



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

## Region II - China



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Zou Jianqiu and Lu Feng

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

2009

## **Acknowledgement**

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## A. Introduction

The CFC-FAO-ICRISAT project titled “Enhanced utilization of sorghum and pearl millet grains in the poultry feed industry to improve livelihoods of small-scale farmers in Asia” was implemented by ICRISAT in India, China and Thailand, with the participation of farmers along with local partners.

The project aimed at mobilizing groups of small-scale sorghum and pearl millet farmers in order to improve productivity and to enhance harvesting, storage handling practices, and grain marketing. The project engaged seed and grain suppliers, credit agencies, poultry feed and alcohol manufacturing companies, and poultry producers. The ultimate objective of this intervention was to increase the income of farmers by 15 percent at the end of the project. This report highlights the impacts of the project in China.

In the initial year of the project, 2005, the project was implemented in 1 cluster ( 6 villages) in China. As the project entered the second and third year of operation, the number of villages as well as the number of participating farmers involved in the project clusters, have increased. This report analyses the impact of the project on the project farmers since its inception in China. Impact assessment, is an essential component of the project and involves an objective assessment of the benefits for the farmers group involved by the end of the project intervention.

The assessment is not expected to measure the real welfare impact at the district/village level at the end of project. However, we can expect to see some quantifiable impact at the household level for a few selected key parameters, which when sustained beyond the project life can lead to an overall welfare impact at the village and community level. The benchmark for comparison of the key parameters is the baseline data available for the project clusters under the project prior to the start of the project. Additionally, farmers from control villages (not participating in the project) were surveyed for a ‘with and without comparison’ ie, with and without project intervention.



## B. Impact Assessment

### The following were the broad indicators tracked for the impact assessment

1. Profile of total production, yield, area, cost of production and revenue from each cluster and comparison of the same with the baseline survey (2005).
2. Improvement in Net Returns (income) of the project farmers.
3. Improvement in the knowledge base and social status of the project farmers.
4. Comparison of yield, cost of production, revenues and market access were made between those farmers who participated in the project and outside the project (from adjacent villages growing target crops).

## C. Approach

### The impact assessment study used the following three-tier approach:

- i. Cluster level indicators
- ii. Household survey to observe impact on income and social status
- iii. Stakeholders' opinion analysis.

## D. Cluster level indicators

In the first level, an assessment of the key interventions carried out under the project is highlighted and the number of beneficiaries are quantified. The key interventions are discussed below:

### Number of farmers participating in the project

As indicated in Table 1, six villages, 300 farmers with 110 ha of land in Heishan County participated in the project in 2005. In 2006, the same villages and the same number of farmers continued with 81 new farmers who joined the project because of crop rotation, while a similar number changed their crop. In 2007, three new villages from Beining county and Heishan county, Hujia, Lijia and Zhong joined the project. Thus, in 2007 there were 9 villages and 434 farmers in the project (Table 1).

**Table 1. Number of villages/ farmers**

Year	No. of villages			No. of farmers with the project		
	Existing	New villages	Total	Existing	New farmers	Total
2005	6	-	6	300		300
2006	6	-	6	219	81	300
2007	6	3	9	277	157	434

## Area under target crop under the project over years

Table 2 represents the area of sorghum in the project in 2005, which was 110 ha, and remained the same in 2006. The production in 2006 was more than that in 2005 due to higher yields. In 2007, the number of farmers and area of sorghum in the project increased to 500 ha. During the three years of the project 2005, 2006 and 2007, the yield levels of sorghum were 7950 t/ha, 9000 t/ha, and 7800 t/ha respectively. The yields of participating farmers were higher than those who didn't participate in the project.

Figure 1 indicates significant yield differences ranging from 900 kg/ha in 2005 to 1500 kg/ha in 2006. This difference in the yields highlights the benefits of the project to the project farmers through introduction of new technologies, appropriate training and linkages. From Table 2 and Figure 1, it is observed that the yield was increasing from 2005 to 2006 and decreased in 2007. This was due to adverse climatic conditions in the region during that year. However, it is important to note that in all three years the yields of the participant farmers were higher than those of the non-participant farmers.

**Table 2. Area, production and yield of sorghum**

Year	TotalArea(Ha)	Total Production (Tons)	Yeild (t/ha) in project farmer fields.	Yeild of sorghum planted by non- participants (t/ha)	Percent increase in yield (t/ha)
2005	110	874.5	7950	7050	12.76
2006	110	990.0	9000	7500	20.0
2007	500	3900.0	7800	6750	15.56

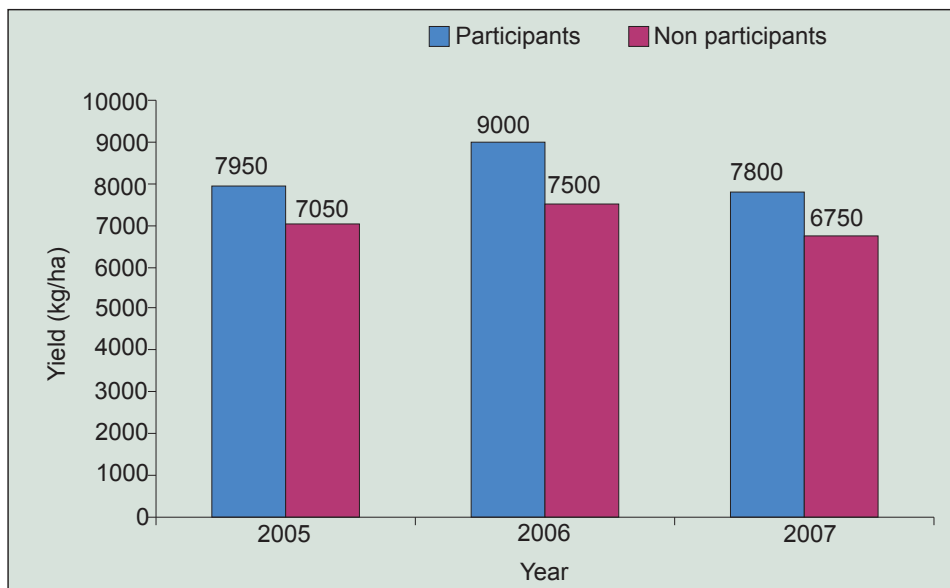


Figure. 1. Yield of sorghum in different years.

## Infrastructure created under the project, its utilization and benefits

In 2005, after discussions with head of the local government and administrative division of Heishan county for land allocations and permission for construction of storage structures, Fangshan was identified as a suitable place to build storage structures. The design, structure and costs of the godowns and sheds were discussed with farmers, agricultural experts and civil engineers. Tie-ups with industry and other private sector partners were actively sought in order to foster further technical linkages as well as for financial support. Liaoning Green Fangshan Organic Foodstuffs Co. Ltd was chosen as a partner for the building of a godown and shed.

In 2006, the storage godown was completed and guidelines on its use were adopted. A dryer was installed and lead farmers were trained on its use and management.

In 2007, demonstrations on optimum fertilizer dosage were conducted in Xiaodong. The results showed it was possible to reduce fertilizer use by 30% in the sorghum crop. Additionally adding potassium sulphate and micronutrients was found to be useful for the sorghum in the project area.

## Marketed surplus of sorghum

**Table 3. Marketed quantities and price of sorghum**

Year	Total production (tons)	Free marketing (tons)	Contract marketing (tons)	Average price or range		
				Market price (US\$/kg)	Price obtained by the target farmers (US\$/kg)	Percent increase in price US\$/kg)
2005	874.5	567.5	232.0	0.145	0.175	20.68
2006	990.0	661.0	254.0	0.16	0.175 - 0.190	14.06
2007	3900.0	2741.5	1050.0	0.190	0.219 - 0.23	18.15

Note: 1 US Dollar = 6.85 Yuan.

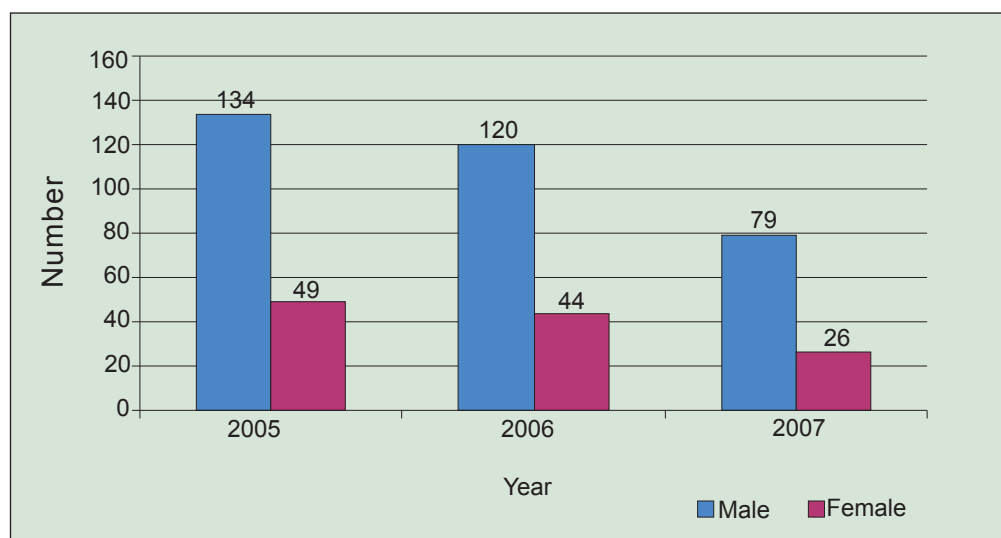
The lowest price the industries gave to farmers for sorghum was 0.175 US\$/kg in 2005, which was higher than the market price. Thus, under the contract farming, the farmers got a higher price and higher profitability. As part of the contract farming, the company identified sorghum hybrids with higher yields and better quality and provided them a 5-10% discount on seed price. The Sorghum Research Institute (SRI) provided good quality seeds and training on better cultivation practices to increase the yields. In 2006, the price of sorghum ranged between 0.175 and 0.190 US\$/kg, whereas in 2007, the price was about 0.219 to 0.230 US\$/kg. Thus, during 2006 and 2007 farmers were benefited from the project with 14-20% higher income than non-participant farmers because of the linkages with industries and other input supply organizations (Table 3).

More and more farmers opined that bulk sale of sorghum under contract farming was a profitable model for small-scale farmers. It would be the best selling style in the future. Farmers wanted more information on where to sell their produce and asked for help in getting connected with other industries that could provide a better price for their produce.

## Training programs/visits conducted in the cluster villages.

**Table 4. Training programs conducted from 2005-2008**

Year	Title of Training program (With serial number by year)	Area of program	Total no. of participants	
			Male	Female
2005	1. Hybrid selection, cultivation techniques, control of soil insects, and sorghum seed treatment techniques. 2. ICRISAT, sorghum and sorghum seed production, and contract farming. 3. Techniques of post harvest handling, storage, and sorghum marketing.	Government meeting room of Heishan county.	134	49
2006	1. Introduction of new hybrids and cultivation techniques 2. Dryer use techniques 3. Storage techniques, information on sorghum marketing and selection of suitable selling time.	Government meeting room of Heishan county.	120	44
2007	1. Fertilizer use, hybrid selection and godown usage. 2. Disease and pest control; cultivation techniques; godown usage.	Government meeting room of Heishan county.	79	26



*Figure. 2. Number of male and female participants in the on-station training.*

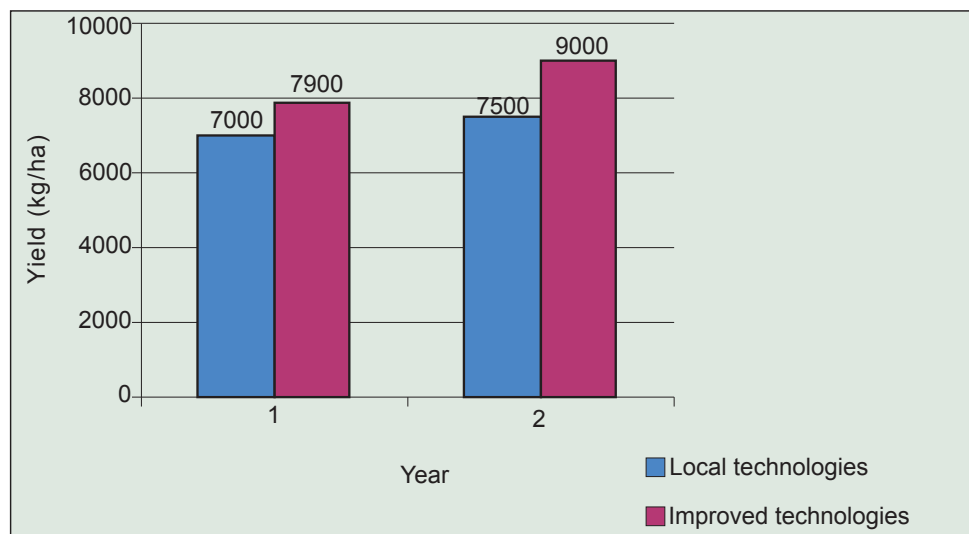
Several on-station training programs were planned and conducted during the project period according to the needs of farmers, which included hybrid cultivar selection, improved cultivation techniques, control of soil-borne pests and diseases, and seed treatment techniques in 2005; Introduction of new hybrids, improved cultivation and harvesting techniques in 2006; optimum fertilizer

use, disease and pest control and godown management in 2007 (Table 4). A total of 452 farmers participated in these training programs. During the training programs, invited experts provided instruction about techniques of post-harvest handling, storage, and marketing of sorghum. Farmers appreciated the visits of scientists to their fields as they got inputs to address farm level constraints. Field Days were unique learning events wherein the farmers were able to compare the performance of available hybrids and select the most suitable.

The number of participants for the on-farm training and field visits were more than for on-station training because these were more convenient for the farmers. The percentage of the women farmer participants was more than 24 percent (Figure 2). The project laid emphasis on training more and more women farmers.

**Table 5. Yield of sorghum with improved technologies (kg/ha)**

Year	Local technologies	Improved technologies	Increase over local technologies (%)
2005	7000	7900	13
2006	7500	9000	20



*Figure 3. comparison of yields between local and improved technologies.*

The impact of training programs in this project is depicted in Table 5 and Figure 3. In 2005, the yields of sorghum with local technologies was 7000 kg/ha, whereas with improved technologies, they were 7900 kg/ha, indicating a yield increase of 13%. In 2006, the yields from improved technologies increased by more than 20%.

## Training material developed and distributed: 2005-2007

**Table 6. Training Material distributed: 2005-2007**

Year	Type of material (flyer/poster/literature)	Title of the Material	Numbers of material distributed by language
2005	1. Manual	1. Manual of sorghum production techniques	500 copies in Chinese
	2. Poster	2. Food, feed and liquor use sorghum hybrid-Liaozha No. 13	20 copies in Chinese
2006	1. Manual	1. Newly developed sorghum hybrids, characteristics, and production technologies	400 copies in Chinese
	2. Poster	2. New sorghum hybrids used in different areas	40 copies in Chinese
2007	1. Flyer	1. Best use of fertilizer (How to use fertilizer best)	100 copies
	2. Manual	2. Introduction of new sorghum hybrids	100 copies
	3. Flyer	3. Sorghum planting and management	200 copies
	4. Flyer	4. Control of sorghum diseases and insect pests	100 copies

Training material on improved technologies for sorghum production techniques, new sorghum hybrids, optimum use of fertilizer, sorghum planting and management, control of sorghum diseases and insect pests were developed and distributed to farmers in the three years by SRI (Table 6). The farmers acknowledge the impact of the information material in enhancing the production, and acknowledge the role of the project in improving the yields and income level of target farmers.

## Demonstrations (method and result demonstrations) carried out over different seasons

**Table 7. On-farm demonstration 2005-2007**

Year	Type of demonstration	No. of farmers exposed
2005	1. Balanced nutrients	82
	2. Time of application	
	3. Intercultural operations	
2006	1. Improved cultivars	152
	2. Disease and pest control	
	3. Cultivation techniques	
	4. Harvesting at physiological maturity	
	5. Post-harvest drying	
2007	1. Improved cultivars and characters	237
	2. Fertilizer use and time of application	
	3. Balanced nutrients (reasonable fertilizing)	
	4. Disease and pest control	
	5. Cultivation techniques	
	6. Harvesting at physiological maturity	
	7. Post-harvest drying	

On-farm demonstrations were conducted every year (Table 7). Among the demonstrations, there were varying numbers of cultivars. There were a total of 15 demonstrations in Heishan county and Beining County. Additional new cultivars were selected and new seed sources were identified jointly with farmers.

A total of 471 farmers visited the field demonstrations. The demonstrations on different dosages of fertilizer were conducted in Xiaodong. The results showed that it was possible to reduce 30% of fertilizer than that generally applied by the farmers for sorghum in China without significant reduction in yield. Exposure visits were conducted for the farmers to enhance their knowledge on optimum fertilizing, harvesting at physiological maturity, hybrid characters, disease and pest control, cultivation techniques etc. Farmers learned how to get high yields and good quality sorghum grains through balanced fertilizer application. Thus the farmers were able to increase their income from sorghum production, and reduce cost of cultivation.

## Analysis of Testing

**Table 8. Analysis results of soil samples**

Year	No. of samples	Tested parameters	Analysis Results
2005	50	Analysis for N, P, K, PH and Organic matter	The results showed that content of available K <sub>2</sub> O in Heishan was less than that required for sorghum. Usually farmers there did not apply potassium before. But they used 100-150 kg/ha potassium this year and got better grain yield.
2006	50	Analysis for N, P, K, PH and Organic matter	<ol style="list-style-type: none"> <li>1. Farmers applied nitrogen and phosphate, the content of available N and K<sub>2</sub>O in Heishan County is OK.</li> <li>2. Soil of Heishan County is a little alkaline.</li> <li>3. Content of available K<sub>2</sub>O in soil of Heishan County could not satisfy the needs for sorghum growth. So we suggested that farmers to apply 100-150 kg/ha potassium.</li> </ol>
2007	60	<ol style="list-style-type: none"> <li>1. Analysis for N, P, K, PH and Organic matter</li> <li>2. Analysis for Zn, Fe, Mn, B, Ca and Mg</li> </ol>	<ol style="list-style-type: none"> <li>1. The soils in the project area are slightly alkaline.</li> <li>2. Organic matter content is low, so application of manure is beneficial</li> <li>3. The contents of available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O in some fields are OK. But they are not enough in other fields. So farmers should apply N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O every year according to the analysis results.</li> <li>4. Similarly, the contents of Zn, Fe, Mn, B, Ca and Mg in some fields are OK, but not enough in other fields. So farmers should apply micronutrient in some fields.</li> </ol>

In order to understand the nutrient contents in the farmers fields, 160 soil samples were collected from project areas and were analyzed by the Soil



Research Institute in 2005, 2006 and 2007. Results were shared with farmers during farmer meetings (see Table 8). Based on the analysis of soil samples the nutrient content summaries for soil in Heishan County were made

Available N content ranged from 70-90 mg/kg, available P<sub>2</sub>O<sub>5</sub> 10.4-19.7 mg/kg, available K<sub>2</sub>O 63-99 mg/kg, organic matter 0.65-0.98%, and pH 7.0-8.0. The results also indicated that soils in Heishan County are slightly alkaline with low content of available K<sub>2</sub>O that cannot support the nutritional needs of the sorghum crop. So farmers were never advised to apply 100-150 kg/ha potassium.

On-farm trails were conducted highlighting the application of Zn, Fe, Mn, B, Ca and Mg during 2007, and it was concluded that the Zn, Fe, Mn, B, Ca and Mg content in a few fields were satisfactory. This was not the case in all fields, so farmers were advised to apply micronutrients according to the test results of the respective fields.

## Analysis of grain samples

**Table 9. Analysis results of grain samples**

Year	No. of grain samples tested	Test Results					
		Hybrid	Starch content%	Protein content %	Lysine content %	Tannin content %	Mycotoxin%
2005	40	Liaozha No 10	69.38-70.46	9.10-9.75	0.20-0.22	0.07-0.075	0
		Liaozha No 12	74.04-75.82	10.25-11.8	0.22-0.28	0.03-0.04	0
2006	40	Liaozha No 13	71.28-73.54	10.5-11.3	0.26-0.28	0.07-0.10	0
		Liaozha No 15	76.59-77.22	9.0-10.37	0.22-0.23	0.6-0.11	0
		Liaozha No 18	71.89-72.74	10.26-11.18	0.21-0.22	1.09-1.43	0
		Liaozha No 25	75.89-77.01	11.05-11.98	0.29-0.30	0.03-0.05	0

In order to assess the grain quality, around 80 representative sorghum grain samples were collected at different times from different villages and at different drying places (roof/wall/threshing ground) and were analyzed for mycotoxin content. During all three years, sorghum grain harvested by farmers was free from any mycotoxin (especially no aflatoxin), and there was very little bird damage (Table 9).

## **E. Benefits from the project**

Due to project interventions farmers of both the counties benefited by the increase in the yield per unit area. Under the project, new cultivars and seeds of sorghum hybrids were supplied to the farmers. The average yield of the hybrids was 5-10% higher than that of the prevailing hybrids. The performance of new cultivars in yield, resistance, and grain quality, Liaoza No 10, Liaoza No 11, Liaoza No 12 and Liaoza No 13 were found better than other hybrids, and farmers got 750 kg/ha more grain (with income increase of US\$ 131.4 /ha) than the other hybrids.

### **i. Potential economic benefits for industry**

Sorghum grain is being projected as one of the main components of feed formula in China. This would mean a considerably growing market for sorghum in the future. The quality of sorghum grain will have influence on the feed formula. Some of the hybrids promoted in the project were found good for the feed.

### **ii. Effect on environmental protection**

The resistance to common pests and diseases such as head smut, leaf disease and aphids of the hybrids introduced in the project are better than the old hybrids. The farmers did not use large amounts of pesticides to get higher yields. This not only reduced farmers' investment on crop management, but also protects the environment from pollution.

### **iii. The project sets an example to surrounding farmers**

Initially, 6 villages, 300 farmers and 110 ha of land in Heishan County were part of the project, and it increased to 9 villages, 434 farmers and 500 ha. Heishan County is a major sorghum production region, and the nearby counties and cities also grow sorghum. The farmers learnt the techniques of selecting sorghum hybrids, methods to get high yields, and marketing to obtain more income from Heishan county as a core sorghum growing area that radiates knowledge to other areas.

### **iv. The project holds an identical view with Chinese policy**

China is carrying out an activity to construct a new socialistic countryside. The objective of the activity is to increase incomes of farmers and improve farmers' living environment. The CFC/FAO/ICRISAT project to enhance utilization of

sorghum grains in poultry feed industry to improve livelihoods of small-scale farmers in Asia holds an identical view with Chinese policy, and was welcomed not only by farmers but also by the local government.

## **F. Constraints and Experiences from the project**

- During data collection for the baseline survey, and impact survey farmers were hesitant to answer the questions and provide information.
- ① Select suitable time for the training programs
- ② Popularize nutrient requirement of sorghum by arranging training programs and providing printed information to farmers and other related stakeholders
- ③ Select different partners to meet the various requirements of farmers
- ④ Provide proper guidance to farmers on marketing sorghum and other commodities.

## **G. Household survey to document the impact on income and social status**

At the second level, a survey of the direct beneficiaries of the project, ie, the farmers in the different clusters, was carried out. Fifty-six respondents, 45 of whom are project participants, and 11 non-participants were selected. The 45 participants were sampled from the 9 project villages (5 for each village); the 11 non-participants were sampled from 3 villages around the project area. The survey aimed to measure the impact of the project intervention on the following six dimensions, which covered the probable changes in economic as well as social aspects of the target beneficiaries.

- i. Technological Dimension
- ii. Input Access
- iii. Market Access
- iv. Economic Dimension
- v. Knowledge and Social Dimension

The measurement of changes in aspects such as education level, housing, investments and asset formation, are not included as the impact on these would not be visible at this stage. However, they will be flagged wherever appropriate for future assessments.

Brief descriptions of the findings under the six dimensions are presented below:

**i. Technological Dimension:** This includes farmer’s perceptions due to learning new technologies of crop production such as scientific seed treatment, fertilizer application, grain handling and storage, yield of new cultivars, etc. The indicators under this component would measure productivity improvement and the reduction in unit cost of production.

This survey shows how the target farmers appreciated the information and benefits of knowledge acquired through the project, through a scale of 1 to 5, with 5 being the highest and 1 the lowest. Table 10 shows that target farmers gave the highest scores to the knowledge of crop production and disease management. It also indicates that the farmers are satisfied with the information about storage, bulking and handling grain, and fertilizer application in the project.

**Table 10. Benefits from the components of the project**

Component	Information on Knowledge acquired through project (%)				
	Rank 1				
	1	2	3	4	5
Crop production	0	0	20.4	43.2	36.3
Storage	2.3	36.4	29.5	20.4	11.3
Seed treatment	38.6	54.5	6.8	0	0
Bulking and handling grain	18.2	15.1	30.3	30.3	6.0
Fertilizer application	0	36.4	45.4	18.2	0
Disease management	0	2.2	25.0	43.2	29.5

1. On a scale of 1 to 5, with 5 being the highest and 1 the lowest.

In Table 11 and Figure 4 we see the yield of sorghum in a recent year between different target farmers. In 2004, the total production of sampled participants was 187.9 tons, average was 4.18 tons per family and the average yield was 7576.5 kg/ha. By comparison, for the non-participants production was 27.350 tons, 2.5 tons per family and yields were only 6961.9 kg/ha. The yield of sorghum was on the rise due to improved technology and information. By 2007, for sampled participants, production was 311.6 tons, 6.9 tons per family and yield of 7854.1 kg /ha, while for the non-participants, they were 53.1 tons, 4.8 tons and 7307.4 kg/ha.

**Table 11. Production and yield of sorghum**

Year	Production total (tons)		Production per family (tons)		Yield (kg/ha)	
	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
2004*	–	27.35	–	2.5	–	6961.9
2005	231.3	35.95	5.1	3.3	7701.3	7095.4
2006	301.6	48.35	6.7	4.4	8107.6	7476.7
2007	311.6	53.10	6.9	4.8	7854.1	7307.4

\* Baseline survey data before commencement of the project.

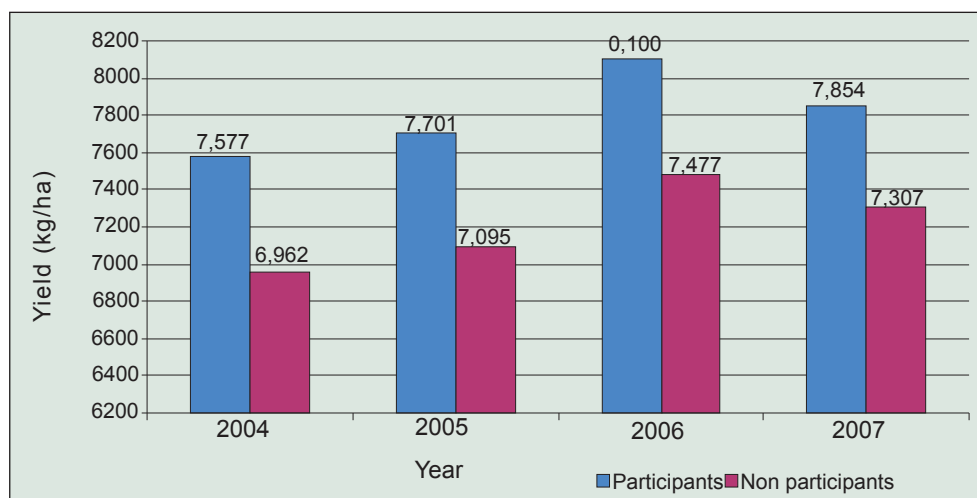


Figure 4. Yield of sorghum for different groups.

**ii. Input Access:** In this dimension, the impact of improved inputs, especially seeds that were obtained through the project as a result of linkages with the seed companies and SRI, were assessed. Target farmers of the two samples (respondents and non-respondents) purchased seeds from different places (Table 12). In 2004, 72.8 percent of the participants purchased seeds from seed shops; 24.2 percent of the respondents purchased seed from LAAS; while another 3 percent the respondents purchased seeds from a private seed company. For the non-participants, all the respondents purchased seeds from seed shops. But gradually, more farmers bought seed from LAAS. In 2007, only 9.1 percent of the participants purchased seeds from seed shops; 84.8 percent of the respondents purchase seed from LAAS; while another 6 percent of the respondents purchased seeds from a co-operative. For the non-participants, 36.4 percent of the respondents purchased seeds from seed shops. 54.6 percent of the respondents purchased seed from LAAS; while another 9 percent of the respondents purchased seeds from a private seed company.

**Table 12. Input linkages**

Year	Source of seed (%)							
	Seed shop		LAAS		Private seed company		Co-operative	
	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant
2004	72.7	100	24.2	0	3.0	0	0	0
2005	60.6	81.8	39.4	18.2	0	0	0	0
2006	15.1	27.3	81.8	63.6	3.0	9.1	0	0
2007	9.1	36.3	84.8	54.5	0	9.1	6.1	0

**iii. Market Access:** One of the important aspects of the project was to enable bulk sales of the produce through the support of the infrastructure and market linkages created under the project. This would then result in increased price realization for the produce along with savings in the marketing and transaction costs. Measuring key indicators, such as marketing/transportation costs, prices obtained and comparison with baseline data is the scope of this dimension.

Table 13 shows the market access and bargaining power of the target farmers. For the participants, 63.5 percent of them sell their products in the bulk market under the project, the others sell it by themselves in the market, and the non-participants have the similar sale pattern. Most of the farmers opined that bulk marketing is better than individual marketing, and in 2007, the survey shows that the price of bulk sales is US\$ 0.24 / kg, which is higher than that of individual sale (US\$ 0.225/ kg). In the project, most farmers agreed that the bulked sale of sorghum or contract farming are important and useful, and would be the best selling style in the future. Farmers wanted partners to provide them with more information on where to sell their produce and help them in linking with some industries.

**Table 13. Market access and bargaining power**

Sale pattern		Bulk marketing is better than individual marketing		Price of Individual sale	Price of Bulk sale
Market (%)	Bulking market under the project (%)	Yes (%)	No (%)	Mean (Yuan/kg)	Mean (Yuan/kg)
36.5	63.5	100	0	0.225	0.24

Table 14 shows reduction in the marketing costs due to bulk marketing for the sale of sorghum. For participant farmers, total cost reduced due to bulk marketing was US\$ 0.015/ kg, of which, bagging cost was 0.003, transportation

cost was 0.004, handling and market fees was 0.005, and labor charges were 0.003. Above all, bulk marketing can thus reduce the cost of marketing compared to small scale sales.

**Table 14. Reduction in marketing cost due to bulk marketing of sorghum**

Reduced cost of bulk marketing US\$/kg				
Bagging	Transportation	Handling market fees	Labor charges	Total
0.003	0.004	0.005	0.003	0.015

**iv. Economic Dimension:** The economic dimension measured the cumulative effect of the above factors in increasing the net returns of the farmers. This survey focused on the marketing of major produce owned by the respondents (see Table 15. In 2004, for sampled participants, sale of total of sorghum grain was 154.5 tons (total values US\$ 28,302.2), and the mean price realized from the sorghum sales was US\$ 0.18 per kg. For the non-participants, the mean price was US\$ 0.15 per kg, which is less than that obtained by the participants. With the increase in production, farmers had more sorghum grain to sell. In 2007, for the participants, sale of total of sorghum grain increased to US\$ 273.6 the total value rose to US\$ 66,922.6, and the mean price reached US\$ 0.24 per kg. For the non-participants, the average price increased to US\$ 0.21 per kg, which was still lower than that of the participants. Figure 5 shows that the price obtained by participants was higher than that obtained by non-participants over the past four years, indicates that the project significantly benefitted the farmers.

**Table 15. Prices obtained by different groups**

Year	Sale total (tons)		Sale total (US\$)		Mean price US\$/kg	
	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
2004	154.5	10.70	28,302.2	1,655.7	0.18	0.15
2005	204.4	23.70	40,044.1	3,978.8	0.20	0.17
2006	262.8	29.70	53,895.6	5,290.0	0.20	0.18
2007	273.6	32.40	66,922.6	6,811.1	0.24	0.21

Under the project, the formation of a Farmers' Association and capacity building of farmers was an important activity. Table 16 provides details of the knowledge gained under the project by target farmers'.

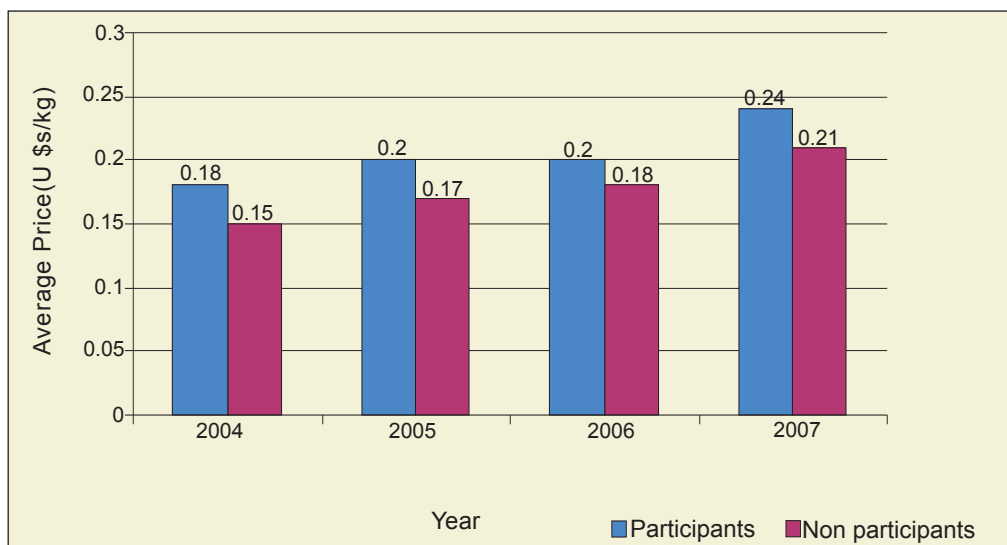


Figure 5. Prices obtained by different groups.

**Table 16. Formation of Farmers' Association and capacity building of farmers**

Formation of Farmers' Association (%)			Bulking and storing of grain and construction of the storage structure (%)	
Better negotiating ability	Increased empowerment/ leadership opportunities	Sense of self-confidence and independence	Able to get better prices	Enhancement of collective bargaining power
36.4	48.5	15.2	51.5	48.5

**Table 17. Benefits from the components of the project**

Joint marketing of the grain (%)			
Reduction in marketing costs	Enhance bargaining power with more channel choices	No need to depend on a commission agent for cash payment	Reduced dependency on the middlemen
51.5	39.4	3.0	6.1

Table 17 shows the benefits from the various components of the project in joint marketing. 51.5 percent of them agree that joint marketing of the grain can reduce marketing costs, 39.4 percent of them opined that it enhanced bargaining power with more channel choices, only 3 percent of them felt that it can reduce their dependence on a commission agent for cash payment, while 6 percent felt that it reduced dependency on the middlemen.



**v. Knowledge and Social Dimension:** Although the span of 3 years may be too short to bring about an evident complex social change, the assessment of changes in the social status and knowledge of the beneficiaries could provide useful insights on the impact of the project. From Table 18 it is clear that the target farmers gave the highest scores to input linkages under the project. Secondly, the farmers are satisfied with the association building. However, they think that the role of a credit institution was not obvious and very effective for them.

**Table 18. Benefits from the components of the project**

Component / Rank	Information on knowledge acquired through project (%)				
	1	2	3	4	5
Credit institution	45.4	39.4	9.1	3.0	3.0
Association building	3.0	51.5	33.3	3.0	9.1
Input linkage	3.0	21.2	57.6	15.2	3.0

Note: on a scale of 1 to 5, with 5 being the highest and 1 the lowest.

**Table 19. Grading of the initiatives carried out under the project**

Rank	Grade the initiatives (%)				
	Training	Exposure/visit	Demonstration plots	Scientific storage	Visits of scientists
1	0	0	0	0	0
2	0	0	6.8	2.2	0
3	52.2	52.2	25.0	50	27.2
4	36.3	20.4	61.3	43.1	45.4
5	11.3	27.2	6.8	4.5	27.2

Note: 5-point scale, with 5 being very good and 1 very poor.

Table 19 lists the ranking of the initiatives carried out under the project. Demonstration plots, scientific storage and visits of project scientists to the field get the highest rank and are followed by training and exposure/visits.

In summary, the impact assessment study provided a comparison of the benefits to the farmers under the project compared to their status at the beginning of the project and to non-participating farmers.

## H. Analysis of stakeholders' opinion

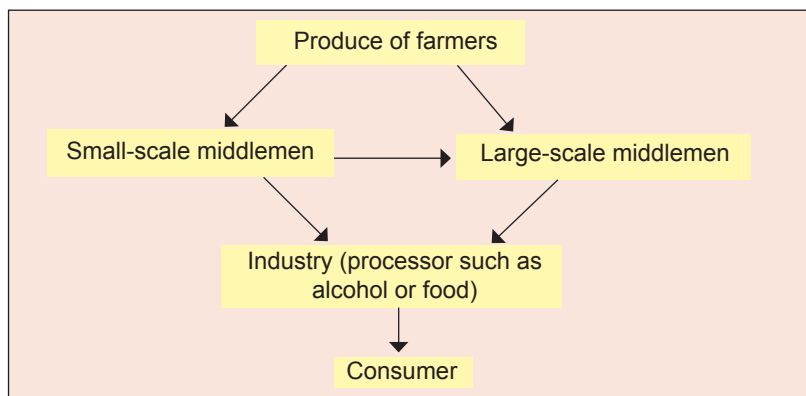
In the final tier of the impact assessment, wherein the views and opinions of some of the key stakeholders such as bankers, poultry farmers and feed manufacturers, project partners, Farmers' Associations, Village Leaders and Consultants are presented to understand what each stakeholder group thinks about the success and impact of the project. This also incorporates suggestions on how to make the project sustainable in the long run.

**Table 20. Linkages with input suppliers and credit institutions**

Credit Linkages	Jinzhou Branch, Agricultural Bank of China Xiaodong Credit Agency Heishan County	
Input supply	Seeds	Jinzhou Academy of Agricultural Sciences Tieling Academy of Agricultural Sciences
	Fertilizer and others	Partners, Local fertilizers and pesticides supplier.
Marketing system	Try to link farmers with feed industries, alcohol industry, export companies and pigment industry.	

The general information was obtained from the study area after analyzing the baseline survey and other studies. Based on the problems and constraints in each of the critical areas, innovative action plans were made under the project. The following diagram gives the description about the present system, existing problems and relevant solutions carried out for improving the linkages.

### Linkages prior to the project intervention:



## **i. Market linkages**

### **Constraints**

- (1) People knew little about nutrition status of sorghum. Most of them traditionally thought that sorghum was not as good as maize for animal nutrition, so they did not like to use sorghum grain in the feed industry.
- (2) There was no stable source of raw material. Although some feed industries liked to use sorghum in feed, they did not know where to buy good material for feed. Earlier, there was almost no contract farming adopted in the target area.
- (3) Farmers did not know where to sell their produce. About 59.8 percent of the respondents could not obtain information on market prices of sorghum prior to the sale. Market information is very important for the respondents to make a decision on production and management. 68.9 percent of the respondents acknowledge that market information influenced their decision. Since they did not get essential information about the price and which industries want the produce, they were just selling sorghum grain to middlemen or to the market, and were exploited by the middlemen.
- (4) Lack of availability of suitable sorghum cultivars used in feed industry.
- (5) Low support from the government. At present, Chinese farmers get a grain subsidy if they plant maize, rice or wheat. Only in a few provinces can farmers get grain subsidy from planting sorghum.
- (6) Farmers do not want store sorghum grain. Due to price fluctuations, poor market information and the storage problem they face, farmers do not store sorghum grain for longer than 3 months after harvesting.

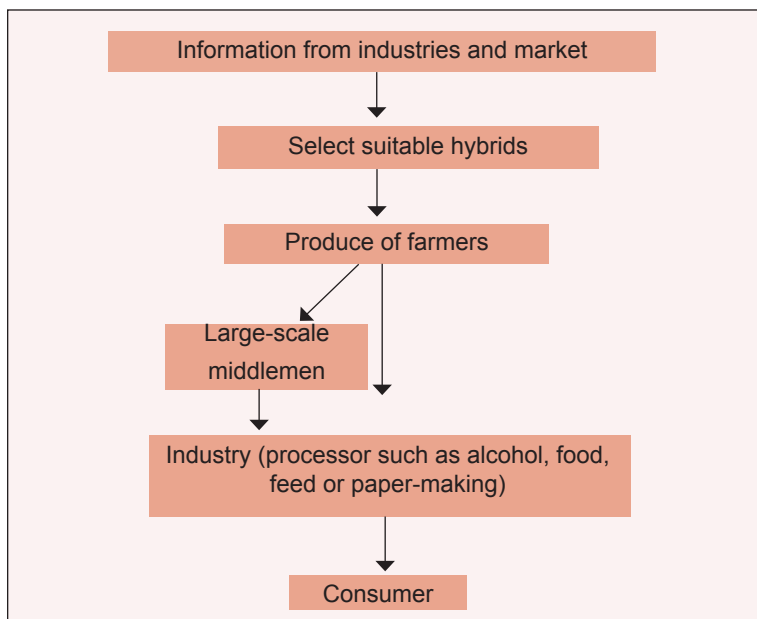
### **Innovations**

According to the existing problems, the following innovations were developed :

- (1) Provide training and information material to related industries, officials and farmers; and encourage them to realize the superiority of sorghum as feed.
- (2) Provide good seed to farmers, and support industries developing their production base. Organize contract farming between farmers and processors (such as Liaoning Green Fangshan Organic Foodstuffs Co. Ltd, Jinzhou Jingchao Food and Mill Co. Ltd, Jinzhou Daoguang 25 Liquor Making Groups).
- (3) Train farmers on getting and using market information. Help farmers establish Farmer Associations. Facilitate the process of identification of the market linkages by organizing meetings with potential stakeholders.

- (4) Construct storage structures for local farmers and ensure safe and cost-effective storage, so that farmers can store sorghum grain for more than half a year and get higher prices.

**The innovative linkage promoted under the project :**



Three industries are making contract agreements with farmers under this project. They are: Heishan Xinhe Food and Oil Trade Co. Ltd, Jinzhou Jingchao Food and Mill Co. Ltd, Liaoning Green Fangshan Organic Foodstuffs Co. Ltd. In the three years a total of 149 farmers had contract agreements with companies; the total quantity of sorghum purchased by the industry was 1,536 tons. Because of the contract farming, the company could select high yielding and good quality sorghum hybrids for farmers and have a 5-10% discount on seed price. Of course, sometimes, the farmers did not handle the situation well – when the price in the market was higher than the contract price, they did not honor the contract, which was not good for them.

**ii. Credit linkages**

Most farmers rely on their own sources of finance and only a few borrow from the banks and/or relatives or private moneylenders.

## **Constraints**

The major constraints faced by farmers when borrowing money from banks or moneylenders are:

- (1) Government or private banks need enough security such as house or animals, and they sometimes need a guarantor, which is not easy for the farmer to arrange. Borrowing money from a bank is often a lengthy and time-consuming procedure. Most times it is difficult to get a big loan for farmers from a bank.
- (2) Excessive interest rates and penalty on non-repayment. Banks refuse to extend further loans if the farmers do not repay on the earlier terms.

## **Innovations**

- (1) Simplify the procedure for farmers to borrow from the bank or credit agency. In this, joint meetings involving farmers and collaborating partners were organized to explore the farm credit resources under the project. Farmer groups were linked with the bankers and other agricultural credit agencies. Bankers provided information on preparation of documents for loan and arranged a contact person of the village to communicate with the bank.
- (2) Enhancing the relationship between the Farmers Associations and the credit supply agencies for further cooperation. Bankers were made to know more about the farmers and their produce so that they could trust the farmers, and the farmers could easily get loans at lower interest rates and multiple loans from the bank or credit agency.

## **iii. Input linkages**

### **Present status**

- (1) Respondent farmers of target areas purchased seeds, fertilizers and pesticides from different channels such as the shops, the seed companies, appointed dealers and fertilizer station.
- (2) Labor assets of the respondents interviewed are given in the baseline survey. Although they have a few small irrigating facilities (such as water pump etc.), they rarely use those because of non-availability of irrigating aqueduct system. Respondent farmers mainly use livestock (horse or donkey) as draught power for farming work.

## **Constraints**

- (1) The different sources of these inputs lead to quality problems. Seeds, pesticides or fertilizers were of bad quality and affected the yield and quality of farmers' produce, thus reducing the benefit of farmers.
- (2) Less input in irrigation, especially in drought years, reduced planting of sorghum area.
- (3) Farmers used more livestock (horse or donkey) as draught power than machines. Therefore, farmers use more seeds and more time to plant and manage sorghum, resulting in lower income.

## **Innovations**

The following activities were undertaken under the project:

- (1) Selection of ideal sorghum hybrids for different fields based on soil and market surveys.
- (2) Identify good quality seed, fertilizers and pesticide sources for farmers in order to guarantee the quality of farmers' input, and assure the high yield and good quality of sorghum.
- (3) Use of machinery for sowing, plowing, harvesting and threshing.

To sustain the project interventions the following measures have been undertaken: Requirements and needs of farmers assessed and support for strengthening the Farmers' Associations through training (on-farm and on-station) and discussion, exposure visits were planned accordingly; extended information support for establishing linkages with credit agencies, and institutionalizing the marketing linkages with the liquor industry, food industry and poultry feed companies.



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## About ICRISAT



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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