to 1,840 kg ha^{-1} in 2007 (Table 130), which was higher than the yield recorded by control farmers (1,772 kg ha^{-1}).

The impact of the project is also evident from fodder yields, which went up by over 500 bundles ha^{-1} for project farmers during the project period. As in the other clusters in Maharashtra, farmers in Koke use only hybrid seeds for rainy-season sorghum.

Both project and control farmers said there was improvement in grain and fodder quality during 2004-07 (Table 131). This was on account of the climate as well as the improved seeds distributed as part of the project.

Additionally, mold incidence reported by the project farmer sample decreased from 7% in 2004 to 3% in 2007 (Table 132) and from 10% to 8% for the control sample. The project helped participating farmers cut the frequency of mold incidence by using mold-resistant cultivars and by harvesting grain at the appropriate stage (physiological maturity).

Table 131. Farmers (%) reporting higher grain and fodder quality.

	Project farmers		Control farmers	
Year	Grain quality	Fodder quality/palatability	Grain quality	Fodder quality/palatability
2004	11	15	10	10
2005	17	22	19	22
2006	42	33	24	26
2007	55	55	51	52

Table 132. Incidence of sorghum mold.

	Mold incidence	
Year	Project farmers (%)	Control farmers (%)
2004	7	10
2005	7	10
2006	8	17
2007	3	8

The average household production of sorghum grain gradually increased from 741 kg in 2004 to 870 kg in 2007 (Table 133). At the same time, consumption of grain came down from 54% of production in 2004 to 44% in 2007. On the other hand, production of sorghum grain by control farm households decreased slightly from 700 kg in 2004 to 688 kg in 2007 (Table 134).

The proportion of grain used for the farmers' own consumption tends to decrease for both samples as the quantity that is sold increases. Project farmers realized better prices for their grain than control farmers in the last two years of the project.

The average household production of fodder increased for both project and control farmers from 2004 to 2007 (Tables 135 and 136). The proportion of fodder production that is fed to cattle decreased by 2 percentage points for both groups and the proportion of sales increased marginally.

Table 133. Production, utilization and sale of rainy-season sorghum grain by project farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	741	800	812	870
Consumption (% of production)	54	50	45	44
Other uses (% of production)	6	5	5	4
Sales (% of production)	40	45	50	52
Average sale price (Rs kg^{-1})	4.2	4.90	6.13	7.80
Modal months of sale	Dec, Jan	Dec, Jan	Dec, Jan	Jan, Feb
Type of market	Regulated	Regulated	Regulated and bulk marketing	Regulated

Table 134. Production, utilization and sale of rainy-season sorghum grain by control farmers.

Variable	2004	2005	2006	2007
Average production per household (kg)	700	675	689	688
Consumption (% of production)	47	42	42	40
Other uses (% of production)	8	9	9	11
Sales (% of production)	45	49	49	49
Average sale price (Rs kg^{-1})	4.94	5.07	5.99	7.31
Modal months of sale	Dec, Jan	Dec, Jan	Dec, Jan	Jan, Feb
Type of market	Regulated	Regulated	Regulated	Regulated

Table 135. Fodder utilization by project farmers.

Variable	2004	2005	2006	2007
Average production per household (bundles)	582	596	800	809
Used as cattle feed (% of production)	100	99	98	98
Total sales (% of production)	0	1	2	2
Average sale price (Rs $bundle^{-1}$)	218	318	450	530

Table 136. Fodder utilization by control farmers.

Variable	2004	2005	2006	2007
Average production per household (bundles)	780	772	867	928
Used as cattle feed (% of production)	100	100	98	98
Total sales (% of production)	0	0	2	2
Average sale price (Rs $bundle^{-1}$)	356	378	587	557

Seed Systems

There were significant differences between the sources of seed accessed by project and control farmers. The proportion of project farmers' seed purchases facilitated by the project through collaboration with the Maharashtra Agricultural University and private seed companies increased from 7% in 2005 to 50% in 2007. Simultaneously, seed purchases from shops decreased from 100% in 2004 to 50% in 2007 (Table 137). Control farmers too increasingly accessed seed from the university and seed companies, indicating that these seed sources gained popularity in the region through the project.

Seed costs of both project and control farmers increased along with the increase in grain prices (Table 138). However, project farmers incurred less expenditure than control farmers from 2005 onward on account of the discounts available to them under the aegis of the project.

Table 137. Proportion of respondents (%) accessing seed from various sources.

	Project farmers		Control farmers	
Year	Private seed shop	University/ seed company	Private seed shop	University/ seed company
2004	100	0	97	3
2005	93	7	100	0
2006	46	54	85	15
2007	50	50	80	20

Table 138. Seed costs[1] (Rs ha^{-1}) incurred by sorghum farmers.

Year	Project farmers	Control farmers
2004	476	476
2005	216	541
2006	281	585
2007	325	671

1. Average cost of seed requirement for 1 ha at an average seed rate of 6.25 kg ha^{-1}.

Table 139. Utilization of credit linkages set up by the project.

Credit variable	Project farmers	Control farmers
Major source	Banks, cooperative lending agencies	Private lenders, banks, cooperative lending agencies
Average borrowing per household (Rs)	23,236	19,400
Interest rate (% per year)	7.00	72.00
Other costs (Rs per transaction)	Rs 566	Rs. 632[1]
Remarks	Low rate of interest, reduced burden	High rate of interest; pledging of land records with moneylenders; lengthy procedures

1. Cost incurred in availing loan from banks and cooperative lending agencies.

Credit Linkage Benefits

Project farmers in this cluster borrowed an average of Rs 23,236 per household (Table 139), which was higher than the borrowing by control farmers (Rs 19,400). The interest rates paid by the two samples were significantly different: while project farmers paid Rs 7 per annum as interest, control farmers spent Rs. 72 per annum at an interest rate of 6% per month. Moreover, project farmers incurred less transaction costs (Rs 566 per transaction) compared to control farmers (Rs 632 per transaction).

Market Intelligence and Marketing Costs

About 52 of the project farmer respondents obtained price information from the market; only 17% of control farmers did so (Table 140). The price realized due to bulk sale of grain by project farmers in 2006 was significantly higher (Rs 6.35 kg^{-1}) than the price obtained by control through individual sale in the market (Rs 5.90 kg^{-1}).

Farmers in the Koke cluster mainly sell their grain to local traders in Bori, where there are no commission charges unlike in other clusters. Marketing charges increased by 22% in 2007 on account of increased transportation and labor costs. However, farmers who bulk marketed their grain in 2006 realized higher cost efficiencies and spent about 40% less on an average (Table 141).

Storage

The proportion of farmers storing their grain decreased from 58% in 2005 to 44% in 2007 and concurrently there was an increase in the sale of produce.

Table 140. Access to market information and price realization by respondents.

Variable	Project farmers	Control farmers
Farmers obtaining price information (%)	52	17
Sources of information	Market	Market
Farmers whose marketing decisions were influenced by information (%)	100	100
Farmers preferring bulk/collective marketing over individual marketing (%)	52	14
Farmers obtaining higher prices due to bulk sales (%)	44	NA[1]
Market price (Rs kg^{-1}) (2006)	5.90	5.90
Bulk sales (Rs kg^{-1}) (2006)	6.35	NA

1. NA= Not applicable.

Table 141. Marketing costs (Rs bag^{-1} of 100 kg) incurred by farmers.

	Costs incurred by farmers		
Marketing activity	2004	2006[2]	2007[1]
Bagging	2	4	3
Transportation cost	10	Borne by industry	11
Labor charges (loading, weighing and unloading)	2	2	3
Other costs	3	6	5
Total cost bag^{-1}	17	12	22

1. Direct sale in the market.
2. Bulk marketing.

The higher prices prevailing in the market in 2007 for good quality grain produced by project farmers must have encouraged many of them to sell their produce rather than store it.

Interestingly, the concept of selling rainy-season sorghum grain had not been prevalent in the cluster. However, the impact of the project enabled farmers to increase production to higher levels in order to earn extra income. The traditional practice of storing sorghum grain in gunny bags continued among farmers.

Knowledge

The majority of project farmers in Koke ranked the knowledge they gained through the project as 'good' in most of the areas (Fig. 23). However, knowledge gain in areas like seed treatment was rated 'average' and in disease management 'low'. As there are relatively few problems relating to the production aspects of sorghum in the Koke cluster, farmers there may not have perceived these as important areas of knowledge.

Farmers' Perception and Feedback

Various participatory activities like training programs, exposure visits, demonstration plots, scientific storage and visits by scientists conducted under the project were received well by project farmers (Fig. 24). Among these, project farmers highly appreciated the scientists' visits as they were helpful in solving their production, storage and marketing problems instantly in the field.

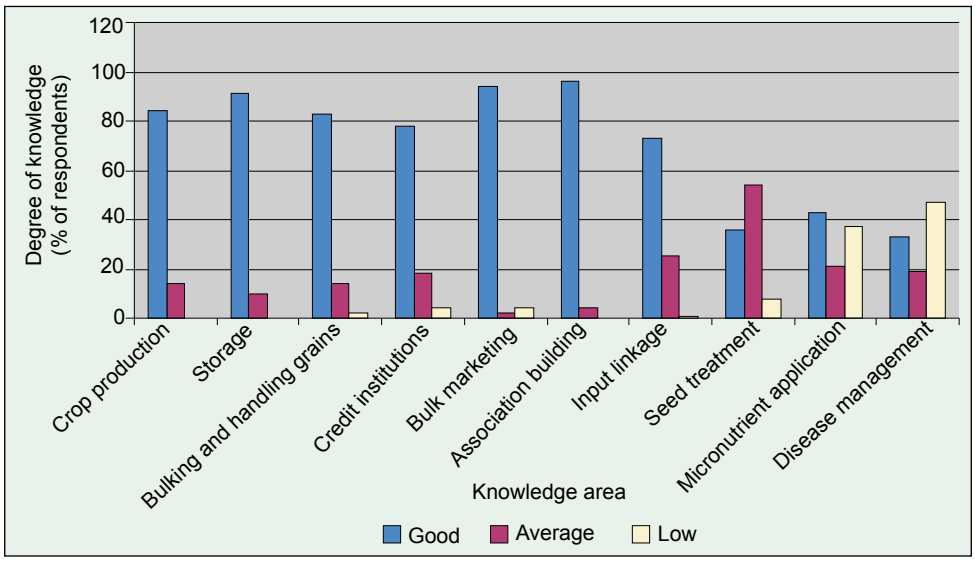

Figure 23. Knowledge acquired through project activities.

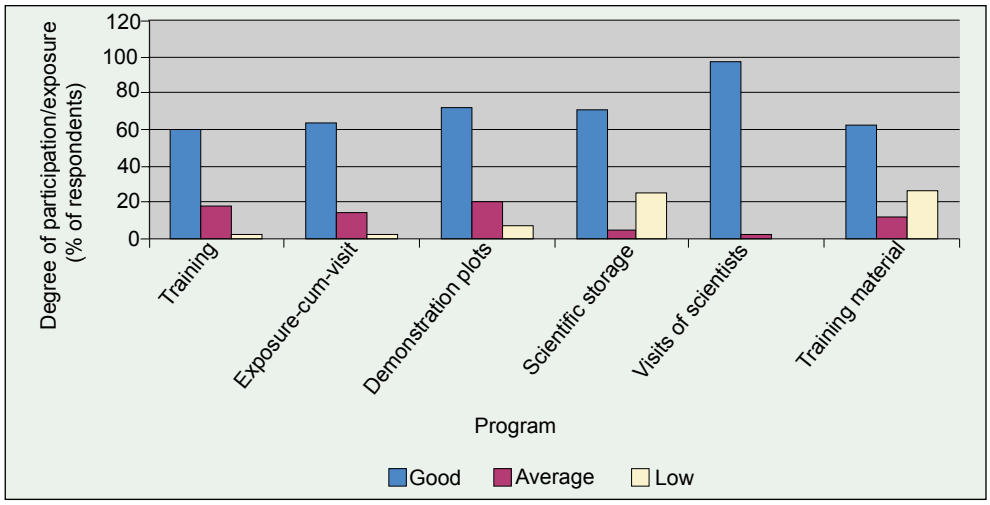

Figure 24. Farmers' perception of project activities.

However, a small section of farmers ranked as 'low' aspects of the project such as scientific storage and training material. This may be on account of higher expectations from these farmers.

Farmers' perception of benefits accruing to them from different components of the project varied (Table 142). The majority of project farmers said they benefited from the crop production aspect of the project (70%), followed by bulking and storage structure (49%), farmers' association (47%), bulk marketing (42%) and credit linkages (37%).

Effect of Improved Crop Production Technologies

Seventy project farmers said they had benefited from crop production technologies introduced by the project in Koke. All of them cited increased area and yield and improved quality of grain and fodder as the specific benefits they had received.

Table 142. Benefits of project initiatives.

Project component	Project farmers who perceived benefits (%)
Crop production	70
Farmers' association	47
Bulking and storing of grain and construction of storage structure	49
Bulk/joint marketing of grain	42
Credit linkages	37

Effect of Farmers' Associations

Similarly, 47 farmers perceived benefits from the formation of farmers' associations. All of them said this had given them better negotiating power, leadership opportunities and increased their sense of self-confidence and independence.

Effect of Project Infrastructure

Similarly, all the project farmers who said they had benefited from the project infrastructure at Koke cited the specific benefits of better price realization, freedom from distress sales, enhanced role of women, application of knowledge of safe storage and handling of grain.

A large majority of the farmers who benefited from the bulk/joint marketing initiatives of the project said this component enhanced their bargaining power and reduced their marketing costs (Table 143).

Farmers who welcomed the credit-related initiatives of the project said reduced interest rates was the key benefit in their view (Table 144). The other benefits this group of respondents cited were fewer problems associated with loan processing. Unlike the project clusters in Andhra Pradesh, the farmers of Koke had developed a better relationship with banks and accessed credit for the long term as well.

Overall Opinion of Project Farmers

Koke farmers in general were very receptive to the project. The following were some of the key opinions expressed by a majority of project farmers.

Table 143. Benefits of bulk/joint marketing of grain.

Benefit	Percentage of total respondents (38)
Enhanced bargaining power	100
Reduction in marketing costs	95

Table 144. Benefits of credit linkages established under the project.

Benefit	Percentage of total respondents (55)
Reduction in interest rates	96
Fewer problems in obtaining credit	92
Availability of credit for horticulture, land development, education, etc.	90
Reduction in loan processing time	88

- Seeds provided under the project helped farmers in getting higher yields. Farmers hoped the seed supply linkages with the Marathwada Agricultural University and private seed companies would continue in the coming years.
- Most of the project farmers supported the project's concern for small and marginal farmers.
- Project initiatives such as building warehouses, bulking grain and establishing output linkages with industrial buyers helped the farmers realize better prices than before.
- A few farmers expressed the need for a harvester and thresher to be included in the facilities provided by the project.
- Farmers wanted the project to continue and extended to other crops.
- The majority of farmers said cooperative action was a key lesson they had learnt from the project. It was instrumental in increasing the confidence and bargaining power of small and marginal farmers.
- The impact of improved seeds on the quality and yield of grain was appreciated by a majority of farmers.
- A few farmers expressed their satisfaction with visits by international delegations.

Economics of Cultivation

The average total cost of cultivation of sorghum in the Koke cluster was Rs 11,704 ha^{-1} in which labor costs had a large share of about 44% (Table 145). If fixed costs such as land rent and the share of family labor were not taken into account, the total cost of cultivation would be Rs 5274 ha^{-1}.

On an average, there was an increase of 67% in grain yield and 49% in fodder yield (Table 146). This coupled with the substantial increase in the prices of grain (83%) and fodder (77%) ensured that returns from grain and fodder also rose. Thus in Koke, gross returns increased by 187% and net returns by 481%. There was a marked improvement in the B:C ratio from 1.60 to 4.15.

Even if the yields of both grain and fodder were lower by 20%, net returns would be Rs 13,953, or more than four times the returns recorded in the baseline study.

A look at the share of different components of the total variable cost in Koke (Fig. 25) shows that land preparation and FYM application made the highest contribution of 22% followed by fertilizer application (18 %).

Table 145. Costs of sorghum cultivation (Rs ha^{-1}) in Koke cluster.

Cost	Material	Labor	Others	Total	Contribution of family labor
Land preparation		1,246		1,246	623
FYM application/animal penning	556	122		678	122
Sowing	393	721		1,115	557
Fertilizer application	1,508	100		1,608	100
Intercultural operations		703		703	703
Weeding		706		706	706
Protection from birds		563		563	563
Harvesting		764		764	382
Threshing		175	961	1,136	175
Marketing			686	686	
Fixed costs (land rent)			2,500	2,500	
Total	2,457	5,100	4,147	11,704	3,931
Total excluding land rent				9,204	
Total excluding land rent and family labor				5,274	

Table 146. Comparison of production costs and returns with baseline data.

Variable	Baseline sample (2004)	Project sample (2007)	Increase (%)
Cost of cultivation (Rs ha^{-1}) excluding land rent and family labor	4,768	5,273	11
Grain yield (kg ha^{-1})	1,100	1,840	67
Fodder yield (bundles ha^{-1})	1,077	1,600	49
Price obtained for grain (Rs kg^{-1})	4	7.3	83
Price obtained for fodder (Rs bundle^{-1})	3	5.3	77
Returns from grain (Rs ha^{-1})	4,400	13,432	205
Returns from fodder (Rs ha^{-1})	3,231	8,480	162
Gross returns (Rs^{-1})	7,631	21,912	187
Net returns (Rs^{-1})	2,863.5	16,639.5	481
B:C ratio	1.6	4.15	

1.There is no significant difference in net returns and benefit - cost ratio when calculated at 2004 constant price for grain and fodder.

2. Decomposition of contribution to gross returns indicates that the increase in grain yields contributed 14%, grain price 54.8%, fodder yields 4.5%, fodder prices 14.6%, the rest due to interaction effects.

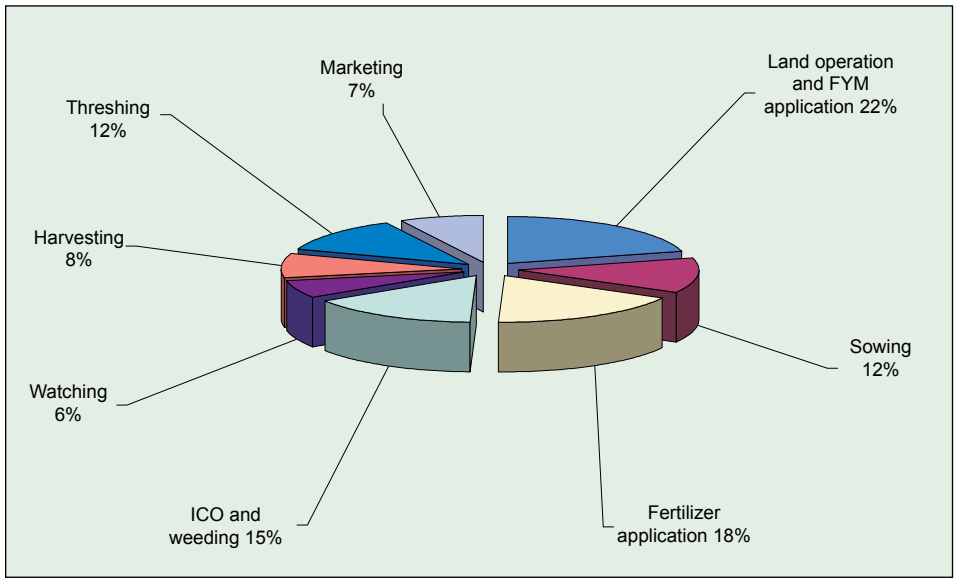

Figure 25. Components of the total variable cost of rainy-season sorghum.

As in the other clusters, there was an increase in the total cost of cultivation in Koke, mainly on account of the increase in labor and input costs (mainly fertilizers) and the use of improved seeds. Due to higher yields, costs associated with quantity of output (such as harvesting, threshing and transportation) also increased.

Chapter IV: Stakeholders' Opinions and Farmers' Associations

In this chapter we present the opinions of some project stakeholders such as partners, credit institutions, farmers, etc. on the implementation of the project and relevant sustainability issues. We also present details of the various associations set up in the five project clusters.

Name of respondent	Dr A Rajashekher Reddy
Designation	Professor
Organization	Sri Venkateshwara Veterinary University
Place	Hyderabad
Date	25-01-08
Mailing address	Department of Poultry Science, College of Veterinary Science, Rajendranagar, Hyderabad 500 030, India
Telephone	24015323; Mobile: 9346946287

1. How have you and/or your organization benefited from the project?

Under an earlier project on "Exploring market opportunities for sorghum poultry feed" funded by DFID UK, we demonstrated to poultry farmers that pelleted sorghum feed can be an alternative to maize with better nutritive value. I was able to disseminate this information through the CFC-FAO-ICRISAT project and demonstrate the benefits of sorghum poultry feed formulations. I learnt about new aspects of sorghum utilization from the CFC seminar on 'Alternative uses of sorghum and pearl millet in Asia' to which I contributed a paper on 'Sorghum and pearl millet use in poultry feed'. This project was an opportunity for our University to work with different partners/organizations for the welfare of Andhra Pradesh's resource-poor farmers. Our goal was to enhance sorghum and pearl millet productivity by 10% and help farmers secure remunerative prices for their produce. The project was also an opportunity for the scientists of Sri Venkateshwara Veterinary Univeristy and the Acharya NG Ranga Agricultural University to participate in an innovative project, which was the first of its kind in the university system.

2. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

The project contributed immensely to increasing productivity, improving grain quality and establishing marketing linkages through which farmers could

sell their produce to poultry feed manufacturers for better remuneration. Our university played an important role in linking sorghum and pearl millet farmers with poultry producers. Improved grain quality and bulk marketing improved the prospects of sorghum being used in poultry feed as an alternative to maize. As a poultry scientist and nutritionist, I have developed sorghum-based poultry feed formulations as a cost-effective option. The mindset of poultry farmers has changed and they are now open to using good sorghum grain in poultry feed as a cheaper alternative.

3. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

Implementation: The project was implemented in the true spirit of the plans despite the fact that it was a difficult task to bring all the stakeholders on one platform to work toward a common goal.

Constraints: We worked to overcome the constraints that cropped up during project implementation. However, there were still some constraints that needed attention in areas like arrangement of credit linkages during the bankers' and farmers' meetings, low response from women, farm advisory/field-level support, shortage of the seed of desired cultivars, difficulties in procurement of fertilizers, and adverse weather conditions.

Suggestions for improvement: Project activities should be extended to new areas. Greater participation by women will enable the project to have more impact. Resource persons should be identified in each cluster to disseminate project benefits to nonproject farmers within the cluster and beyond.

4. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute toward this objective?

The following factors are crucial for sustaining the project:

- Strengthen farmers' associations and equip them to carry out the project
- Establish better linkages with universities/federation of farmers' associations/ seed supply agents/agricultural officers or field workers
- Strengthen credit linkages to help resource-poor farmers
- Develop alternative market opportunities other than poultry feed use
- Place greater emphasis on self-help groups and women farmers' participation.

Our organization can play a role in the following activities in sustaining the project:

- Dissemination of information on production technologies through video films
- Strengthening linkages between grain producers and poultry feed manufacturers
- Dissemination of information on use of sorghum and pearl millet grain in poultry and livestock feed
- Helping feed manufacturers in developing sorghum poultry feed formulations
- Providing information on effective use of sorghum straw in cattle feed.

Name of respondent	Mr SP Panchavate
Designation	Chief Manager
Organization	State Bank of Hyderabad
Place	Beed, Maharashtra
Date	31.01.08
Mailing Address	Regional Office, State Bank of Hyderabad, Beed, Maharashtra, India
Telephone	02442230913; Mobile: 9421335254

1. Briefly describe your/your organization's role in the project.

Our organization financed the project beneficiaries as mandated to us in the memorandum of understanding of the project. We directed our local branches to actively participate in the project.

2. How have you and/or your organization benefited from of the project?

On account of this project, forward and backward linkages are assured.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

Definitely. With adequate finance available, farmers increased their yield and income and improved their livelihoods.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

Implementation: From the very beginning of the project, we directed our local functionaries to proactively participate in the implementation.

Constraints: A few of the selected beneficiaries were from outside the area of operation of our local branches.

Suggestions for improvement: There must be advance planning in coordination with our local functionaries for timely execution of the project.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

We must create awareness among farmers so as to strengthen forward linkages and impart sustainability to the project. Our organization can aid this process by providing timely and adequate financing.

Name of respondent	Mr Sajid Ali Syed Ali
Designation	Vice-president of warehouse
Organization	Godown Koke
Place	Koke, Maharashtra
Date	15.01.08
Telephone	Mobile: 9890778198

1. Briefly describe your/your organization's role in the project.

We turned farmers' attention toward hybrid (sorghum) production. Then we conceived and strengthened the local farmers' association to achieve production and marketing objectives.

2. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

Yes, in the following ways:

- We improved our incomes due to the project's marketing efforts
- We got kisan (farmer) credit loans
- We now have a godown or storage facility in our village
- We are directly linked to the Maharashtra Agricultural University, Parbhani.

3. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

The project was well-implemented. However, the following aspects should be looked at:

- We need a threshing yard
- A compound wall for the warehouse is needed for better safety
- A dal (pulses) processing unit operated by an SHG would increase the period of warehouse use.

4. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

The farmers' association should be registered We should make a coordinated effort to establish input linkages to supply seed and fertilizer to farmers in time and to ensure sale of produce through bulk marketing. The farmers' association can be instrumental in this effort.

Name of respondent	Dr SS Ambekar
Designation	Sorghum breeder
Organization	Marathwada Agricultural University
Place	Parbhani, Maharashtra
Date	25.11.08
Telephone	024452249532; Mobile: 9422859537

1. Please briefly describe your/your organization's role in the project.

I was the principal investigator from the Maharashtra Agricultural University.

2. How have you and/or your organization benefited from the project?

In the context of the drastic decrease in sorghum area over the last 20 years, the CFC-FAO-ICRISAT project has been really good for marginal farmers who are dependent on the crop. Farmers received several benefits from the project in terms of higher grain prices, savings on marketing costs by avoiding market intermediaries and use of improved seed and production technology.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

Prior to this project, the area under sorghum cultivation had drastically reduced due to the non-profitability of the crop. This project enabled farmers to get higher prices for their grain (up to Rs 150 per 100 kg more than the market price). This was possible by improving the quality of grain through better harvest practices. Our institute supplied improved seed of genotypes like PVKSU 9 to the project.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

The project should have drying, threshing, weighing and warehousing facilities at one place so that farmers can bring all their material to one place. This will lead to better prices for their produce. The project should be extended to other crops like soybean, pigeonpea and green gram.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

For long-term sustainability, we should ensure supply of quality certified seed and other inputs, provide farmers information on recommended technology and establish market linkages.

Name of respondent	Dr Syed Ismail
Designation	Associate Professor
Organization	Marathwada Agricultural University
Place	Parbhani, Maharashtra
Date	28.01.08
Telephone	9890931861

1. Please describe your/your organization's role in the project.

Our organization had the responsibility of mobilizing small farmers for adopting improved production packages like seed and fertilizer. We also improved their skills in harvesting, bulking, grading and selling produce directly to end users. We are satisfied with the role we played.

2. How have you and/or your organization benefited from the project?

I benefited by sharing experiences with farmers. It helped me plan my research work.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

The project has had an impact on livelihoods in the following ways:

- Farmers are now using hybrids and varieties with good grain quality and high yield potential
- Farmers are saving money by using their own produce for consumption apart from selling it in the local market
- Farmers have benefited from direct linkages with industry.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

The project was implemented well but we faced constraints in getting land for building storage structures. The project must also have harvesters and threshers. We should build many more small storage structures.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

Our organization will conduct farmers' rallies, training programs, etc, not only in project villages but also in others. We will share the experiences we gained in this project and will collaborate with farmer groups/SHGs to enable them to realize their potential.

Name of respondent	Dr Birajdar Sanjay Namdeurao
Designation	Subject matter specialist (MS Agronomy)
Organization	Krishi Vigyan Kendra
Place	Ambajogai, Beed, Maharashtra
Date	29.01.08
Mailing Address	Deendayal Research Institute, Krishi Vigyan Kendra, Digholamba, Ambajogai, Beed, Maharashtra
Telephone	02446258552; Mobile: 9421901246

1. Please describe your/your organization's role in the project.

Our organization participated in the following activities:

- Implementing project activities in two clusters in Beed district

- Guiding the formation and strengthening of farmers' associations
- Providing technological backup for growing sorghum and pearl millet
- Developing storage structures and drying facilities in the clusters
- Improving the bargaining capacity of farmers in grain sales
- Developing market and credit linkages with companies and banks
- Efforts for sustaining this activity over a longer period.

2. How have you and/or your organization benefited from the project?

It was an opportunity to work with farming communities growing sorghum and pearl millet. The creation of warehousing and drying facilities may have a good long-term impact. This is the first project in which our organization got an opportunity to work with international experts.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

The project:

- Strengthened farmers' groups
- Improved crop productivity
- Created new avenues of marketing grain to poultry feed and beverages industries
- Empowered women by involving SHGs in project activities
- Developed good market and credit linkages.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

Implementation: The program planning was very effective. The experience of the Project Executing Agency (PEA) team helped us in implementing the project effectively.

Constraints: The outbreak of bird flu in the first and third years of the project affected marketing to the poultry feed industry. There was a need for facilities like threshers, light weighing machine and book-keeping.

Suggestions for improvement: The project must have a time frame of five years.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

Involvement of SHGs in purchasing, storage and marketing can help the project attain sustainability goals. Farmers' membership and share capital in the group are crucial for success. Our organization can be the facilitator for resolving farmers' problems, technological backup and establishing linkages.

Name of respondent	Mr Rajeshwar Patil
Designation	Deputy Manager
Organization	State Bank of Hyderabad
Place	Ambajogai, Maharashtra
Date	29.01.08
Telephone	02446247079; Mobile: 9423347077

1. Please briefly describe your/your organization's role in the project.

Being a financial institution, we identified small and marginal farmers for the project and financed them as per their eligibility.

2. How have you and/or your organization benefited from the project?

The project gave us an opportunity to finance more poor/small farmers.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

With farmers coming together, lengthy lending procedures were cut short; so it became easier for farmers to get loans.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

Implementation: The project was implemented well.

Constraints: Identification of small farmers.

Suggestions for improvement: The project should have started before the crop season which would have enabled farmers to get loans in time.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

The ICRISAT project is good for small farmers who cultivate coarse grain. Our bank would like to continue lending a helping hand to small farmers.

Name of respondent	Ms Latabai Bhagwanrao
Designation	President
Organization	Self-help group Sarswati Mahila Bachat
Place	Koke, Maharashtra
Date	15.01.08
Mobile	9890341674

1. Please describe your/your organization's role played in the project.

The project provided us seed bags which we distributed to farmers at a 50% discount. We also arranged and attended important meetings carried out as part of the project.

2. How have you and/or your organization benefited from the project?

We gave loans to farmers at low interest rates. The loans generated income for our SHG.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

The project helped in building ties between farmers and SHGs. It also helped women farmers in enriching their knowledge.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

The warehouse should be kept in the care of SHGs which can protect it. This project should fund us to develop new poultry farms in this village. That will earn farmers additional income and create employment opportunities.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

Name of respondent	Mr SI Sarode
Designation	Field Officer
Organization	State Bank of Hyderabad
Place	Parbhani, Maharashtra
Date	21.01.08

Mailing Address	State Bank of Hyderabad
Telephone	02452220297; Mobile: 9960421788

1. Please describe your/your organization's role in the project.

We identified farmers for the project and gave loans to eligible farmers.

2. How have you and/or your organization benefited from the project?

We could get secure business.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

Yes, it made a difference by encouraging sorghum growers.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

Implementation: ICRISAT officers helped us in achieving the project's goals.

Constraints: Sometimes field visits delay loan disbursement.

Suggestions for improvement:

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

Arrangements for marketing of produce will definitely help bankers in increasing business. We are always ready to extend our cooperation to farmers.

Name of respondent	Dr CMS Tripathi
Designation	Program Coordinator
Organization	Krishi Vigyan Kendra
Place	Ambajogai, Maharashtra
Date	30.01.08
Mailing Address	Post Box No. 28, Ambajogai, Beed 431 517, Maharashtra, India
Telephone	02446258552; Mobile: 98904677522

1. Please describe your/your organization's role in the project.

We worked as facilitators among farmer groups, research institutions and private sector organizations. Our role included facilitating input supply for grain production; linking farmers with credit institutions; developing market systems and improved handling, bulking and storage practices; and liaising with seed companies, market sources, feed manufacturing companies and poultry producers. We also helped farmers' associations in erecting warehouses.

2. How have you and/or your organization benefited from the project?

The project helped immensely in terms of developing a farmers' network, creating basic amenities for marketing, introducing new production technologies and transferring advanced technologies to farmers. Working with institutions like ICAR was a benefit to us.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was your/your organization's contribution to that effort?

The project has certainly helped farmers in increasing their income as well as knowledge. It also created a sense of cooperation and strengthened farmers' bonds with Krishi Vigyan Kendras. The scientists of KVK worked whole-heartedly for the success of the project.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

Constant follow-up efforts by ICRISAT scientists was of immense help in project execution. The goals were thus reached in a timely manner. The impact of epidemics like bird flu on the poultry industry was a constraint to the project.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

Some key factors that can help sustain the project are:

- Expansion of the project area
- Involvement of women farmers
- More efforts to link credit institutions
- Exploring new market avenues other than poultry feed.

Our KVK can help project sustainability by:

- Linking the project with its strong network of women SHGs
- Creating awareness about the project through its extension activities

- Spreading project activities throughout the district, given strong financial backing.

Name of respondent	Ms Vijayalakshmi
Designation	Branch Manager
Organization	State Bank of India
Place	Shadnagar
Date	22.4.2008
Telephone	08548-252209; Mobile: 9989636321

1. Please describe your/your organization's role in the project.

We identified small and marginal farmers eligible for financing under the project.

2. How have you and/or your organization benefited from the project?

Our target of distributing loans to small and marginal farmers was achieved. Loan recovery would not be a problem in this project because forward linkages have been established with industrial buyers.

3. Has the project been able to change the livelihoods of small and marginal farmers? What was of your/your organization's contribution in that effort?

Our organization played a key role in the success of the project. After consultations with ICRISAT scientists, we decided to finance agricultural and allied activities in project villages. We decided to spend every Tuesday exclusively in the service of project farmers. This enabled quick processing of loan applications and timely distribution of loans.

4. Please give your opinion on the implementation of the project. What were the constraints? Could it have been implemented better?

The implementation of the project was excellent. Support to the project villages will continue in the coming years.

5. What steps can the project management take to make the project sustainable in the long term? What can you/your organization contribute to this objective?

Proper utilization of loans is a key factor in the sustainability of the project.

Details of Farmers' Associations

Palvai cluster, Andhra Pradesh

Name of the association	Krishnsswami Rythu Samaykya Mutually Aided Marketing Cooperative Society Ltd., Palvai village, Maldakal mandal, Mahbubnagar district, AP.
Number of farmer members	833
Villages covered	12
Membership fee	None
Number of committee members	15
Number of office-bearers	16 (president and members)

Main responsibilities and functions carried out under the CFC-FAO-ICRISAT project

- Warehouse construction
- Assisting in hybrid seed distribution to farmers
- Assisting in credit linkage activities
- Coordinating the conduct of training programs
- Warehouse maintenance and bulking activity

Majority opinion on formally registering the association

Association members felt that registration was necessary to get government recognition and be eligible to receive benefits under future schemes.

Details of other welfare programs carried out/to be carried out by the association

The association is interested in renting the infrastructure created by the CFC-FAO-ICRISAT project and using it for the welfare activities of SHGs. This information has been communicated to SHGs. There is a plan to invite traders and dealers to store their material in the warehouse.

Udityal cluster, Andhra Pradesh

Name of the association	Sri Ramalingeswara Rythu Samaykya Mutually Aided Marketing Cooperative Society Ltd., Uditiyal village, Balanagar mandal, Mahbubnagar district, AP.
Number of farmer members	905
Villages covered	13
Membership fees	None
Number of committee members	12
Number of office-bearers	13 (president and members)

Main responsibilities and functions carried out under the project

- Warehouse construction
- Assisting in hybrid seed distribution to farmers
- Assisting in credit linkage activities
- Coordinating the conduct of training programs
- Warehouse maintenance and bulking activity.

Majority opinion on formally registering the association

Association members felt that registration was necessary to get government recognition and be eligible to receive benefits under future schemes.

Details of other welfare programs carried out/to be carried out by the association

The president and members of the association have spoken to SHGs active in the cluster. If any of them shows an interest in carrying out welfare activities such as weaving and preparation of food products, the warehouse would be of great use during the off-season. This will create opportunities for women farmers and earn income for the warehouse.

Details of other associations

In addition to the farmers' associations set up by the project, several other associations and development projects conducted by the government of Andhra Pradesh are in operation in the project clusters of Andhra Pradesh: Rytu Mitra groups, SHGs, Development of Women and Children in Rural Areas (DWCRA) and dairy cooperative groups in Palvai, and Rytu Sangha, SHGs and Rytu Samakhya in Udityal.

Anjanpur cluster, Maharastra

Name of the association	Farmers' Association, Anjanpur
Number of farmer members	1248
Villages covered	18
Membership fees	None
Number of committee members	17
Number of office-bearers	18 (president, secretary, supervisor and members)

Main responsibilities and functions carried out under the project

- Warehouse construction
- Assisting MAU partners in hybrid seed distribution

- Updating of local market and industrial buyers' prices
- Communicating price information to farmers
- Bulking
- Price negotiations
- Mobilizing farmers to participate in training and field day programs.

Majority opinion on formally registering the association

The majority of association members felt that registration would have the following benefits:

- After registration, private banks would give warehouse stock loans, an additional benefit for farmers
- Registration would help farmers in getting subsidized seed, fertilizer and agricultural implements
- Bulk losses, if any, could be addressed to the government
- Registration would help in attracting industrial buyers.

Details of other welfare programs carried out/to be carried out by the association

The association is planning to rent the warehouse during the off season for SHG welfare activities and rent it out to other farmers for grain storage at nominal charges.

Koke cluster, Maharashtra

Name of the association	Farmers' Association, Koke
Number of farmer members	1372
Villages covered	12
Membership fees	None
Number of committee members	17
Number of office-bearers	18 (president, vice-president, secretary and members)

Main responsibilities and functions carried out under the project

- Warehouse construction
- Assisting the MAU partners in hybrid seed distribution
- Updating of local market and industrial buyer prices
- Communication of price information to farmers
- Bulking
- Price negotiations
- Mobilizing farmers to participate in training and field day programs.

Majority opinion on formally registering the association

The members favored registration as it would give a sense of responsibility to every member. On account of registration, the management of the warehouse would have to be audited, which would bring in transparency. The following benefits of registration were envisaged:

- Maintenance of accounts and book-keeping would be done with greater responsibility
- Discounts in inputs would be available to the association under government schemes
- Association members would have the right to vote in District Cooperative Credit (DCC) bank and housing elections.

Details of other welfare programs carried out/to be carried out by the association

The association identified a few active SHGs which were interested in collaborative efforts. SHGs from Nandkheda, Sanpuri and Kharadgaon were given an opportunity to participate in hybrid seed distribution for which service they were given a commission of about 2% of the total value of seed distributed. This allowed the SHGs to extend loans to their members or expand their welfare activities.

The farmers' association identified two active SHGs and invited them to conduct their group welfare activities at the warehouse. Also, traders are to be allowed to store their produce in the warehouse. This would generate income as well as keep the association active. If any traders volunteer to take up this offer, the matter could be discussed with ICRISAT and other project partners.

Rohatwadi cluster, Maharashtra

Name of the association	Farmers' Association, Rohatwadi
Number of farmer members	677
Villages covered	12
Membership fees	None
Number of committee members	16
Number of office-bearers	17 (president, secretary, supervisor and members)

Main responsibilities and functions carried out under the project

- Warehouse construction
- Assisting MAU partners in hybrid seed distribution

- Updating local market and industrial buyer prices
- Communication of price information to farmers
- Bulking
- Price negotiations
- Mobilizing farmers to participate in training and field day programs.

Majority opinion on formally registering the association

Members favored registration in view of the following benefits:

- Registration would mandate issue of stock receipts, the furnishing of which would allow loans to be availed from banks
- If would make association members eligible for discounts on agricultural inputs.

Details of other welfare programs carried out/to be carried out by the association

Seed distribution was done through SHGs; so women's participation was enhanced. The association also plans to explore opportunities to rent the godown during the off season for welfare activities.

Details of other associations

In Koke, all the project villages have SHGs and Seva Sahakari (cooperative) societies which help in credit distribution. There is also a Mahatma Phule Seva Bhavi Samstha, which is associated with rural education and a Krishi Vigyan Mandal which disseminates agricultural information. Self-help groups and Seva Sahakari societies which deal with rural credit are active in Anjanpur. Similarly, in Rohatwadi, a storage tank is being constructed by the irrigation department to provide drinking and irrigation water to the villagers.

Chapter V: Summary and Conclusions

Andhra Pradesh

Project area. The project was implemented in two clusters, Palvai and Udityal, in Andhra Pradesh.

Target crops. The target crop in Palvai was pearl millet and sorghum in Udityal.

Area under target crop. There was not much of an increase in the average area of the target crop per household in both clusters (Table 147). Farm households maintained or only marginally increased their area under the target crop. As the land holdings of farmers in both clusters were small (an average of 3.28 ha in Palvai and 2.12 ha in Udityal), there was little scope for them to increase the area under a particular crop.

However, the total area of the target crop as well as the proportion of the area of the target crop in relation to the cropping pattern showed a considerable improvement over the baseline results on account of increased participation by farmers. The increase in area under the target crop in the cropping pattern shows that there was increased participation in the project by farmers and also that some farmers actually started growing the target crop after the project intervention.

Grain and fodder yields. Grain productivity among project farmers showed remarkable improvement in both clusters over baseline and control results (106% and 73% respectively). This was likely due to the project in general, and the use of inputs like hybrid/improved cultivar seeds and better production technologies in particular.

At the same time, fodder productivity also increased in Udityal and Palvai, though not as significantly as grain yield. Thus improved seed not only yielded more grain compared to local varieties but also increased fodder production.

Quality of grain and fodder. As per the farmers' perception, the quality of both grain and fodder considerably improved in both clusters. Hybrid/improved

Table 147. Summary of results for Palvai and Udityal clusters in Andhra Pradesh.

Component	Palvai cluster		Udityal cluster	
	Improvement over 2004-05 (%)	Advantage over control (%)	Improvement over 2004-05 (%)	Advantage over control (%)
Area under target crop				
Average area per farmer	3	NA[1]	8	NA
Total area under project	55	NA	300	NA
Proportion of area of target crop in the cropping pattern	19	NA	34	NA
Yield of target crops				
Grain yield	106	32	73	23
Fodder yield	43	20	28	10
Quality of produce (farmers' perception of high quality)				
Grain quality	6% to 50%	NA	0% to 71%	NA
Fodder quality	44% to 56%	NA	8% to 65%	NA
Input costs and quality				
Use of hybrid and improved cultivars	3% to 88%	Control farmers: 10%; project farmers: 88%	0% to 80%	Control farmers:15%; project farmers: 80%
Cost of seed	NA	Fell by 51%	NA	Fell by 52%
Marketed quantity of grain at the household level	56	37	59	187
Price obtained				
Grain	31	5	46	17
Fodder	59	0.5	17	-1
Net return	854	NA	220	NA
Reduction in marketing costs (Rs 100 kg bag^{-1})	NA	9	43	38

1. NA= Not available.

cultivars not only yielded higher quantities of grain and fodder, but also yielded quality grain which fetched higher prices.

Quality and cost of inputs. Nearly 80% of the respondents in both clusters used hybrid/improved cultivar seeds accessed through the linkages established by the project. This was a significant improvement over baseline and control results.

Seed costs increased along with grain prices as compared with baseline results in both clusters. Yet, the cost of hybrid/improved cultivar seeds for

project farmers was lower than for control farmers on account of the discounts available to project farmers.

Marketed quantity of grain. Output linkage initiatives and increased grain yields as outcomes of the project influenced a shift in the farmers' attitude toward utilization of grain from consumption to commercial purposes. At the time of project inception, the farmers of Udityal and Palvai used to sell their produce in the nearest regulated market. The marketed surplus from each household was small. Project interventions opened up for the farmers opportunities of bulking, direct selling to the poultry industry and off-season sale. This considerably improved the net marketed quantity of grain at the household level in both clusters.

Prices obtained. Farmers in both clusters were able to get higher prices for their produce compared to what they had got in 2005. The higher prices obtained by farmers in 2007 compared to 2004 in Palvai were mainly on account of a general increase in market prices. However, project farmers in the Udityal cluster who bulk sold to industrial buyers in 2007 realized 17% higher prices than control farmers.

Net returns. Higher productivity coupled with higher prices increased the net returns of project farmers of Palvai and Udityal by 854% and 220% respectively over the baseline results.

Marketing costs. Due to project interventions, especially bulk marketing to the poultry feed industry, project farmers' marketing costs per 100 kg bag decreased over the baseline results and also with respect to control farmers. In the case of Palvai a small saving of 9% was achieved over control on account of collective marketing, which reduced transportation costs.

Maharashtra

Project area. The project was implemented in three clusters in Maharashtra, namely Anjanpur, Rohatwadi and Koke.

Target crops. The target crop in Anjanpur and Koke was rainy-season sorghum and pearl millet in Rohatwadi.

Acreage under target crops. In Anjanpur the area under the target crop remained more or less the same as in the baseline study (Table 148). Increased water availability from canals encouraged the farmers of Anjanpur to shift to cash crops like sugarcane. Nevertheless, the sorghum area was maintained as the facilities provided by the project encouraged sorghum growers.

In Rohatwadi too target crop acreage remained stable. However, farmers in that cluster decreased the area under pigeonpea cultivation and increased the area under cotton.

In general, farmers in Maharashtra have been orienting their cropping pattern toward cash crops. However, project interventions changed their mind set toward the target crops by demonstrating yield increases and high grain prices through industrial linkages.

Grain and fodder yields. Grain productivity showed a marginal improvement in Anjanpur and Rohatwadi over the baseline and control results. However, Koke registered 67% increment in yield in relation to the baseline study, reflecting the potential realized through application of improved production technologies.

Fodder productivity showed only a marginal improvement over baseline and control for all clusters in Maharashtra.

Quality of grain and fodder. As per farmers' perceptions, grain and fodder quality improved considerably in all the clusters compared to the perceptions recorded in the baseline study.

Quality and cost of inputs. In general, farmers in all the Maharashtra clusters have been using hybrids and improved cultivars. The seed cost in all these clusters remained comparatively lower than control on account of seeds being supplied at a discount through project linkages.

Marketed quantity of grain. In Anjanpur and Koke, output linkage initiatives changed the pattern of grain utilization. There was a shift from consumption toward commercial purposes. At the time of project inception farmers had no other option than selling the produce in the nearest regulated market or at the

Table 148. Summary of results for Anjanpur, Rohatwadi and Koke clusters in Maharashtra.

Component	Anjanpur cluster		Rohatwadi cluster		Koke cluster	
	Improvement over 2004-05 (%)	Advantage over control (%)	Improvement over 2004-05 (%)	Advantage over control (%)	Improvement over 2004-05 (%)	Advantage over control (%)
Area under target crop						
Average area per farmer	-1.59	NA[1]	0	NA	7	NA
Total area under project	399.00	NA	49	NA	21	NA
Proportion of area of target crop in the cropping pattern	-21.43	NA	14	NA	-5	NA
Yield of target crop						
Grain yield	19	6	1.84	0.76	67	4
Fodder yield	65	2	5	15	49	7
Quality of produce (farmers' perception of high quality)						
Grain quality	11% to 64%	NA	11% to 55%	NA	19% to 63%	NA
Fodder quality	12% to 55%	NA	15% to 55%	NA	21% to 63%	NA
Input costs and quality						
Use of hybrid and improved cultivars	Since 2004 all farmers are cultivating hybrids	Since 2004 all farmers are cultivating hybrids	Since 2004 all farmers are cultivating hybrids	Since 2004 all farmers are cultivating hybrids	Since 2004 all farmers are cultivating hybrids	Since 2004 all farmers are cultivating hybrids
Cost of seed	NA	Fell by 13%	NA	Fell by 21%	NA	Fell by 51%
Marketed quantity of grain	10	10	4	2	30	6
Prices obtained						
Grain	64	3	44	9	86	7
Fodder	48	25	41	13	143	5
Net return	118	NA	63	NA	481	NA
Reduction in marketing costs (Rs 100 kg bag^{-1})	36	44	NA	NA	5	26

1.NA= not available.

village level. The project provided them opportunities of bulking and direct selling to poultry industries and off-season sales. On the other hand, Rohatwadi farmers continued to sell pearl millet grain in the local market because of better prices.

Prices obtained. Output linkage initiatives by the project helped farmers get higher prices for their grain in all the clusters compared to baseline and control results. Compared to Rohatwadi, farmers in Koke and Anjanpur obtained higher premiums due to the establishment of direct linkages with industrial buyers.

Net returns. Increase in grain and fodder productivity coupled with price increases helped raise the net returns for project farmers in Anjanpur and Rohatwadi clusters by 118% and 63% respectively over baseline.

However, higher productivity coupled with higher prices increased the net returns of Koke farmers by 481% over baseline net returns.

Marketing costs. After project intervention, marketing costs per 100 kg bag fell comparatively over the baseline and control samples in Anjanpur and Koke clusters. Marketing costs were not compared for Rohatwadi as bulk sales to industrial buyers did not materialize.

Acronyms and Abbreviations

ANGRAU	Acharya N G Ranga Agricultural University
APMC	Agriculture Product Marketing Committee
CFC	Common Fund for Commodities
DFID	Department For International Development, UK
DWCRA	Development of Women and Children in Rural Areas
EC	Electrical Conductivity
FAO	Food and Agriculture Organization
FFA	Federation of Farmers' Associations
FYM	Farm Yard Manure
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
KVK	Krishi Vigyan Kendra (Farmers' Science Center)
MAU	Marathwada Agricultural University
PEA	Project Executing Agency
SHG	Self-help group
SVVU	Sri Venkateshwara Veterinary University
VHL	Venkateshwara Hatcheries Limited

About ICRISAT

ICRISAT
Science with a human face

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 644 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

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