

CROP DIVERSIFICATION IN THE CHIA WATERSHED WITH IMPROVED VARIETIES OF BEANS AND RICE

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Chia Lagoon Watershed Management Project

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INTRODUCTION

A central objective of the Chia Project is to increase household food security, nutrition and incomes through opportunities to diversify and market high value crops. A key component is to add value to the production and marketing of rice and beans in the lowland areas of the Chia Watershed. The aim is to introduce high yielding, disease resistant varieties of these crops, which are in high demand among communities in the district, and which fetch good prices in local and regional markets.

The practice being promoted by the project involves growing rice under rainfed conditions, followed by beans under residual soil moisture during the winter season. Beans are a special focus not only for income and nutrition, but as a soil-improving legume rotation with cereals.

Varieties being promoted at present include Kilombero and Superfaya rice and Kalima beans. Results on these crops are presented below.

RICE

The usual practice involves growing rice under rainfed conditions on the alluvial lowlands, with a second crop during the dry season under irrigation. There is currently little opportunity for the latter following the collapse of the major irrigation schemes in the area – Mpamantha, Lifuliza and Likowa. Although efforts are underway to rehabilitate one or more of these schemes, the results reported here deal strictly with rainfed rice.

Before the start of the rains, arrangements were made to secure and deliver 1 ton of Kilombero and 5.7 tons of Super Faya rice seed from the Bwanje Valley Irrigation Scheme. The seed was delivered to 24 villages in Linga and Zidyana EPAs involving 398 participants for planting on a target area of 61 ha.

Planting and Yield Results:

Data on seed distribution, planting rates, production and yields are shown in **Tables 1 and 2**.

Problems with the erratic and late onset of the rains affected nursery establishment and delayed transplanting. Only 72% of the farmers who received seed produced a crop because some farmers were not serious about growing rice. Many of these farmers failed to even plant, suggesting the need for greater care in selecting participants based on genuine interest and ability. Despite this unfortunate waste of time and resources, production and sales of rice showed excellent results with potential for significant improvement.

Of the 398 farmers who received seed, 286 planted and produced a crop. Results for each variety were very similar. Seed planted per farmer averaged 10.9 kg on 0.08 ha at a rate of 133 kg per ha. This seed rate was more than 2 times higher than originally planned, which clearly reduced the area planted to the crop – a drop from a target of 61 to 33 ha (**Table 2**).

Table 1: Seed Distribution and Planting Rates of Kilombero & Super Faya Rice, Chia Watrshed

Variety	Distribution of Seed			Farmers who Planted	Seed Planting Rates	
	Farmers	Kg/Farmer	Total Kg		Area/kg	Kg/ha
Kilombero	59	10.2	1,000	42	75.8	131.9
Super Faya	339	11.6	5,700	244	74.6	134.1
Totals/Avg	398	10.9	6,700	286	75.2	133.0

Table 2: Production and Harvest of Kilombero and Super Faya Rice in Chia Lagoon

Variety	Ha Planted		Yield kg/ha *		Kg Produced	
	Per Farmer	Total	Avg/Farmer	Weighted	Per Farmer	Total
Kilombero	0.070	4.16	3,384	2,672	188	11,112
Super Faya	0.085	28.81	3,398	2,712	231	78,135
Totals/Avg	0.078	32.97	3,391	2,692	210	89,247

* The average yield of 3391 kg/ha per farmer was higher than the weighted mean of 2692 kg (total production / total area planted) due to high yields obtained by small vs large farmers.

Farmers averaged an excellent yield of 3.4 tons/ha for each variety (see **Table 2**), but yields were generally higher among smaller farmers, perhaps because they were better able to care for the crop. This differential skewed the true average of 2692 kg/ha based on total production ÷ the total area under production (89,247 kg ÷ 32.97 ha).

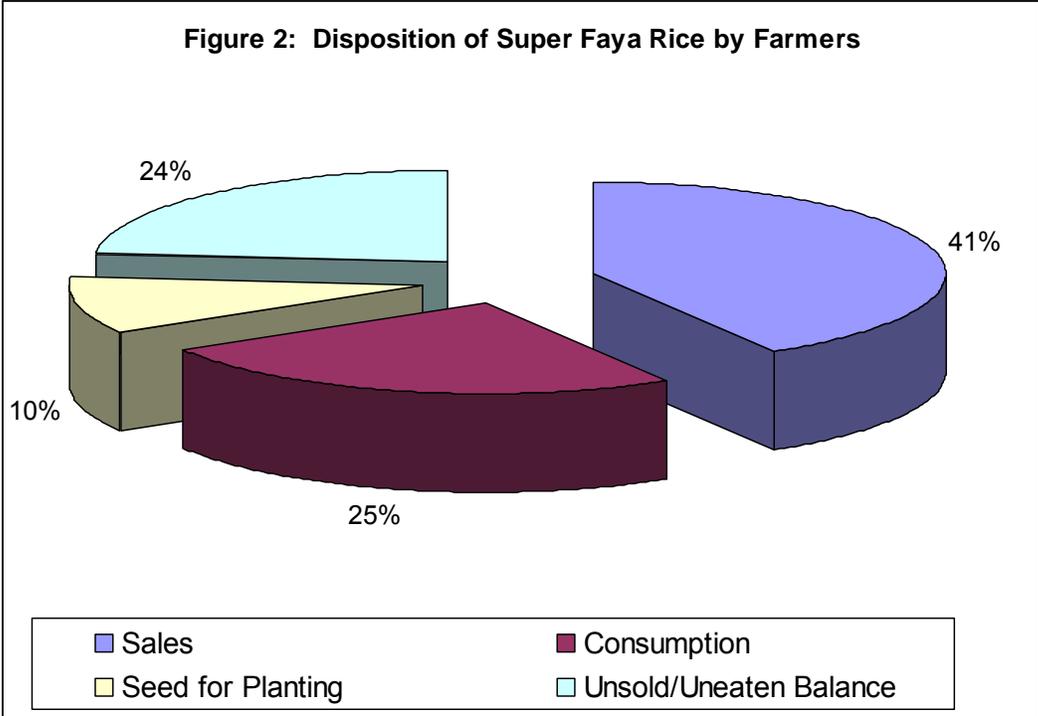
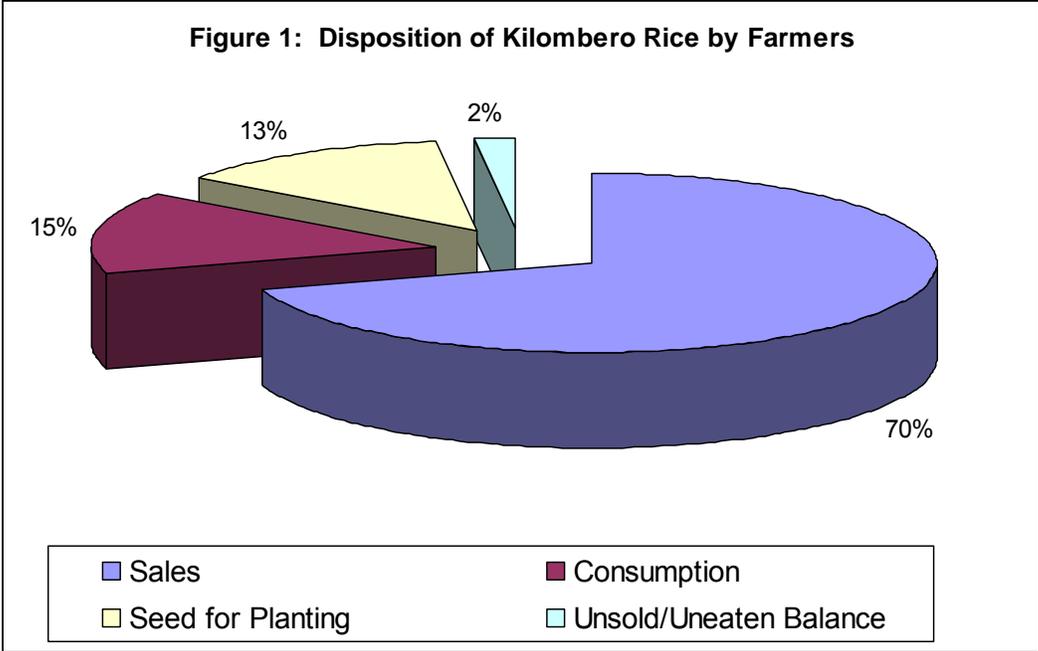
Disposition and Sales of Rice

The disposition of the 2 rice varieties by farmers to date is shown in **Figures 1 and 2**. The results differed considerably between varieties, with higher sales and lower levels of consumption for Kilombero (presumably due to its income potential). There was also little or no balance after keeping seed for next year.

Table 3 shows sales and prices as of September 30. Although demand for both rice varieties is high, prices and marketability of Kilombero are clearly superior. The project helped to identify a buyer from Blantyre, Rice and Milling Company, which offered K40/kg for unmilled Kilombero rice. This compares with a price of MK22/kg by local vendors, MK30 by ADMARC, and MK35 by NASFAM (although NASFAM later offered a price of MK 40). Gross returns per ha were \$1013 for Kilombero vs. \$714 for Super Faya with gross margins of \$881 and \$575 respectively. Gross margins were calculated from the rainfed values in **Table 4** based on variable use of fertilizer.

Table 3: Income from Sales of Kilombero and Super Faya Rice in Chia Lagoon (as of 09/30/06)

Variety	Avg Price/kg		Income from Sales of Unmilled Rice				Returns (USD per Ha)	
	MK	USD	Per Farmer		Total		Revenue	Gr. Margin
			MK	USD	MK	USD		
Kilombero	40.40	0.30	5,343	40	315,231	2,335	1,013	881
Super Faya	28.80	0.21	2,747	20	930,217	6,890	714	575
Totals/Avg	35	0.26	4,045	30	1,245,448	9,226	863	728



Market surveys indicate that Kilombero is preferred due to its flavor, texture and aroma. Supermarkets in urban areas favor Kilombero over others and sell it at a higher price. There also appears to be good export potential in Zimbabwe and South Africa. To date, Rice and Milling Company has purchased 32 tons of Kilombero rice from Chia farmers - including those who obtained seed from sources outside the project. Sales of Super Faya rice by farmers supported by the project total over 33 tons. Together, the income generated among rice farmers totals over MK2.5 million (USD 18,116).

Table 8: Revenue and Gross Margins for Multiplying Certified Kalima Seed (US\$ / hectare)

	Unit	US\$/unit	System of Production							
			Irrigation & Chemicals		Residual Moisture & Chemicals		Irrigation w/o Chemicals		Residual Moisture w/o Chemicals	
			Amount	Total US\$	Amount	Total US\$	Amount	Total US\$	Amount	Total US\$
Total revenue	Kg	1.00	2,250	2,000.00	1,200	1,200.00	1,500	1,500.00	650	650.00
VARIABLE COSTS										
Material inputs										
Seed	Kg	1.07	80	85.60	80	85.60	80	85.60	80	85.60
D compound	50kg bag	26.46	4	105.84	4	105.84	0	-	0	-
CAN	50kg bag	19.39	0	-	0	-	0	-	0	-
Pesticide	500 ml	4.29	10	42.90	10	42.90	0	-	0	-
Total material inputs			234.34	234.34		234.34	85.60		85.60	
Labor (field)										
Land prep	Day	1.00	15	15.00	15	15.00	15	15.00	15	15.00
Weeding	Day	1.00	9	9.00	4.8	4.80	6	6.00	2.6	2.60
Fertilising (D compound)	Day	1.00	0.5	0.50	0.5	0.50	0	-	0	-
Fertilising (CAN)	Day	1.00	0	-	0	-	0	-	0	-
Pesticide application	Day	1.00	2	2.00	2	2.00	0	-	0	-
Irrigating	Day	1.00	20	20.00	0	-	20	20.00	0	-
Harvesting	Day	1.00	9	9.00	4.8	4.80	6	6.00	2.6	2.60
Pack and transport to collection point	Day	1.00	4	4.00	2	2.00	2.5	2.50	1	1.00
Total Labor (field)	Days		44.5	44.50	14.1	14.10	34.5	34.50	6.2	6.20
Treadle pump costs										
Depreciation (based on total days use)	500 days	120.00	20	4.80	0	-	20	4.80	0	-
Maintenance (half depreciation)	500 days	120.00	10	2.40	0	-	10	2.40	0	-
Total treadle pump costs			7.20	7.20			7.20			
Total cost			286.04	286.04	248.44	248.44	127.30	127.30	91.80	91.80
Gross Margin per hectare			1,713.96	1,713.96	951.56	951.56	1,372.70	1,372.70	558.20	558.20
Break-even yield @ current wtd avg price (kg/ha)				286.04		248.44		127.30		91.80
Break-even price @ current yield (US\$/kg)				0.13		0.21		0.08		0.14
Total labour required (days & US\$)			44.5	44.5	14.1	14.1	34.5	34.5	6.2	6.2
Gross Margin Return to Labour (US\$/day)				39.52		68.49		40.79		91.03
Gross Margin if yield or price drops by			10%	1,513.96	10%	831.56	10%	1,222.70	0.1	493.20
Gross Margin if yield or price drops by			30%	1,113.96	30%	591.56	30%	922.70	0.3	363.20

Farmer Impacts, Challenges and Plans

Surveys of farmers revealed high interest and demand for seed, especially Kilombero, which was favored slightly over Super Faya mainly because of its marketability and price. Project support for these varieties had also affected farming practices. For example, early maturing and high yielding characteristics allowed more time for other crops and use of less fertilizer. Some farmers had even switched to planting in rows instead of randomly.

A meeting held in August with ~80 rice farmers discussed issues related to 1) sustainability after the end of the project; 2) seed self-sufficiency; 3) structure of the rice association; and 4) findings of the rice survey (see above). Desired actions to address points 1-3 include:

- Provide low cost irrigation to alleviate problems of variable rainfall for a good crop.
- Prepare land early with timely delivery of more seed to ensure higher production and yields.
- Select a group of good farmers to multiply basic seed for self-sufficiency.
- Establish direct links between the association and good buyers/markets.
- Arrange formal access to credit for loans on inputs and irrigation.
- Support and encourage rice clubs to promote problem solving within groups.
- Encourage protection of rice nurseries.

Selected success stories and photographs are attached.

BEANS

The Chia Project and TLC are collaborating with Bunda College in the multiplication and production of Kalima beans by smallholder farmers. The initiative is being implemented in collaboration with the Bean and Cowpea Collaborative Research Support Program (CRSP) managed by Bunda College and Washington State University with USAID funding.

A major thrust of this program is not only to increase incomes and nutrition, but to diversify farm production with a soil-enhancing legume crop that can be rotated with cereals, notably maize in upland areas, and rice in the lowlands of the watershed. The program involves 2 elements:

- 1) multiplication of certified seed, and
- 2) production of grain for sale and consumption.

Multiplication of Certified Seed

Planting and Yield Results:

Data on the distribution and planting rates of basic Kalima seed are shown in **Table 5** for 2004, 2005 and 2006, with production and yields in **Table 6**. The initial small number of farmers was due to a shortage of basic and certified seed, hence the justification for this program. After promising results in 2004 with irrigation in Lilongwe District, the multiplication of certified seed was expanded in 2005 to include Kasungu and the Chia Watershed.

In 2006, production of certified seed was continued with 30 farmers in Chia. Problems with erratic and late rains affected production of basic seed by the CRSP and its subsequent collection and delivery by the project to farmers in Chia. This problem was compounded by the late harvest and sale of rainfed rice which affected land preparation for beans.

Planting rates were reduced in 2005 and 2006 due to the high population stand from planting 2 seeds per station. Yields were highest under irrigation with fertilizer and pest control (1774 kg/ha), although reasonable yields were also obtained under residual soil moisture in Chia (1072-1300 kg/ha). Interviews with Chia farmers indicated little use of fertilizer in 2005 and 2006. The increased yield in 2006 is thought to be a result of the experience gained by farmers, with potential for higher yields with early planting.

Table 5: Production of Certified Kalima Seed from Basic Seed - Seed Distribution and Planting Rates

Year	Location	System	Distribution of Seed		Seed Planting Rates		
			Farmers	Seed Kg	Kg/Farmer	M ² /kg	Kg/ha
2004	Lilongwe District	Irrigation + Chem	11	70	6.4	74.0	135.1
2005	Lilongwe / Kasungu / Chia	Irrigation +1/2 Chem	25	300	4.0	100.0	100.0
2005	Chia Lagoon	Res. Moisture + 1/2 Chem	90	900	10.0	122.0	82.0
2006	Chia Lagoon	Res. Moisture + 1/2 Chem	30	264	8.8	113.6	88.0
		Averages	39	383.5	7.3	102.4	101.3

Table 6: Production of Certified Kalima Seed from Basic Seed - Production and Harvest

Year	Site Location	System	Ha Planted		Yield kg/ha Avg/Farmer	Kg Produced	
			Per Farmer	Total		Per Farmer	Total
2004	Lilongwe District	Irrigation + Chem	0.047	0.52	1,774	84	920
2005	Lilongwe / Kasungu / Chia	Irrigation +1/2 Chem	0.040	1.00	1,425	57	1,425
2005	Chia Lagoon	Res. Moisture + 1/2 Chem	0.122	11.00	1,072	131	11,794
2006	Chia Lagoon	Res. Moisture + 1/2 Chem	0.100	3.00	1,301	130	3,900
		Averages	0.08	3.88	1,393	100	4,510

Sales and Income:

The price of \$1.00/kg of certified seed was maintained for all 3 years. Production and sales were clearly linked to the area planted, but the revenue and gross margins per ha were excellent for all sites and for all years (see **Tables 7 and 8**), with an average of \$1394/ha and \$1206/ha respectively. This could be improved with early planting combined with experience and better management.

Table 7: Production of Certified Kalima Seed from Basic Seed - Income from Sales

Year	Location	System	Avg Price/kg USD	Proceeds from Sales		Returns (USD per Ha)	
				Per Farmer USD	Total USD	Revenue	Gr. Margin
2004	Lilongwe District	Irrigation + Chem	1.00	84	920	1,780	1,574
2005	Lilongwe / Kasungu / Chia	Irrigation +1/2 Chem	1.00	57	1,425	1,425	1,218
2005	Chia Lagoon	Res. Moisture + 1/2 Chem	1.00	131	11,794	1,072	902
2006	Chia Lagoon	Res. Moisture + 1/2 Chem	1.00	130	3,900	1,300	1,130
Averages			1.00	100	4,510	1,394	1,206

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			Amount	Total US\$	Amount	Total US\$	Amount	Total US\$	Amount	Total US\$
REVENUE										
Total revenue	Kg	1.00	2,250	2,000.00	1,200	1,200.00	1,500	1,500.00	650	650.00
VARIABLE COSTS										
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Pesticide	500 ml	4.29	10	42.90	10	42.90	0	-	0	-
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Gross Margin if yield or price drops by 10%			10%	1,513.96	10%	831.56	10%	1,222.70	0.1	493.20
Gross Margin if yield or price drops by 30%			30%	1,113.96	30%	591.56	30%	922.70	0.3	363.20

Impacts, Challenges and Plans

- Income generated from sales of beans is being used to support 365 people in the area based on an average household size of 12.2 which includes extended family members.
- All farmers have great interest in growing Kalima beans next year.
- Major challenges faced were related to late planting from late land preparation after the rice harvest, and late delivery of seed. Yields were consequently reduced from lower soil moisture levels. The problem was compounded by a minor aphid infestation, which was treated using local pesticides with limited efficacy.
- Training on sound agronomic practices for multiplication was provided by Bunda College.
- Chia Project and TLC staff provided regular backup extension support in the agronomy and processing of seed. They also conducted quantitative assessments of yields.
- Bunda College evaluated the seed produced for certification.
- Prices paid to farmers were tied to the dollar exchange rate at \$1.00/kg.
- The Chia Project and TLC purchased most of the certified seed from farmers for onward delivery to other interested farmers to expand the program and its benefits.
- Constraints to multiplication are noted below, which are being addressed as follows:
 - Sustainability from limited availability and capacity to multiply basic seed – investigations are underway to secure greater quantities of basic and certified seed. The latter includes the 3.9 tons of seed purchased from farmers this season. The Project is also exploring the acquisition of parental lines of Kalima beans for producing basic seed among a select group of Chia farmers so that the area can become more self-sufficient.
 - Quality of training and extension support needs to be provided to other interested parties/organizations, a challenge which the Project is willing to undertake.
 - Markets need to be identified for certified seed, especially when the program expands beyond the capabilities of the Project and TLC.
 - Continued promotion and production of Kalima and other improved bean varieties must consider changes in prices depending on quality and increased seed availability.

Production of Grain from Certified Bean Seed

Promotion of Kalima bean seed has been highly successful, predominantly because yields and cash returns are high and farmers like the variety. As a result, neighboring farmers formed more clubs in 2006, increasing the membership from 90 to 560. This increase in demand triggered the project to supply 6.16 tons of certified seed in June and July this season for producing and selling grain. The seed provided included certified seed purchased from Chia farmers last season.

Production of Bean Grain

Data on the production and disposition of grain from certified Kalima seed are shown in **Table 9** and **Figure 3**. The average and total area planted was 0.14 ha and 78.4 ha respectively. Total production was 50.6 tons, averaging 90.4 kg per farmer with a yield of 646 kg/ha.

Disposition of Bean Grain

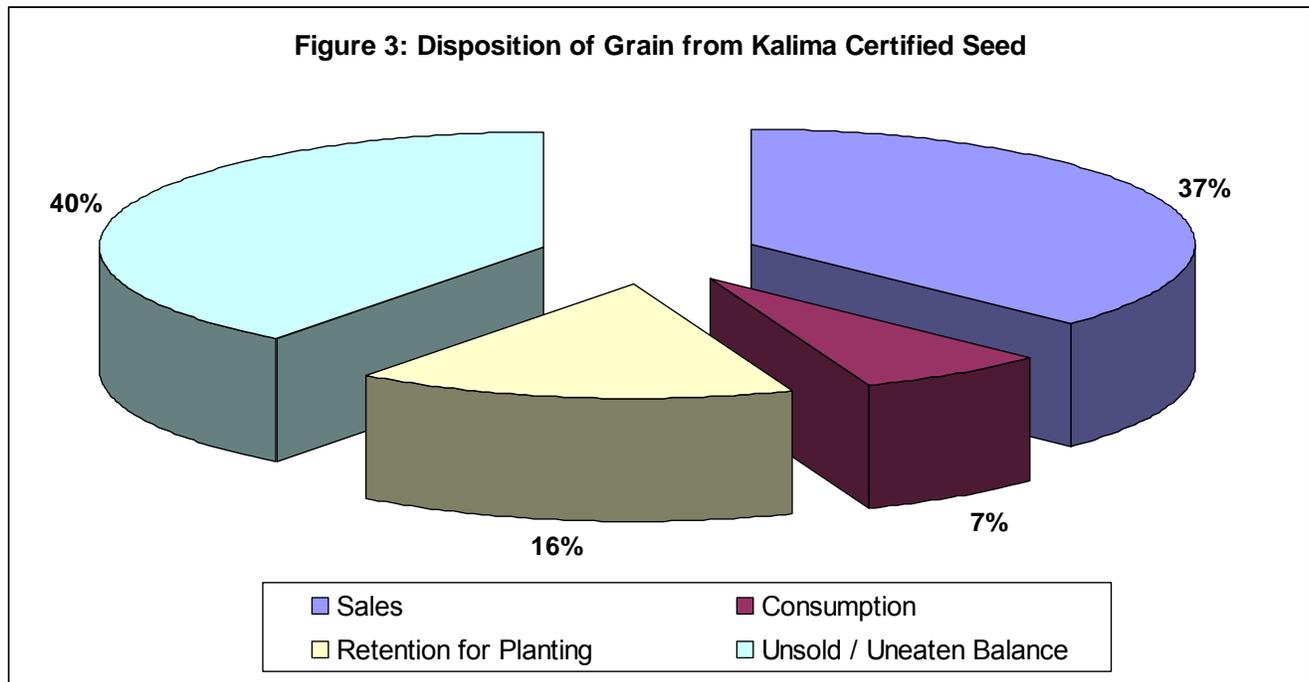
By October 19th 2006, some farmers had sold their harvest in local markets. This totaled 18.8 tons or 37% of the bean harvest at an average price of MK 60.34/kg. These sales generated MK 1,152,000 (USD 8,348) at an average income per farmer of MK 4,114 (USD 30). Other farmers are waiting to sell their produce at higher prices.

Revenues to date have contributed towards the purchase of sheep and goats, fishing nets, bicycles, clothes, timber, and soap. Sales have also helped pay school fees and hospital bills.

70% of the farmers had consumed 7% of the bean harvest as of mid October. In addition, 92% of farmers plan to retain an average of 14.6 kg for planting next season, although the Project is recommending new certified seed to ensure quality with higher yields and prices.

Table 9: Production and Disposition of Grain from Certified Kalima Seed

Distribution of Seed	Quantity
No. Farmers	560
Kg/Farmer	11
Total Seed kg	6,160
Seed Planting Rates	
M ² /kg	127.3
Kg/ha	78.6
Area Planted (ha)	
Per Farmer	0.14
Total	78.4
Production (kg)	
Per Farmer	90.4
Total	50,624
Avg Yield Kg/ha	646
Disposition to Date of Grain (kg)	
Sales	18,802
Consumption	3,544
Retention for Planting	8,176
Unsold / Uneaten Balance	20,102
Income to Date from Sales (\$)	
Price per Kg	0.44
Per Farmer	29.81
Total	8,348
Potential Returns (\$ per Ha)	
Revenue (if all sold)	282.34
Gross Margin (with no chemicals)	190.34



Impacts, Challenges and Plans

These are similar to those observed with planting basic seed.

- Income from bean sales will help support 4370 people in the watershed based on a household size averaging 7.8 people which includes extended family members.
- The average yield of 646 kg/ha is considerably lower than the yield of 1300 kg/ha achieved with basic seed. This is likely due to the selection of best farmers and the agronomic support given for multiplying basic seed.
- Although harvests were lower than expected, there was strong interest in growing kalima beans next year due to the high yielding capability of Kalima vs. local varieties.
- Major challenges faced were related to late planting from late land preparation after the rice harvest, and late delivery of seed. Yields were consequently reduced from lower soil moisture levels. The problem was compounded by a minor aphid infestation, which was treated using local pesticides with limited efficacy. Early delivery of seed will be a priority next season.
- Most farmers have not repaid seed provided by the project, which can either be done in cash or in kind with the grain produced. Due to the lower than expected harvest, the issue will be resolved next growing season.
- Plans for the 2006/07 season include the supply of 10 tons of certified Kalima seed to 600 bean farmers in the Chia Watershed (about 15 kg/farmer).

Selected success stories and photographs are attached.

SELECTED RICE AND BEAN STORIES WITH PHOTOGRAPHS

Many farmers experienced great success with the production and marketing of beans and rice this year. Selected stories are presented below.

Rice

Mr. Tito Mtalanje of Zidyana EPA harvested 650 kilogrammes of Kilombero rice, which he sold at K40.00/kg realizing K26,000. With the proceeds, he bought iron sheets for his house. "During the previous 20 years of growing rice, I was unable to realize my dream to own a house with a roof of iron sheets. I have finally realized this dream, praises to the Chia Project!" Mr Mtalanje said in a jovial mood.

Village Headman Yolomani II purchased a TV set and 25 iron sheets after raising and selling rice and beans. He produced 500 kg of rice and sold 375 kg at MK40 per Kg. He also sold 360 kg of beans at MK60 per kg. "In my experience, this was a very rare opportunity. With the income from the sales of rice and beans, I was able to watch the World Cup in 2006. I will live to remember Chia Project for this success" the Village Headman said.

Beans

Mr. Dalabu Tsinde of Likowa supports 18 people from his farm in the village of Namakwati. In 2005, Dalabu planted 20 kg of Kalima bean seed received from Total LandCare. Following a successful yield of 200 kg of certified seed, Dalabu was very pleased with the outcome of the sale. Before encountering TLC, Dalabu could not afford to send two of his four children to school. After the sale of his Kalima crop, these two children were able to attend school. Life changed for the rest of the family as well. The increased income allowed Dalabu's wife to buy greater amounts of varied foods to improve family nutrition. Improvements of this nature directly impact the health and general well-being of the whole family. For example, two of Dalabu's extended family members were ill at the time of harvest, but with his support, they were able to receive much needed medical attention. This and many similar stories have had significant impacts on people's lives, such as buying iron sheets for roofing, bicycles for transport, goats and chickens animal protein and income, and farm inputs.

In 2006, Mr. Darabu Tsinde produced 900 kg beans from which he sold 360 kg realising K24.000. "Since I was born, I have never seen an income like this. I am molding bricks right away to build a good house for myself and family."



Production of Kilombero rice in Mpamantha and Likowa, Chia Watershed Project



Harvesting and Marketing of Kilombero Rice, Chia Watershed Project



Land preparation and newly planted Kalima beans under conservation agriculture and residual soil moisture, Likowa, Chia Watershed Project



Kalima beans under conservation agriculture, Chia Watershed Project



Visit to Chia farmers: From left, Alan Eastham, US Ambassador to Malawi; Autman Tembo, USAID, Trent Bunderson, Chief of Party Chia Project, Curt Reintsma, USAID Director, Diane Gooch & Alex Damaliphetsa, Project Coordinator & Manager



Farmer club for growing rice and beans, Chia Watershed