Felix Baquedano, Mamoutou Diarra, and Aly Ahmoudou**. Economic Analysis of the 2007 Crop Year.** INTSORMIL Bulletin No. 9. November 2009.

Picture 1. Millet field in the Production-Marketing project in Tingoni, Mali, summer of 2007 (Courtesy of B. Ouendeba)

Foreword

The summer of 2007 was a very unusual rainfall year with too little rain at the beginning and in the middle of the season flooding especially in the lowland regions where sorghum is often concentrated.

Our marketing strategies are designed to help compensate for poor rainfall years, either deficits or excesses. In normal and good rainfall years the moderate fertilization combined with new cultivars and better agronomy substantially increases yields. Therefore farmers following the recommended practices can pay for the additional inputs and make a profit even without following the marketing strategies. Moreover, in these years prices tend to start lower and not increase as fast as in adverse rainfall years so the return to seasonal price marketing strategies is not as great as in adverse rainfall years. In adverse rainfall years there are still better yields than with traditional cultivars and technologies. However, the yield increase needs to be supplemented with changes in marketing strategies to pay for the inputs and make a profit. In these years the seasonal price increases are substantial.

So the summer of 2007 serves as a good test of the functioning of the marketing strategy as a safety net for the increased expenditures required in the project to overcome the acute soil fertility problems in the Sahel. We also focus on the differences in selling after the seasonal price recovery for the farmers' association and the individual farmers. The associations can wait until shortly before the next planting season to sell and then buy the inputs for the next season. Individual farmers often feel various pressures to have cash at harvest so farmers have more difficulty in waiting to sell unless there inventory credit is available.

We look at the effect of marketing strategies at covering the increased expenditures of this project especially comparing the ability of the farmers' association and the individual farmer to obtain the seasonal price recovery. Also for adverse rainfall years the repayment rates of farmers are very important indicators of the long run ability of farmers' associations to be sustainable.

1. Introduction

The 2007/08 production season was a challenging season due to low land flooding in much of Mali. In Dioila, one of the villages in the program, total rainfall reached 1042mm which was 52 percent higher than the previous year (Annex 1). In Tingoni, another of the program villages, total rainfall reached 1971 mm or 188 percent higher than the average rainfall of the previous two years (Annex 1). With the flooding on the heavier lowlands yields collapsed there. So this year was instrumental for evaluating by how much the marketing strategies helped in reducing income losses.

The project has put an emphasis on combining its technology introduction with marketing strategy innovations and the institutional development of farmers' associations. The Production-Marketing Project has concentrated on five marketing strategies: (i) producing a cleaner grain and charging a price premium for it; (ii) storing and selling later in the year to benefit from the seasonal price increase; (iii) selling bulk quantities of outputs and buying inputs in bulk to increase negotiating power and get higher prices for the cereal and lower prices for inputs; and (iv) selling to premium markets that are willing to pay more especially millet food processors; and (v) convincing policy makers not to drive down the price increases of bad rainfall years with food aid or subsidized food imports.

In the next sections we will analyze individually the results for each of the villages in the program. We will concentrate on evaluating yields, the returns to technology and marketing, and institutional development for each of the farmers' associations. With respect to marketing we will estimate the benefits received by farmers and the cooperatives from storage and from selling a higher quality grain.

1.1 Regions, Villages, and Number of Farmers in the Project in 2007/08

In 2007/08 a total of 190 farmers participated in the INTSORMIL-IER production and marketing project in Mali with a total area harvested of 300 ha (Table 1.1). The program intervened in three regions in Mali (Koulikoro, Sikasso, Segou).

Table 1.1. Distribution of Farmers and Harvested Areas in the INTSORMIL-IER Production-Marketing Program in 2007/08.

Region	Village	Number of Farmers	Harvested Area (Ha)
Koulikoro	Dioila	45	48
Koulikoro	Kafara	39	56
Sikasso	Kaniko	42	48
Segou	Tingoni	68	150
Total		190	300

Dioila was added to the program in 2007/08. In Tingoni in 2007/08 area under production was increased to 150 ha from 50 ha in 2006/07. In Kaniko and Kafara crop area was maintained at around 50 ha.

DIOILA

In Dioila, the INTSORMIL-IER Marketing and Production project has partnered with the cereal farmers cooperative union, ULPC. The project introduced the sorghum variety Soumba[1] along with a technology package that consisted of 100 kg of the complex fertilizer NPK (17-17-17) and 50 kg of Urea (46-0-0). For Dioila 2007/08 was the first year in the program. Our discussion of results for Dioila will start with the comparison of yields between the program variety, Soumba,and our associated technologies with the farmers' traditional variety and practices. We will then analyze the returns to storage and marketing first for the farmers and then for the cooperative.

2.1 Yields of Program Farmers in Dioila

In Dioila a total of 54 farmers in two communities and 4 villages participated in the program (Table 2.1). Our analysis of yields will be based on a survey of 34 farmers (or 76 percent of total farmers) participating in the program (Table 2.1).

Table 2.1. Distribution of Program Farmers in Dioila, Mali.

	Number of Program Farmers	Surveyed Population
Community of Nangola	19	16
Village of Magnambougou	8	7
Village of Kenie	11	9
Community of Wakoro	26	18
Village of Tonga	17	10
Village of Wakoro	9	8
Total Program Farmers	45	34

Source: ULPC

Total sorghum production using the Soumba variety promoted by the Production-Marketing program in Dioila was 40.2 tons. In total 48 Ha were harvested by the 45 program farmers. The average yield for farmers in the program was 838 Kg/Ha. But there were marked differences in yields between the communities, that can be largely explained by differences in

[1] The Soumba cultivar had been previously tested by ICRISAT and farmers were happy with it.

topography. Nangola is located in higher ground relative to Wakoro. Wakoro is close to the river bed that passes through Dioila and therefore suffered much more from the excess rains.

In Nangola yields increased overall 42 percent over farmers' traditional variety and practices (Table 2.2). Of the two villages in the community of Nangola, farmers in Magnanbougou had the highest yield increases. Farmers in Magnanbougou increased their yields over their traditional variety by 125 percent (Table 2.2). In contrast in the village of Kenie yields increased 7 percent by using the program variety over their traditional variety.

In the community of Wakoro yield gains were lower relative to the community of Nangola. On average, in Wakoro the program variety increased farmers' yields by 13 percent (Table 2.2). In Tonga, one of the two villages in the community of Wakoro, farmers increased their yield by 26 percent. In contrast, in the village of Wakoro farmers increased their yields by 3 percent (Table 2.2).

Table 2.2. Yield Changes in Two communities and Four Villages of Dioila ,Mali.

	Soumba	Traditional	Difference
	Kg/Ha		%
Community of Nangola	1,182	830	42
Village of Magnambougou	1,293	575	125
Village Kenie	1,096	1,029	7
	-		
Community of Wakoro	725	641	13
Village of Wakoro	761	738	3
Village of Tonga	689	545	26

Source: Farm Household Surveys and ULPC.

2.2 Returns to Technology Packages

The principal priority for the production and marketing project is to increase income by raising yields and prices received. Our discussion begins first by presenting the costs of the technology package offered by the program. Then we discuss the average returns by village in Dioila of the technology package. We finish by presenting the returns to marketing for the farmers' cooperative ULPC in Dioila.

2.2.1 Cost of Technology Package

The technology package for farmers in Dioila was the same for the two communities in terms of fertilizer and seed quantity. For one hectare farmers received 2 bags or 100kg of the complex fertilizer NPK and 1 bag or 50kg of the nitrogen based fertilizer Urea. The total cost for

Picture 2. Sorghum (Soumba) in Dioila, Mali, 2007. We made the decision to substitute Nachtichama here in 2008 as shorter and higher yielding than Soumba.

fertilizer was 38,500 FCFA/Ha. Farmers also received 4 Kg of seed of the sorghum variety Soumba, at a cost of 200 FCFA/Kg. Farmers in Nangola also opted to receive an additional 5,000 FCFA/Ha to pay for labor in order to ridge their fields for water harvesting[2]. Therefore in Nangola farmers received a total credit with fertilizer of 44,300 FCFA/Ha while in Wakoro farmers' total credit was 39,300 FCFA/Ha (Table 2.3).

[2] Farmers are expected to construct ridges for water harvesting to reduce the riskiness and increase the returns from moderate fertilization. Initially the program financed this expenditure. More recently farmers have been told that they are expected to do this and pay for it.

Table 2.3. Cost of Technology Package in the Communities of Nangola and Wakoro for ULPC-Intsormil Farmers in 2007/08.

Technology Package Costs in the Community of Nangola						
NPK	12,750	Fcfa/Sac	2	Bags	25,500	Fcfa/Ha
UREA	13,000	Fcfa/Sac	1	Bags	13,000	Fcfa/Ha
Seed	200	Fcfa/Kg	4	Kg	800	Fcfa/Ha
Labor for Field Ridging	5,000	Fcfa/Ha	1	Unit	5,000	Fcfa/Ha
Total					44,300	Fcfa/Ha
Technology Package Costs in the Community of Wakoro						
NPK	12,750	Fcfa/Sac	2	Bags	25,500	Fcfa/Ha
Urea	13,000	Fcfa/Sac	1	Bags	13,000	Fcfa/Ha
Seed	200	Fcfa/Kg	4	Kg	800	Fcfa/Ha
Total					39,300	Fcfa/Ha

Source: ULPC

2.2.2 Yield and Marketing Gains from Technology Packages in Dioila

In this section we will focus on the returns from increased yields and marketing for farmers and to the cooperative ULPC. With regards to marketing the program promotes various strategies. One strategy is to produce cleaner grain by threshing on plastic or tarps instead of on the bare ground as is traditionally done. A cleaner grain results in farmers often being able to demand a premium price from the market. Another concept promoted by the project is for farmers to hold and store their grain rather than selling at harvest when prices collapse. This enables farmers to benefit from the seasonal price increase. The price increases can double from harvest prices in adverse weather years such as 2007. Given that the farmers with whom the program works are in a cooperative, the farmers association then can search for premium markets in which they can sell in bulk at higher prices.

2.2.2.1. Farmers' Returns from Yield Increases and Marketing

At harvest, between November and December, in 2007/08 market prices for sorghum in Dioila were 85 FCFA/Kg (Table 2.4). The ULPC cooperative in Dioila gave farmers in the program a 15 FCFA/Kg price premium for the quality of their grain. This represented a 17 percent increase over the harvest price for farmers.

Table 2.4. Prices at Harvest, Price Premium, and Farmers Sale Price in 2007/08 in Dioila, Mali.

Harvest Price	Price Premium for Quality Grain	Sale Price
	FCFA/Kg	
85	15	100

Source: Farm household interviews and ULPC

In Dioila farmers in the community of Nangola from an increased production of 352 Kg/Ha were able to raise their revenues by 29,906 FCFA/HA (Table 2.5). The increases in revenues from increased production covered 68 percent of the cost of the technology package. The additional 15 FCFA/Ha from selling a cleaner grain increased revenues further by 17,730 FCFA/Ha, which represented 40 percent of the cost of inputs. Therefore, total gains for farmers in Nangola were on average 47,636 FCFA/Ha or 108 percent of the cost of the technology package promoted by the program (Table 2.5).

Within the community of Nangola, the village of Magnambougou had the highest increase in revenue. Farmers in Magnambougou raised their revenues from increased yields by 61,038 FCFA/Ha (Table 2.5). The 15 FCFA/Kg price premium further increased farmers revenue by 19,393 FCFA/Ha for a total revenue gain of 80,431 FCFA/Ha or almost double the cost of the technology package.

In contrast in Kenie the yield and price premium gains only increased farmers' revenues by a total of 22,129 FCFA/Kg (Table 2.5). The increased revenue for farmers in Kenie covered only 50 percent of the cost of the technology package. For farmers adversely affected by rainfall conditions we need to develop an insurance program. However, some farmers did not practice good agronomy in spite of the project emphasis on that. We need to distinguish between the two explanations for poor yields in the future.

Table 2.5. Per Hectare Monetary Gains from Increased Yields and Higher Quality Grain Sales for Farmers in Dioila in 2007/08

	Yield Gain	Gain from Increased Yield	Gains from Sales at Harvest with a 15 FCFA/Kg Quality Premium	Total Gains	(%) of Technology Cost Covered by Gains
	(1) Kg/Ha	(2)	(3) FCFA/Ha	(4)	(5)
Community of Nangola	352	29,906	17,730	47,636	108
Village of Magnambougou	718	61,038	19,393	80,431	182
Village Kenie	67	5,692	16,437	22,129	50
Community of Wakoro	84	7,104	10,875	17,979	46
Village of Wakoro	23	1,975	11,417	13,392	34
Village of Tonga	144	12,233	10,333	22,566	57

Source: Authors Calculations from ULPC and Survey Data. Column (1) is the difference between farmers' yields using their traditional variety and farmers yields using the program variety Soumba and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 85 FCFA/Kg; (3) Gains from the quality premium are calculated by multiplying farmers yields using the Soumba technology package by 15 FCFA/Kg; (4) Total gains are the sum of (2) and (3); (5) is the ratio of total gains to the cost of the Soumba technology package with fertilizer.

In the community of Wakoro the increase in farmers' revenue from better yields and selling a higher quality grain were on average smaller relative to the community of Nangola. In the community of Wakoro the extra 84 Kg/Ha increased farmers' revenue at harvest by 7,104 FCFA/Ha which covered 18 percent of cost of the technology package (Table 2.5). The 15 FCFA/Ha price premium further increased farmers' revenues by 10,875 FCFA/Ha covereing 28 percent of the cost of the technology package. The total increase in farmers' revenues from better yields and selling a cleaner grain was 17,979 FCFA/Ha or 46 percent of the cost of the technology package (Table 2.5).

Of the two villages in the community of Wakoro farmers gains in revenue, from increased yields and higher prices from selling a cleaner grain, were especially important in the

village of Tonga. In Tonga the increased yields and prices raised farmers' revenues by 22,566 FCFA/Ha which represented 57 percent of the total cost of the technology package.

These results for Dioila were disappointing. In 2008 a better cultivar was introduced. Moreover, as we shall see most of the gains from improved marketing were captured by the cooperative, ULPC, managing the marketing. These profits were utilized for constructing new office facilities for the ULPC.

2.2.2.2. Returns to the Coopertative ULPC from Marketing

In total the cooperative in Dioila, ULPC, marketed approximately 31 tons of grain (Table 2.7). Almost 20 tons or 64 percent of the grain marketed came from farmers' reimbursement of their input credit. Farmers reimburse their input credit in grain which the cooperative then sells and uses the revenues plus profits to buy fertilizer and seed for the following season. Therefore this grain constitutes a revolving fund for the cooperative. More than 11 tons or 36 percent of the marketed grain came from the surplus grain sold by farmers to ULPC (Table 2.7). In Dioila the program was successful in recovering 100 percent of the total input credit given to farmers at planting despite the bad rainfall year and moderate yield gains.

Table 2.6. Quantity of Sorghum Grain Commercialized by ULPC by Source and Community in 2007/08.

Community	Reimbursement	Purchase From Farmers	Total
		Kg	
Wakoro	11,004.00	2,017.00	13,021.00
Nangola	8,860.00	9,169.00	18,029.00
Total	19,864.00	11,186.00	31,050.00

Source: ULPC

ULPC marketed the grain bought from farmers and received as reimbursement for the input credit from three sales. ULPC bought farmers grain at harvest for 100 FCFA/Kg. At the time of the sales, between March and May, the market price for sorghum was 115 FCFA/Kg in the local market. But the ULPC sold for 125 FCFA/Kg which included a 10 FCFA/Kg price premium for grain quality (ULPC Verbal Communication, 2008) (Table 2.7). This means that for the first two sales ULPC gained 15 FCFA/Kg by waiting for the price recovery and an additional 10 FCFA/Kg as a clean grain premium (Table 2.7). These two sales represented the bulk of the quantity marketed. The last 5 percent of marketed grain was also sold at a higher quality premiumof 20 FCFA/Kg because of the quality of the grain in addition to the price gain from storage (Table 2.7).

Table 2.7. Price Gains from Storage and Grain Quality for Program Grain Marketed by ULPC in 2007/08

Sale	Harvest Price	Gains From Storage	Gains from Grain Quality	Sale Price	Quantity Sold
		FCFA/Kg			(Mt)
1	100	15	10	125	20
(% Gains from Harvest Price)		15	10	25	
2	100	15	10	125	10
(% Gains from Harvest Price)		15	10	25	
3	100	15	20	135	1.5
(% Gains from Harvest Price)		15	20	35	
Weighted Average	100	15	10	125	
(% Gains from Harvest Price)		15	10	25	

Source: Authors Calculations from ULPC data.

Besides the reimbursement of their input credits farmers also sold some of their grain to the ULPC. To finance these purchases the ULPC borrowed from a local microcredit institution. The financial costs incurred by ULPC amounted to an annual rate of 18.3 percent (Verbal communication ULPC, 2008). Given the amount purchased from farmers this amounted to a cost of 0.02 FCFA/Kg. The storage cost at the central storage depot that ULPC owns amounts to 12.25 FCFA/Kg (Verbal communication ULPC, 2008). Therefore per Kg sold ULPC had to recover a total of 12.27 FCFA/kg in storage and financial cost. Given the distribution of sales, the gains from storage and grain quality, and taking into account storage and financing cost the weighted average benefit from marketing the program grain for ULPC was 13.21 FCFA/Kg (Table 2.8).

None of the additional benefit of 13.21 FCFA/Kg obtained by ULPC from storing and selling at a price premium was redistributed back to the program farmers. The farmers governing body, composed of the representatives of the different villages associations that form ULPC, voted to invest these earnings in the construction of a new building to house their offices. Currently the building that they use is being rented and this rent is being paid by a donor that will stop paying the rent in the future. The benefit of 13.21 FCFA/Kg obtained by ULPC from storing and selling at a higher price therefore can be considered an additional benefit that farmers decided to reinvest.

Table 2.8. Returns to Marketing for ULPC, Dioila, Mali.

Sale	Gains From Storage	Gains for Quality	Storage and Financing Cost	Net Benefit	Quantity Sold
		FCFA/Kg			(Mt)
1	15	10	12.27	13	20
2	15	10	12.27	13	10
3	15	20	12.27	23	1.5
Weigthed Average	15	10.48	12.27	13.21	

Source: Authors calculations from ULPC data.

If we consider the investment in these office facilities as also a benefit to farmers in the ULPC, then farmers' total gains from the program further increase from the additional 13.21 FCFA/Kg. On average in the community of Nangola farmers revenue increases by an additional 6,981 FCFA/Ha or close to 15 percent when taking into account the benefit obtained by ULPC from storing and marketing (Table 2.9). In the community of Wakoro the benefit obtained by ULPC from storing and selling increase farmers revenue by an additional 1,232 FCFA/Ha or almost 7 percent (Table 2.9). The total gains for farmers in the communities of Nangola and Wakoro averaged 54,616 FCFA/Ha and 17,979 FCFA/Ha respectively (Table 2.9)

Table 2.9. Per Hectare Monetary Gains from Increased Yields, Higher Quality Grain Sales, and Sales to ULPC for Farmers in Dioila in 2007/08

	Gain from Increased Yield	Gains from Sales at Harvest with a 15 FCFA/Kg Quality Premium	Gains from Sales to ULPC	Total Gains	Total Gains Without Gains from Sales to ULPC	(%) of Technology Cost Covered by Gains
	(1)	(2)	(3)	(4)	(5)	(6)
			FCFA/Ha			
Community of Nangola	29,906	17,730	6,981	54,616	47,636	123
Village of Magnambougou	61,038	19,393	8,711	89,142	80,431	201
Village Kenie	5,692	16,437	5,635	27,763	22,129	63
Community of Wakoro	7,104	10,875	1,232	19,211	17,979	49
Village of Wakoro	1,975	11,417	1,455	14,847	13,392	38
Village of Tonga	12,233	10,333	1,010	23,576	22,566	60

Source: Authors Calculations from ULPC and Survey Data. Column (1) is the difference between farmers' yields using their traditional variety and farmers yields using the program variety Soumba and 150 Kg/Ha of fertilizer multiplied by the harvest price of 85 FCFA/Kg; (2) Gains from the quality premium are calculated by multiplying farmers yields using the Soumba technology package by 15 FCFA/Kg; (3) Is the amount of sorghum per hectare sold to ULPC by farmers, after reimbursement of their input credit, multiplied by 13.21 FCFA/Kg the weighted average benefit obtained by ULPC from storing and selling late in the year; (4) Total gains are the sum of (1) through (3); (4) is the sum of (1) and (2); (6) is the ratio of total gains to the cost of the Soumba technology package with fertilizer.

2.3 Conclusions

Despite the adverse weather conditions farmers were convinced of the benefits of fertilizer on new sorghum cultivars. All the farmers in the project in 2007/08 reimbursed the total value of the input credit extended to them. Additionally, for the 2008/09 season all the farmers that started with the program remained. Famers' yields increased over the traditional varieties by more than 20 percent. Of the two communities in the program in Dioila, the gains obtained by farmers in the community of Nangola were more than double the cost of the technology package. In the community of Wakoro the gains obtained only covered 38 percent of the technology costs. This highlights the problems of the low lands where flooding was serious.

In terms of the organizational structure, the structure and organization of ULPC is a very strong point for the program. ULPC has established relations with the local microcredit institutions in the region giving its members access to credit. In addition their marketing organization is also well developed. But despite its strengths and organization only a small part of the benefits from marketing the program grain were passed on to farmers. Sorghum prices increased 47 percent from harvest time to the final sale price at which ULPC sold. Farmers only captured 17 percent of that increase with the remainder 30 percent going to the cooperative. In the future more of these gains will need to be redistributed back to farmers in order to encourage farmers letting the ULPC sell more of their harvest.

3. Tingoni

In 2007 the cooperative of Tingoni, in the village of the same name, started its second year in the INTSORMIL Production-Marketing project. A total of 68 farmers who harvested 150 Ha participated in the program. Our evaluation is based on survey interviews of 32 of those farmers. In Tingoni the program focused on introducing the millet cultivar (Toroniou) as this area is an important millet producer.

We will begin our discussion by first discussing farmers' yields using the program technology package as compared with yields with farmers' traditional cultivars and practices. Then we will discuss the economic returns to farmers of using the technology package. Finally, we discuss the returns to marketing first for farmers and then for the local cooperative.

3.1 Farmers Yields

Before final harvest results were obtained, with the aide of SG 2000, the cooperative of Tingoni projected yields using crop cuts from a 25 m^2 plot. Yields for the program millet were expected at 1075 Kg/Ha. Actual[3] yields from the population sample put them at 1,333 (Table 3.1). In our analysis we use the actual yields even though they only cover 47 percent of the population. We consider them to be more accurate as all the farmers grain was weighed before being put into community storage.

The factor that impacted yields the most was rainfall. Due to the lack of rainfall at the beginning of the season farmers had to replant. Later with the excess water the millet crop was not able to take full advantage of the fertilizer. In our discussion with some farmers they reported that part of the fertilizer applied was washed away before the plant could assimilate it. Despite these problems in Tingoni, farmers saw an increase in yields of 34 percent when using the program millet cultivar and fertilizer relative to using the traditional millet cultivar and no fertilizer (Table 3.1). Farmers using the program cultivar in addition to fertilizer harvested 341Kg/Ha more then when using their traditional cultivar and practices.

Table 3.1 Crop Cuts and Actual Millet Yields for farmers in the INTSORMIL program in Tingoli' 2007/08

Yields	Program Millet	Traditional Millet	Difference
	Kg/Ha		%
Actual	1,333	993	34
Crop Cuts	1075	660	63

Source: Actual (n=32); Crop Cuts (n=68).

3.2 Cost of technology package

The technology package for farmers in Tingoni in the project consisted of 100 Kg/Ha of the complex fertilizer NPK (15-15-15) and 50 Kg/Ha of Urea (46-0-0). In total farmers were

[3] At the end of the season when farmers harvested the cooperative of Tingoni weighed each farmers' individual production prior to deducting their input credit. Therefore, the yields given to us by farmers in Tingoni are actual and not projected as with the crop cuts.

provided on credit with 2 bags of NPK and 1 bag of Urea. The total cost per hectare for fertilizer alone came to 40,500 FCFA/Ha (Table 3.2). In addition, the technology package included 6 Kg of seed and access to two seed treatment packages. The reason for providing farmers with two seed treatment packages was that one of the seed treatments sold out locally. Farmers total cost of the technology package including seed and seed treatment came to 43,200 FCFA/Ha (Table 3.2). In addition to the cost of the technology package farmers also had to pay 10 FCFA/Kg to thresh their grain in the cooperatives mechanical thresher. Farmers were required to repay all input costs in grain at harvest.

3.2 Cost of the INTSORMIL Technology Package given to Farmers in Tingoni, Mali

			Total
NPK	13,500 FCFA/Bag	2 Bag/Ha	27,000.00 FCFA/Ha
Urea	13,500 FCFA/Bag	1 Bag/Ha	13,500.00 FCFA/Ha
Seed	250 FCFA/Kg	6 Kg/Ha	1,500.00 FCFA/Ha
Seed Treatment 1	1,200 FCFA/Bag	1 Bag/6 Kg of Seed	1,200.00 FCFA/Ha
Seed Treatment 2	600 FCFA/Bag	1 Bag/6 Kg of Seed	600.00 FCFA/Ha
Total with Seed Treatment 1			43,200.00 FCFA/Ha
Total with Seed Treatment 2			43,200.00 FCFA/Ha

Source: SG 2000 and Farmers Cooperative in Tingoni

3.2 Returns to Marketing in Tingoni

The Production-Marketing project encourages farmers to sell a higher quality grain by promoting threshing off the ground. In addition it encourages farmers to store and sell later in the year to take advantage of the seasonal price increase. In conjunction with these strategies, the program also encourages bulk sales through the cooperative to premium markets. An examples of premium markets in Mali is the millet food processors. As we will discuss in more detail the cooperative and farmers have made advances in applying these strategies.

3.2.1 Returns to Marketing for Farmers in Tingoni

We begin our discussion of returns to farmers by first discussing the distribution of millet grain obtained by using the program variety. Knowing the distribution of millet grain helps to better quantify the benefits obtained by farmers. In Tingoni, farmers did not sell any of their excess production to the cooperative. Farmers only deposited the required amount of millet grain in the cooperative to reimburse their input credit. The cooperative in Tingoni does not yet have access to funds to purchase any excess grains from farmers hence farmers do not sell to the cooperative. Nevertheless, farmers stored and sold on their own. For reimbursement purposes farmers deposited a total of 450 Kg/Ha or 34 percent of their yield in the cooperative (Table 3.3). They consumed on a per hectare basis 646 Kg or 48 percent of their millet and the remainder was stored and sold later in the year (Table 3.3).

Table 3.3. Average Distribution of Farmers Yields in Tingoni in 2007/08.

	Yield	Reimbursement	Individual Sales	Consumed
		Kg/Ha		
Average	1,333	450	238	646
(% of Yield)		34	18	48

Source: Survey data (n=32).

In terms of the value of the grain reimbursed to the cooperative, the grain was valued at 100 FCFA/Kg by the cooperative in Tingoni. At the time of reimbursement the market price for millet was 75 FCFA/Kg. Therefore farmers earned 25 FCFA/Kg or 33 percent more over the market price because of the quality of grain (Table 3.6). In terms of individual sales, none of the farmers interviewed reported receiving a premium for the quality of grain. Nonetheless, farmers earned an additional 33 FCFA/Kg or 44 percent more from storing and selling later in the year (Table 3.6)

Table 3.3. Prices Received by Farmers from Marketing in Tingoni, Mali

	Harvest Price	Gains From Grain Quality	Gains From Storage	Sale Price
		FCFA/Kg		
Reimbursement to Cooperative	75	25	0	100
(% Gain from Harvest Price)		33	0	33
Individual Sales	75	0	33	108
(% Gain from Harvest Price)		0	44	44

Source: Authors calculations from survey data and the Tingoni Cooperative.

Given the distribution of production and prices received by farmers, from the additional 341 Kg/Ha produced by farmers from using the program millet, they gained 25,551 FCFA/Ha more (Table 3.4). From the 25 FCFA/Kg quality premium, given by the cooperative of Tingoni to farmers for their millet grain, farmers gained an additional 11,250 FCFA/Ha. From storing on their own and selling later in the year farmers earned an additional 7,846 FCFA/Ha (Table 3.4). They also incurred a cost of 13,333 FCFA/Ha for cleaning their grain through the cooperative. When we deduct the cleaning cost total gains to farmers was 31,314 FCFA/Ha or 72 percent of the cost of the technology package (Table 3.4).

Table 3.4. Per Hectare Monetary Gains from Increased Yields and Higher Quality Millet Grain Sales for Farmers in Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gains from Sales at Harvest with a 25 FCFA/Kg Quality Premium	Gains from Storage	Cleaning Cost	Total Gains	(%) of Technology Cost Covered by Gains
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kg/Ha			FCFA/Ha			
341	25,551	11,250	7,846	13,333	31,314	72

Source: Authors calculations from survey data. Column (1) Yield Gain is the difference between farmers' yields using their traditional variety and farmers' yields using the program millet variety Toroniou and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 75 FCFA/Kg.; (3) Gains from the quality premium is the product of the multiplication of the amount of grain given to the cooperative for reimbursement times the quality premium; (4) Gains from storage are the average amount stored and sold by farmers using their own storage times the reported price difference between harvest and period of grain sold; (5) Cleaning cost is the yield under the new variety Toroniou times the cleaning charge of 10 FCFA/Kg.

3.2.2 Returns to the Cooperative of Tingoni from Marketing

In 2007/08 the cooperative of Tingoni marketed a total 68 mt, this was 3.55 mt more than the amount required to reimburse the input credit. Farmers in Tingoni therefore reimbursed more than 100 percent of the value of the total input credit received at planting. With farmer approval, the sales from the surplus grain were incorporated into the capital of the cooperative and not redistributed back to farmers. The surplus arose from the fact that the cooperative chose to demand a fixed quantity per member based on the total debt of the group and not on individual farmer debt. At a grain valued at 100 FCFA/Kg the quantity demanded per farmer to reimburse the input credit was 450 Kg/Ha. The cooperative marketed the grain in 3 sales. The first two sales were carried out to a food processor from Bamako at a price of 140 FCFC/kg initially and then at a price of 120 FCFA/Kg. The reason for the difference in prices is that the food processor considered that the second batch was less clean. These sales accounted for 29 percent of the total grain marketed. The remaining 71 percent was sold at market price due to the fact that the cooperative needed to recover its revolving fund to purchase the inputs needed for the 2008/09 crop cycle.

Table 3.8 Distribution of sales by the Cooperative of Tingoni in 2007/08 in Mali.

Sale	Quantity Sold	Sale Price
	(Mt)	(FCFA/Kg)
1	15	140
(% of Total)	22	
2	5	120
(% of Total)	7	
3	48	115
(% of Total)	71	
Total	68	

Source: SG 2000

When analyzing the distribution of sales, the weighted average return to storage for the cooperative was 15 percent and the premium for quality was 6 percent (Table 3.9). In FCFA/Kg this means that on average the cooperative received an extra 21 FCFA/Kg from the harvest price at which they valued the grain. The cooperative did not incur storage cost given that they did not invest in treating the grain or pay for facilities as they used borrowed ones. In the 2008/09 season this will change as they have finished building their own storage unit.

Table 3.9. Price Gains from Storage and Grain Quality for Program Grain Marketed by the Cooperative of Tingoni, Mali 2007/08

Sale	Harvest Price	Gains from Storage	Gains from Grain Quality	Sale Price	Quantity Sold
	FCFA/Kg				(Mt)
1	100	15	25	140	15
(% Gain)		15	25	40	
2	100	15	5	120	5
(% Gain)		15	5	20	
3	100	15	0	115	48
(% Gain)		15	0	15	
Weighted Average	100	15	6	121	
(% Gain)		15	6	21	

Source: Authors Calculations from survey data.

Given observed yields in the 2007/08 crop season the cooperative of Tingoni needed 32 Fcfa/Kg to recover the input fund to finance the inputs for the 2008/09 season (Table 3.10). With a weighted average price of 121 Fcfa/Kg that the cooperative received for grain marketed the cooperative receive a net benefit of 89 Fcfa/Kg (Table 3.10)

Table 3.10 Net benefit from Marketing for the Cooperative of Tingoni

	FCFA/Kg
Total Revenue	121
Value of Inputs	32
Net Benefit	89

None of the gains from the marketing efforts by the cooperative of Tingoni were distributed back to farmers. The net benefits were kept to increase the capital base of the cooperative. This was an additional benefit approved by farmers to strengthen their cooperative. Therefore, we add this forgone benefit back to farmers' gains. Farmers in Tingoni deposited 450 Kg/Ha to reimburse their input credit. From marketing this grain the cooperative made a profit of 89 Fcfa/Kg. Had this profit been redistributed back to farmers, their total gains would have increased by 39,866 Fcfa/Ha (Table 3.11). With this additional income gain farmers cover 226 percent of the total cost of the technology package given to them in 2007.

Table 3.11. Per Hectare Monetary Gains from Increased Yields and Marketing by Farmers and the Cooperative of Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gains from Sales at Harvest with a 25 FCFA/Kg Quality Premium	Gains from Own Storage	Cleaning Cost	Gains from Marketing by the Cooperative	Total Gains	(%) of Technology Cost Covered by Total Gains
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kg/Ha			FCFA/Ha				
341	25,551	11,250	7,846	13,333	39,866	97,846	226

3.3 Conclusions

In Tingoni despite the adverse year faced by farmers, yields for the program millet were 34 percent higher than farmers' traditional millet cultivars. But the yield and marketing gains were not enough in this bad year to cover the total cost of the technology package. Without any of the gains from marketing obtained by the cooperative being redistributed back to farmers, the gains from yield and farmers own marketing effort covered 72 percent of the total cost of the technology package. If the gains of the marketing efforts of the cooperative are

included, farmers cover 226 percent of the cost of the technology package. If only part of these gains to the farmers' association were returned to the farmers, there would have been a net profit to farmers. This may have been approved in the group meetings but seems to be a serious neglect of the issue of maintaining incentives to farmers by sharing the profits of the organization. This lack of sharing also partially explains why farmers do not trust the association to market their grain and only repay the input credits.

More needs to be done to continue improving the returns to farmers. First of all, because of lack of funds the cooperative is not able to purchase grain from farmers. Therefore farmers do not market through the cooperative and thus do not have access to the same markets. Additionally the cooperative has only benefited partially from storage given that it is unable to hold grain for long periods of time because of the need to recover the revolving fund to purchase inputs.

In terms of benefiting from premium markets, one positive aspect is that with the help of SG 2000 the cooperative has started to sell to a food processor that is willing to pay a premium for the grain. Additionally SG 2000 is also helping the Tingoni cooperative to put out contracts for 2008/09 in the Malian Cereal board where prices are usually higher.

With regards to institutional development, Sasakawa Global 2000 (SG 2000) has helped the cooperative obtain legal recognition and establish formal relations with micro-credit institutions. In the crop year 2008/09 farmers in the cooperative of Tingoni obtained credit for both inputs and grain purchases from a local microcredit institution.

4. Kaniko

In 2007/08 the village of Kaniko, located in the region of Sikasso, was in the second year of the project. In Kaniko the Production-Marketing project has been working in collaboration with the NGO AMEDD. In total 42 farmers participated in the program, total production was close to 29 tons in the 48 hectares harvested. Our evaluation of results for farmers in the program is based on 27 farm interviews.

The evaluation of the program in Kaniko centers on three aspects. First, we will compare the yield gains farmers had using the variety and technology proposed by the program relative to their traditional cultivar and practices. IER provided farmers with the sorghum variety Nieta in 2006/07 and has let farmers produce their own seed of this cultivar since then. In addition farmers implemented a revolving fund from the first year of input repayments to pay for inputs in succeeding years.

After discussing yields we will then look at the economic returns to farmers from using the technology package proposed by the program. We end our discussion by examining the potential gains farmers had from using the marketing strategies promoted in the program.

4.1 Farmers Yields

In 2007/08 the weather conditions in Kaniko were adverse. Rainfall set in late June, a month later than usual, and total rainfall was substantially higher than the trend causing flooding in lowland farmers' fields. Given these conditions farmers saw very small yield gains over their traditional variety. Farmers' sorghum yields using the program variety were on average 5.58 percent higher than with their traditional cultivars (Table 4.1). The yield for the program variety averaged 989 Kg/Ha. In contrast, the traditional cultivar used by farmers had a yield of 937 Kg/Ha.

Table. 4.1. Yield for IER-INTSORMIL Project Sorghum and Traditional Sorghum in Kaniko, Mali in 2007/08

	Program Sorghum	Traditional Sorghum	Difference
	Kg/Ha		%
Yield	989	937	6

Source: Authors calculations from survey data. n=27.

4.2 Cost of Technology Package

The cost of the technology package supplied to farmers in Kaniko had a total cost of 34,845 FCFA/Ha (Table 4.2). Of this amount 95 percent corresponds to the cost of fertilizer. The remainder is the cost of the seed.

Table 4.2. Cost of Technology Package for Farmers in the IER-INTSORMIL Program in Kaniko, Mali in 2007/08

NPK	2	Bags/Ha	11,000.00	FCFA/Bag	22,000.00	FCFA/Ha
UREA	1	Bags/Ha	11,125.00	FCFA/Bag	11,125.00	FCFA/Ha
Seed	4	Kg/Ha	430	FCFA/Kg	1,720.00	FCFA/Ha
Total Cost					34,845.00	FCFA/Ha

Source: AMEDD

4.2.1 Distribution of Sorghum Production and Farmers' Returns to Technology

The cooperative in Kaniko required farmers to deposit all of their program sorghum into the cooperative. The cooperative in return promised to redistribute gains back to farmers. The

cooperative in Kaniko undertook this policy for two reasons, first to assure full recuperation of the revolving fund for fertilizer. The second reason was to have enough product volume that would allow them to be better positioned to sell. Farmers only partially complied with the association's request. Instead they withheld grain for own consumption and to market as well. On average, on a per hectare basis, farmers gave 65 percent of their total production to the association (Table 4.3). For consumption farmers kept 21 percent and for individual sales they set aside 14 percent

able 4.3. Average Distribution of Sorghum Production by Program Farmers in Kaniko, Mali.

	Yield	Reimbursement	Surplus Grain Sold to the Cooperative	Individual Sales	Consumed
			Kg/Ha		
Average	989	465	176	142	206
(% of Yield)		47	18	14	21

Source: Authors calculations from survey data.

The farmers' association in Kaniko valued farmers' sorghum grain at the harvest price of 75 FCFA/Kg. The price gain (from selling later in the year or from selling a quality grain) was returned to farmers in proportion to the excess grain they deposited with the cooperative after covering their input credit. The cooperative in Kaniko increased its prices by 41 percent or 31 FCFA/Kg by storing and selling 4 months after harvest (Table 4.4). Neither the cooperative nor the farmers were able to obtain a quality premium for their grain. Farmers were able to capture a higher price increase. From storing and selling later in the year farmers increased their prices by 60 percent or 45 FCFA/Kg (Table 4.4).

Table 4.4. Price and Returns to Farmers from Marketing in Kaniko in 2007/08, Mali

Sale	Harvest Price	Gains From Storage	Gains From Grain Quality	Sale Price
		FCFA/Kg		
Sales to the Cooperative	75	31	0	106
(% Gain from Harvest Price)		41	0	41
Individual Sales	75	45	0	120
(% Gain from Harvest Price)		60	0	60

Source: Cooperative of Tingoni-AMEDD

Given the prices farmers obtained and the distribution of production farmers increased their revenues by 3,921 FCFA/Ha from the higher yields of the technology package (Table 4.5). The gain in revenue from storage by selling to the cooperative was 5,354 FCFA/Ha. From storing and selling on their own farmers increased their revenue by 6,407 FCFA/Ha. The total gains in

revenue from the program in 2007/08 for farmers was 15,682 FCFA/Ha or 45 percent of the cost of the technology package.

Table 4.5. Per Hectare Monetary Gains from Increased Yields and Higher Quality Millet Grain Sales for Farmers in Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gain from Sales to the Cooperative	Gain from Storage	Total Gains	(%) of Technology Cost Covered by Gains
(1)	(2)	(3)	(4)	(5)	(6)
Kg/Ha			FCFA/Ha		
52	3,921	5,354	6,407	15,682	45

Source: Authors calculations from survey data. Column (1) Yield Gain is the difference between farmers' yields using their traditional variety and farmers' yields using the program sorghum variety NEED NAME and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 75 FCFA/Kg.; (3) Gains from sales to the cooperative are the product of the price increase obtained by the cooperative times the amount sold by farmers to the cooperative in excess of their reimbursement; (4) Gains from storage are the average amount stored and sold by farmers using their own storage times the reported price difference between the harvest price and the price reported by farmers at which they sold; (5) Total gains are the sum of columns (1) through (4); Column (6) is the ratio of total gains (5) to the total cost of the technology package.

Even though farmers did not cover half of the cost of the technology package with the total gains from the program the results obtained highlights the importance of marketing in bad years. Of the 45 percent of the cost of the technology package covered by the gains from the program 34 percent came from farmers benefitting from one of the marketing strategies promoted, storing and selling later in the year. Farmers in Kaniko need more support in selling their grain to markets that are willing to pay more, such as food processors and the animal feed industry. The cooperative in Kaniko in 2007/08 had no contact with such markets or support to market to them. They were also not able to get a quality premium.

4.2.3 Gains from Marketing for the Cooperative of Kaniko

The cooperative of Kaniko marketed a total of 28.7 mt in 2007/08, the only gain from marketing that the cooperative was able to capture was from storage (or the seasonal price increase). The cooperative was unsuccessful in finding a premium market willing to pay more for higher quality grain. Additionally only 95 percent of all farmers paid their input credit.

Nonetheless, the cooperative on average was able to benefit from a 41 percent average price increase from the sale of the grain a few months after harvest (Table 4.6). On average the cooperative gained an extra 31 FCFA/Kg from the harvest price of 75 FCFA/Kg.

Table 4.6. Price Gains from Storage for Program Grain Marketed by the Cooperative of Kaniko, Mali 2007/08

Sale	Harvest Price	Gains from Storage	Sale Price	Quantity Sold
		FCFA/Kg		(Mt)
1	75	30.5	105.5	28.0
(% Gain from Harvest Price)		41	41	
2	75	45	120	0.7
(% Gain from Harvest Price)		60	60	
Weighted Average	75	31	106	
(% Gain from Harvest Price)		41	41	

Source: Authors calculations from data provided by the Cooperative of Kaniko

The total cost of inputs distributed to farmers by the cooperative of Kaniko had a value of 64 FCFA/Kg (Table 4.7). At the weighted average price at which the cooperative sold this left the cooperative with a benefit of 42 FCFA/Kg after recovering the revolving fund (Table 4.7). Of the net benefit obtained by the cooperative 39 FCFA/Kg or 96 percent of it was given back to farmers. The cooperative kept only 3 FCFA/Kg or 4 percent for itself (Table 4.7).

Table 4.7. Net Benefit, Average Annual Rate of Return, and Distribution of Benefit of Grain Sales by the Cooperative of Kaniko in 2007/08.

	FCFA/Kg
Total Revenue	106
Total Value of Input Credit	64
Net Benefit	42
Farmers Share of Net Benefit	39
(% of Total Net Benefit)	94
Cooperatives Share of Net Benefit	3
(% of Total Net Benefit)	6

Source: Authors Calculations from the data provided by the Cooperative of Kaniko

4.3. Conclusions

Farmers yield gains in Kaniko from using the technology package proposed by the program over their traditional variety were minimal in 2007/08. Farmers only increased yields by 6 percent. This small yield gain was due to the excess rain that farmers received and a cultivar that was too tall and responded poorly to moderate fertilization. Farmers did benefit from selling later in the year and from their cooperative dividing the profits from selling late in the year as well. But with all this, the gains in price and the poor yield gains, farmers were only able to pay off 45 percent of the additional cost of the technology.

Even though farmers in Kaniko only benefited from one marketing strategy, storing and selling latter in the year, this strategy provided the majority of the benefits in this bad year. The cooperative and farmers need to improve their marketing efforts. They need to access premium markets that are willing to pay more for their product. Neither group is obtaining a premium for the higher quality clean grain that they are producing. This situation might discourage farmers from continuing to clean their grain if the only markets they have access to is the local markets. Moreover, quantities of grain handled by the farmers' cooperative are becoming sufficiently high that there should be a premium to increased search for higher paying markets. Finally a better cultivar, Grinkan, is being introduced in the summer of 2008 of intermediate height with a much better response to moderate fertilizer levels.

5. Kafara

In the 2007/08 the Production-Marketing project was in its second year in the village of Kafara. During this particular production season a total of 39 farmers who harvested 56 hectares participated in the program. Our evaluation of program results for farmers and the farmers' cooperative in Kafara is based upon farm interviews of 17 farmers who participated in the program. Our discussion will concentrate on yield gains for farmers and marketing gains for farmers and their cooperative from participating in the program. In terms of yields gains we will compare the gains in yields from using the technology package proposed by the program to the farmers' traditional technology. The program package calls for the use of the improved sorghum variety Natchitchama, and of 150 Kg/Ha of the complex fertilizer NPK (15-15-15) and the nitrogen based fertilizer urea (46-0-0).But many farmers continued with the taller Wassa or Nieta.

In terms of marketing the project encourages farmers to produce a cleaner grain by threshing off the ground. By producing cleaner grain farmers are motivated to search for premium markets that need cleaner grain and are willing to pay a premium for it. The program also recommends that farmers store and sell their grain after harvest to take advantage of the

seasonal price increase. Therefore we will highlight the gains in terms of prices obtained by farmers and the association by following the recommended marketing strategies.

5.1 Yield Gains

The 2007/08 production season was a difficult year with respect to rainfall for farmers in Kafara. Farmers faced an excess of rainfall during this season that averaged more than twice the normal amount rainfall causing severe flooding. Despite the rain, farmers in Kafara saw gains in terms of yields by using the program technology package. On average farmers increased their yields by 26 percent or 221 kg/ha more than their traditional cultivar (Table 5.1).

Table 5.1. Yields for IER-INTSORMIL Program Sorghum and Traditional Sorghum in Kafara, Mali in 2007/08

	Program Sorghum	Traditional Sorghum	Difference
	Kg/Ha		%
Yield	1050	836	26

Source: Authors' calculations from survey data

5.2. Returns to Technology Package

After discussing the yield gains that farmers achieved from using the program technology package we will now discuss its economic return to farmers. We will begin our discussion by first looking at the cost of the technology package given to farmers in Kafara. Then we will discuss farmers' distribution of their sorghum production between sales to the cooperative, individual sales, and consumption. Knowing farmers' distribution of production helps us to better establish the benefits to farmers from the marketing and production project. We follow this discussion by presenting farmers' returns to the technology package and marketing. Then we discuss the returns to marketing for the cooperative.

5.2.1 Cost of Technology Package

Farmers in Kafara were provided credit in 2006/07 to purchase inputs for 1 hectare. At the end of the 2006/07 season farmers had to repay this package in grain according to the valuation that the cooperative in Kafara established for sorghum at harvest. In 2007/08 the technology package was paid for by the farmers' association from the sales of the grain from the previous season. In total farmers were provided credit for 2 bags of the complex fertilizer NPK and 1 bag of the nitrogen fertilizer, Urea, per hectare. The total value per hectare of

Picture 2. Wassa (above) in Kafara is too tall and lodges so we began substituting d Nactichama for it in 2007 but not all the farmers switched.

fertilizer was 36,205 FCFA/Ha (Table 5.2). In addition farmers were advanced 4 kg/ha of seed at a cost of 150 FCFA/Kg. Farmers also had the choice to opt for 5,000 FCFA/Ha to pay for labor to ridge their fields for water harvesting purposes. Therefore depending on the package chosen farmers were advanced a credit of 36,805 FCFA/Ha or 41,805 FCFA/Ha (Table 5.2).

Table 5.2. Cost of Technology Package for Farmers in the IER-INTSORMIL Program in Kafara, Mali in 2007/08

NPK	12,265	FCFA/Bag	2	Bag/Ha	24,530
Urea	11,675	FCFA/Bag	1	Bag/Ha	11,675
Seed	150	FCFA/Kg	4	Kg/Ha	600
Labor for Ridging	5,000	FCFA/Unit	1	Unit/Ha	5,000
Total Cost With Labor for Ridging					41,805
Total Cost With Out Labor for Ridging					36,805

Source: Cooperative of Kafara

5.2.2 Distribution of Sorghum Production and Farmers Returns to Technology

On average, on a per hectare basis, farmers needed 32.4 percent of their total production to reimburse the cooperative for their input credit (Table 5.3). In addition they sold 7.1 percent of their excess production to the cooperative. On their own farmers sold 12.4 percent of their total production. For home consumption farmers kept 48.1 percent (Table 5.3).

Table 5.3. Average Distribution of Project Sorghum Production by Farmers in Kafara, Mali.

	Yield	Reimbursement	Sales to Cooperative	Individual Sale	Consumed
			Kg/Ha		
Average	1056	342	75	131	509
(% of Yield)		32.4	7.1	12.4	48.1

Source: Authors calculation from survey data.

Farmers in Kafara sold their production between the cooperative and the local market. Recognizing the quality of the sorghum grain the cooperative valued farmers' sorghum at 100 FCFA/Kg when the market price at the time was at 75 FCFA/Kg (Table 5.5). Farmers earned a premium of 33 percent from selling to the cooperative. With regards to individual sales farmers were not able to capture a price premium for the quality of the grain. Since farmers were able to store they increased their price by 57 percent from the harvest price (Table 5.5)

Table 5.5. Price Received by Farmers from Marketing in Kafara, Mali

Sale	Harvest Price	Gains From Storage	Gains From Grain Quality	Sale Price
		FCFA/Kg		
Sales to the Cooperative	75	0	25	100
(% Gain)		0	33	33
Individual Sales	75	43	0	118
(% Gain)		57	0	57

Source: Authors calculations from survey data. (n=17)

Given the price obtained by farmers and the distribution of production farmers increased their revenue by 23,547 FCFA/Ha which covered 60 percent of the average cost of the technology package (Table 5.6). The yield increase of 214 Kg/Ha raised farmers' revenue by 16,053 FCFA/Ha which covered 41 percent of the total cost of the technology package. The remaining 19 percent of the 60 percent of the technology package costs covered by farmers gain from the program came from the marketing strategies followed by farmers. The sales to the cooperative at a price premium for cleaner grain contributed to increasing farmers' revenue by 1,866 FCFA/Ha. From storing and selling later in the year farmers increased their revenue by 5,628

FCFA/Ha (Table 5.6). The yield gains covered most of the cost of the technology package in this bad year. Marketing narrowed even furthered the gap between farmers gains from the program and the cost of the technology. Marketing in bad rainfall years, in this case a year with excessive rainfall, reduces the risk of using fertilizer by increasing its return.

5.6. Per Hectare Monetary Gains from Increased Yields and Higher Quality Millet Grain Sales for Farmers in Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gains from Sales to the Cooperative	Gains from Storage	Total Gains	(%) of Average Technology Cost Covered by Gains
(1)	(2)	(3)	(4)	(5)	(6)
Kg/Ha			FCFA/Ha		
214	16,053	1,866	5,628	23,547	60

Source: Authors calculations from survey data. Column (1) Yield Gain is the difference between farmers' yields using their traditional variety and farmers' yields using the program sorghum variety NEED NAME and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 75 FCFA/Kg.; (3) Gains from sales to the cooperative are the product of the price increase obtained by the cooperative times the amount sold by farmers to the cooperative in excess of their reimbursement; (4) Gains from storage are the average amount stored and sold by farmers using their own storage times the price difference between the harvest price and the price at which farmers sold their sorghum; (5) Total gains are the sum of columns (1) through (4); Column (6) is the ratio of total gains (5) to the average cost of the technology package.

5.2.3 Marketing Gains for the Cooperative of Kafara

The cooperative of Kafara in 2007/08 marketed a total of 22.8 mt of sorghum. Of the amount marketed 14.95 mt came from farmers' reimbursement of their individual input credit. The remainder of the grain came from the purchases of farmers surplus carried out by the cooperative. The cooperative kept all additional profits generated from the purchase of this surplus. The decisions to keep these profits was taken by the cooperative without consultation with farmers as was done in the other villages where the project is involved. The cooperative marketed all the grain in one sale. At the time of the sale the price in the market was 100 FCFA/Kg, the same price as the purchase price for the cooperative. Therefore the cooperative did not gain from storage (Table 5.7). However they obtained an additional 25 FCFA/Kg or 25 percent more from the buyer because of the quality of the grain.

Table 5.7. Price Gains from Storage and Grain Quality for Program Sorghum Marketed by the Cooperative of Kafara, Mali 2007/08

	Harvest Price	Gains From Storage	Gains From Grain Quality	Sale Price	Quantity Sold
		FCFA/Kg			(Mt)
	100	0	25	125	22.8
(% Gain from Harvest Price)		0	25	25	

Source: Authors calculation from data provided by the cooperative of Kafara.

To recover the revolving fund to purchase fertilizer the cooperative needed 66 FCFA/Kg (Table 5.8). Therefore given the price return from the market the cooperative had a net benefit of 59 FCFA/Kg.

Table 5.8. Net Benefit and Average Annual Rate of Return of Grain Sales by the Cooperative of Kaniko in 2007/08.

	FCFA/Kg
Total Revenue	125
Total Value of Inputs	66
Net Benefit	59

Source: Authors calculations from data provided by the cooperative of Kafara.

5.3 Conclusions

In 2007/08 despite the adverse rainfall year farmers in Kafara were able to increase their yields by 26 percent. The yield gains covered 41 percent of farmers cost of the technology package. Farmers also increased their price by selling at a premium price and storing and selling later in the year. With the marketing strategies farmers covered 19 percent of the cost of the technology package.

The gains for the cooperative were also significant; because of the quality grain that the cooperative marketed they received a price premium of 25 percent over the market price. The only downside is that farmers that sold their surplus grain after repaying for inputs did not see any additional gains from the marketing efforts of the cooperative. If the cooperative does not eventually redistribute part of its gains to farmers it will discourage them from participating in the cooperative or marketing through it.

6. Conclusions

The 2007/08 crop season was a bad year in Mali for many farmers in the program due to excessive rainfall. Despite the flooding though farmers were able to obtain moderate yield increases. The increases in yields were not sufficient to cover the total cost of the fertilizer based technology package for all farmers; however, for many farmers the increases in prices from the marketing strategies pushed them into profitability or enabled them to cover most of their costs.

Even in this adverse climatic year program performance and farmer confidence is probably best indicated by the 99 percent average repayment rate for the input credits. This shows the continued farmer support of the program in spite of insufficient yield and price gains to pay for all the increased expenditures of many farmers especially those in low lying regions.

A bad year, due to rainfall occurs about a third of the time in Mali. The marketing strategies with which the technology introduction efforts have been coupled have the objective to mitigate the effects of such years and reduce the risk of using moderate fertilizer levels. The IER-INTSORMIL Marketing-Production project has concentrated on five marketing strategies: (i) producing a cleaner grain and charging a price premium for it; (ii) storing and selling later in the year to benefit from the seasonal price increase; (iii) selling (and purchasing) bulk quantities; and (iv) selling to premium markets that are willing to pay more especially to millet food processors and to the animal feed industry; and (v) convincing policy makers not to drive down the price increases of bad rainfall years with food aid or subsidized food imports.

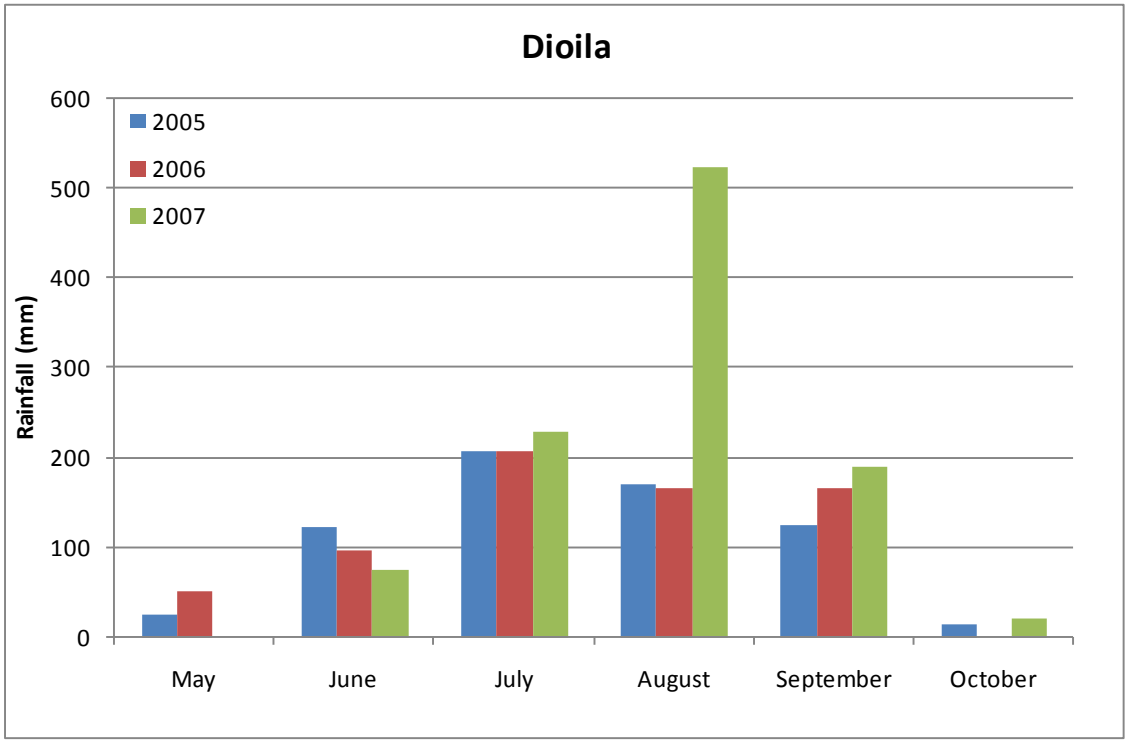
Farmers and farmers' associations in the project benefited from storage as they captured part of the substantial seasonal price increase. Farmers also increased their prices by marketing their grain at a premium after cleaning it better at harvest. The Production-Marketing project has been most successful with these two proposed marketing strategies. In the 2007/08 the marketing strategies helped farmers recover more than half of the input costs. In some cases such as Dioila the gains from the technology package and marketing paid for more than double the costs of the technology package.

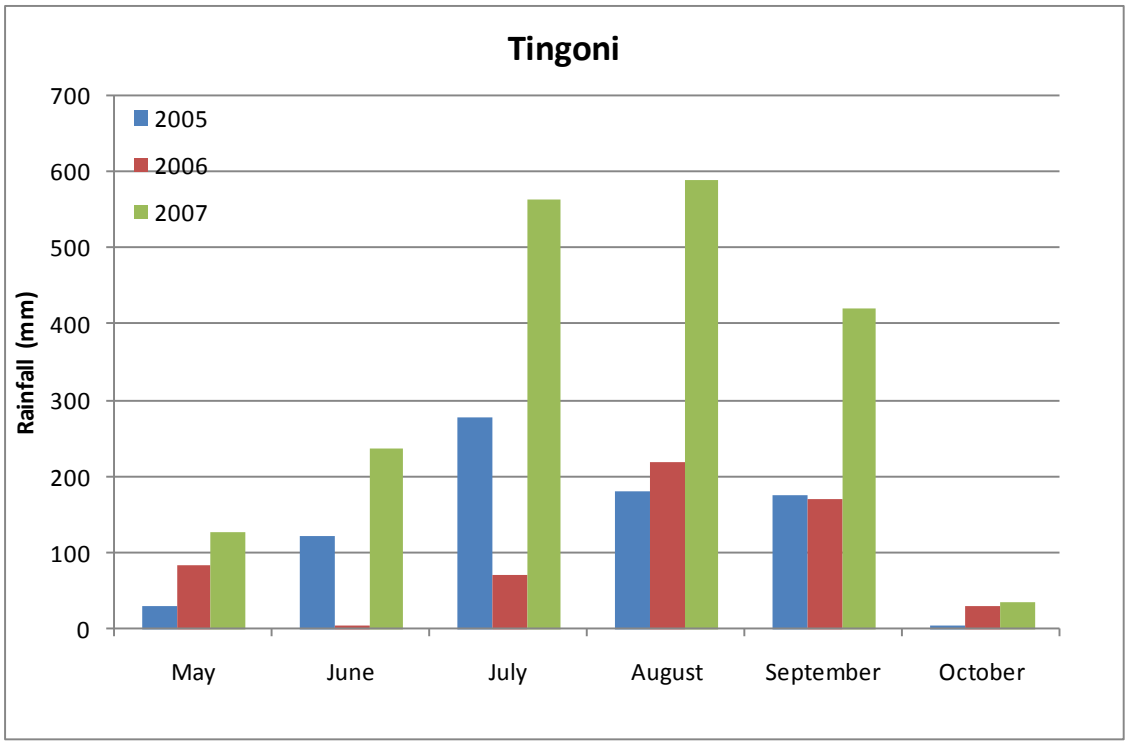
Nevertheless, more needs to be done to increase the benefits that farmers obtain from marketing. All the farmers' cooperatives in the program are at the initial phase of implementing these strategies. More aggressive efforts in searching for new markets are still needed and the program needs to support farmers in doing that. Even these two successful strategies (a premium price for cleaner cereal and waiting for the seasonal price increase) can be more effectively implemented with more widespread contributions by farmers to cooperative storage and marketing at later in the year and with better negotiating with food processors for the premium prices for clean grain. Given the adverse production conditions for cereals in most

of Mali in 2007/08 there was a potential for making substantially higher returns with the marketing strategies.

The program in 2008/09 was successful in retaining all the program farmers. Farmers despite the bad year of 2007/08 were convinced of the benefits of the use of fertilizer and the benefits from increasing their marketing efforts. In 2008 better intermediate height cultivars with increased potential to respond to moderate inorganic fertilizer levels were being introduced in most regions. Now we need to establish better ties between the farmers' associations and the millet food processing, feed mixing sector and the intensive poultry producers in Mali.

Appendix: Annex 1. Three Year Rainfall Distributions for Dioila (Koulikoro) and Tingoni (Segou) in Mali, West Africa.





Annex 2. Quantities and Proportion of Program Sorghum Production Reimbursed and Sold to ULPC and Consumption and Individual Sales in two communities of Dioila, Mali in 2007/08.

	Yield	Reimbursement	Surplus Sold to ULPC	Consumed/Individual Sales
			Kg/Ha	
Community of Nangola	1,182	443	528	211
(%)		37	45	18
Village of Magnambougou	1,293	443	659	190
(%)		34	51	15
Village Kenie	1,096	443	427	226
(%)		40	39	21
Community of Wakoro	725	393	93	239
(%)		54	13	33
Village of Wakoro	761	393	110	258
(%)		52	14	34
Village of Tonga	689	393	76	219
(%)		57	11	32

Source: Authors Calculations from Survey Data and ULPC Data

Picture 4. Soumba in Dioila, 2007. (Picture courtesy of B. Ouendeba).