

Agro-enterprise development in Katakwi District: Cassava processing with Matilong Farming Organisation



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Introduction

This report highlights the initial findings from the establishment of an agro-enterprise project in Katakwi District, North Eastern Uganda, which aimed to process cassava into high quality flour and link a rural farmers group with higher value, urban markets. The client group were the Matilong Youth Mixed Farming Organisation which has worked with DFID for the past 2-3 years and this group was particularly successful in the multiplication and distribution of new Cassava Mosaic resistant cassava planting materials to farmers in Katakwi District. The cassava processing project was viewed as a means to capitalise on the large cassava multiplication plots, managed by Matilong, and enable the group to increase their income through sales of high quality cassava flour.

Action plan

- First meetings between the Matilong and the NARO / IITA postharvest team to discuss the objectives of the cassava processing project and the funding arrangements.
- Rapid local market survey for flour sales.
- Training of Matilong staff in cassava processing and safe use of equipment.
- Evaluation of the processing, equipment and identification of technical constraints.
- Bulk processing of cassava with analysis of production and processing costs, through cost / benefit analysis.
- Quality control of flour including cyanide analysis, flour purity and consumer's reactions.
- Linkage of production with retailers in Soroti or Kampala for flour sales.
- Strengthening marketing linkages and supply of appropriate market information, to enhance the vertical integration of primary and secondary processors.
- Increase production, promote new products and tailor the process to a number of higher value markets.

This action plan was derived from "the Stage-gate approach to market intervention" research plan adopted by the NARO / IITA postharvest team as part of its technology development and transfer strategy, **Annex 1.**

Project partners

Matilong is a grass roots "Community based Organisation", CBO, established by 100 farmers, from Obalanga sub-county in Katakwi District. The objectives of the group are to enhance food security, alleviate poverty through agricultural activities, and through increased incomes, gain greater empowerment for women and youths.

NARO-IITA postharvest team-

The NARO/IITA postharvest group comprises a number of scientists including process engineers, economists and food scientists. This group is working with a number of NGOs to establish pilot cassava processing sites and test the commercial viability of improved cassava products. The team has developed a range of processing equipment and has already set up a number of cassava pilot processing site throughout Uganda. The aim of this work is to increase the marketing opportunities of this low-value crop by improving processing, storage, developing value added products and enhancing product marketing.

The Technology The cassava processing technology consists of power graters, water presses and sun drying mats, see **strategies**. The product was high quality cassava flour, which is white, odourless and contaminant free, ie without soil particles. The process is rapid, producing a safe flour within one or two days compared with 7-10 days for traditional means of processing and the process efficiently removes cyanide from bitter cassava to levels below the internationally recognised safety recommendations.

Initiating the project

Initially meetings were held between Matilong and the postharvest group to discuss the new method of cassava processing, the products, the needs of the Matilong farmers, location of the cassava plots, proposed location for a processing site, labour availability, and marketing. This meeting concluded that Matilong was keen to set up a cassava processing site as this would complement their other activities. Market surveys were planned to evaluate the market potential for other cassava products including native starch and gari. For the purposes of this project, DFID provided Matilong with a 2,500,000/= Ush grant to purchase processing equipment and a 2,500,000/= Ush pay-back loan to assist with training, processing costs and marketing. An agreement was made with Matilong, that the group would pay back the loan from proceeds gained through the sales of high quality flour.

During the first visit of the postharvest team to Matilong at Amucu, Asamuk Sub/County, Amuria District a demonstration of the processing equipment was given to a select number of people including the board members of Matilong and equipment was handed over, see equipment list **Table 1, Annex 2**. The postharvest team also visited the cassava plots which were to be used for processing. The plots included a 200 acre field of Migyera, a bitter variety at (Amucu), and second plot comprised of 80 acres of Nase 2, a sweet variety, and 20 acres of Migyera (Okutoi) in Amuria county. During subsequent backstopping visits, more equipment was delivered to increase processing efficiency, drying capacity and ease in-field transport with the delivery of wheelbarrows.

Table 1 List of equipment delivered to the Matilong site

Item	Cost per Unit	Quantity	Total Value Uganda shillings
Power grater	900,000	2	1,800,000
Jack press (include grids and 8 Ton Hydraulic jack)	214,000	6	1,284,000
Black drying sheet (meters)	952	187	178,000
Wheelbarrows	55,000	4	220,000
Drums (to collect the mash)	12,500	4	50,000
Spanners	2,000	8	16,000
Bags (for pressing)	500	15	7,500
Oil and Fuel	1,000	10	10,000
		Total Ush	3,565,524

Exchange rate 1998, 1US\$ = 1400 Uganda shillings

During the follow-up visits further discussions were held on modification to the processing site. The topics included physical arrangements for the processing i.e., where to peel and process, positioning of the drying and storage areas, payment of labour, use of external labour, quality of flour, transport from the pilot site to millers in Soroti Town. At each subsequent visit it was apparent that Matilong were becoming increasingly confident with the processing and their experiences led to several modifications in the processing setup to reduce labour costs and transportation of fresh cassava to the processing sites. Peeling, washing, grating and pressing were conducted in the cassava field and after de-watering the grated cassava was taken by wheelbarrow to drying areas which were situated near the stores. The stores are part of a disused District Farm Institute. The average distance between the field and drying/storage facilities was 300 meters. This distance will increase as new plots are harvested. Water for the processing is supplied from a bore hole situated behind the stores, 50 Meters.

Lessons learned

Major constraints of the processing & equipment recorded so far:

- Due to intensive use of the graters the group replaced the rasping plate, the metal punched sheet, of both graters. The plates were refitted by SAIMMCO, the manufacturer of agricultural implements in nearest large town of Soroti. SAIMCCO is familiar with the processing equipments as they have worked with the postharvest team in fabricating and re-designing the equipment over the past two years.

- Pressing: Dewatering of the cassava mash is mainly done by boys and they have demanded higher payment for this task, from 1000- 1500 Ugsh / day. The longterm durability of the hydraulic presses was questionable due to weaknesses in the oil seals of the jacks.
- Drying the cassava mash into flour proved difficult during cloudy and rainy days. To avoid a fermentation, the mash / flour was spread in a thin layer overnight, during cloudy days the drying may take several days.

Labour

Cassava processing is conducted by Matilong farmers, both male and female and casual labours. At first there were many people involved in processing but labour requirement has declined as the group become more proficient in processing. Harvesting the tubers, transportation of water, cassava and equipment, cassava grating and dewatering are mainly done by men, while women carry out the peeling, washing of fresh tubers, drying and re-bagging of the flour. Young men finally bag and weigh the flour and load them on the trucks. Until now Matilong have paid the group members and casuals 1000/= Ush per workday.

Product safety versus product costs

In many parts of northeastern Uganda farmers are practising a rapid "short-cut" methods to process cassava flour. Although this method is safe for processing sweet varieties, in some cases it will not reduce cyanide levels of "bitter cassava", to safe levels. Since the outbreak of the Cassava Mosaic Disease, (CMD) epidemic in Uganda, much of the sweet varieties in the cassava belt, were replaced by the newly introduced variety Migyera, (TMS 30572) and there has been some concern that Migyera may be lead to problems with toxicity.

In 1997, there were several newspaper articles which claimed that women and children had suffered from cassava related toxicity problems and various concerns have been raised by researchers and the general public about the health risks of bitter cassava. Interviews with farmers in eastern Uganda, revealed that many farmers, are adopting rapid processing methods but that processors were aware of the cyanide issue and were using a "rule of thumb" harvesting method and only processing Myghera at 12 months, as they claimed this avoids problems with toxicity.

To verify the farmer practices, a variety / harvesting age trial at Serere Agricultural Research Station. First year results from the age experiment showed that HCN levels of Migyera were high from 3-9 months, but then fell to relatively safe levels when tubers were 12 months old, **Table 2**. The data supports the farmers' believe and practices in the Serere / Ngora area, that matured Migyera becomes safe to eat even when boiled, fried or roasted at 12 months.

Table 2 Effect of cassava variety age at harvest on root CNp levels

Variety	Type	3 MAP	6 MAP	9 MAP	12 MAP
		Mg CN/kg DM			
Migyera	Bitter (I)	869	389	267	91
PDB	Bitter (I)	1534	463	360	263
Tongolo	Bitter (Local)	1858	299	384	184

Nase 1	Sweet (I)	184	137	158	58
Nase 2	Sweet (I)	734	86	257	71
SS4	Sweet (I)	459	190	165	98

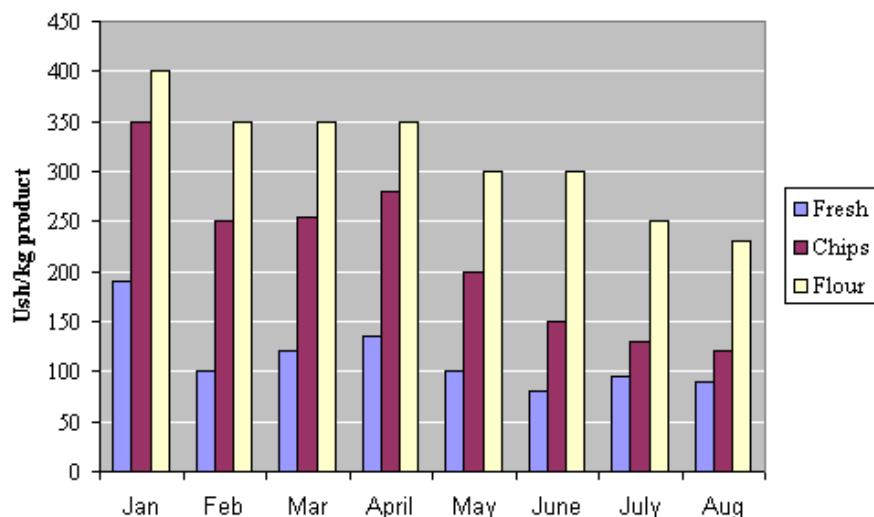
I = improved, MAP = Months after planting, Safe level of tubers = < 100 Mg CN / kg DM

The findings of the product safety work have several implications. The data supports the farmer's assumptions that HCN levels fall with time after planting. The 12 month data, in **Table 2**, showed that Mygyera had a CNp level comparable with SS4 which is considered to be safe variety for raw consumption. Given that Migyera, can be safely processed using a more rapid method at 12 months, then the processing equipment could be adapted to meet the economic competition within the Ugandan market.

Cost/Benefit analysis of the processing

A cost / benefit analysis was carried out on the Matilong processing site in September, 1998, with a follow up in 1999. The cost benefit analysis showed an internal rate of return of 32% based on records made by the Matilong group. Matilong estimates an overall cost price of 203 Ush / kg, for milled flour stored in Soroti Town, ready for wholesale delivery. Unfortunately, prices of cassava chips and flour has fallen dramatically, see **Figure 1**, and the wholesale prices of 'dried chips' flour in Soroti Town are currently between 100-120 Ush/kg. Given these usually low prices, the group had to decide on an appropriate level of income which would merit continued processing.

Figure 1. Consumer prices of Cassava products in Soroti Town from January to August 1998



Two questions arise from the cost benefit analysis

- Are the labour costs of 1000/= Ush per man-day realistic?
- Are the costs of growing 1 acre of cassava at Matilong competitive with an average subsistence Teso cassava farmer?

The objective of introducing improved processing equipment was to set up and operate a profitable enterprise that would generate sufficient income to pay for labour, pay back the initial investment costs of the equipment and maintain a reasonable rate of return in the future. Unfortunately, in the past 6-8 months prices for 'dried cassava chips'

in the Soroti region have fallen to 10 year low prices of 60-80 Ush/Kg. For the average farmer, this price equates to 160,000 Ush, from a yield of 2000 kg of dried chips per acre. Given these prices it may be difficult for Matilong's to operate profitably on the local flour market. Therefore the group may need to find new, higher value markets or reduce production costs.

Clearly labour costs at 1000/= Ush is an aspect, which needs to be investigated. It can be argued that opportunity costs for labour in Katawki are close to zero, as there are few other jobs available in the area. This provides an opportunity to negotiate a reduction in labour costs, although this may result in a refusal to work as some people were already asking 1500/= per workday. Also the production costs of growing one acre of cassava at 150,000 Ush, (Matilong) versus the overall income from one acre of 'dried chips' in the traditional system indicates that this figure may also be unrealistic and therefore needs to be reviewed.

Prospects of cassava sales in Soroti District

In Soroti District cassava is either sold direct from the farm, to mobile traders with trucks/pick-ups, or is sold in the local, weekly markets in each county, or in District Towns through traders, kioskholders, and shop vendors.

In the Soroti areas, many traders buy dried cassava chips from farmers and mill the flour in one of the many hammer mills, at 1000 Ush/bag of 100 Kg. The flour is then transported to the urban markets based on almost daily market information. Few farmers transport their product to Soroti Town as transport facilities are limited and profit margins are currently meagre. In 1997, farm prices of dried cassava were still above 160 Ush/Kg, whereas in Oct-Nov 1998 the product is trading at less than 80 Ush/kg and farmers are not harvesting their cassava in the hope of prices returning to previous levels. The likelihood of prices returning to high, 1997 levels are remote, see price data in the commodity prices section. Reasons for the 1997 peak in prices were caused by a number of compounding factors the most important being, lack of cassava due to the ACMD epidemic, the effects of the El Nino on the weather and the effects of importation of staple food products. In May 1998, local authorities tried to introduce and enforce by-laws to fix farm-gate prices of dried chips at 110 Ush/kg but this intervention has failed. The majority of Kampala cassava flour traders also appear to have shifted to nearby Palissa where cassava has also recovered from the Mosaic Virus Disease.

In discussions with traders, truck drivers, and millers in Soroti Town the team found that Moroto and Tororo, which were the major markets of Teso Cassava, dried chips and flour, are showing low demand, in September 1998. In mid September the Karamajong also harvested their preferred staple crops, millet and sorghum, and stocks of cassava flour in Moroto have halted demand for cassava from the Soroti market.

In 1997, it was observed that many traders came from Tororo District to Soroti Town to buy flour from the millers but again with higher food stocks this market has also disappeared. Reasons for the market collapse in Soroti, as suggested by various millers were the result of a recovery in cassava production in Tororo and Palissa. The introduction of new planting material, such as Migyera has also led to a larger than expected harvests with the result that traders prefer to buy from farmers in the Serere - Ngora area and mill there or in Tororo.

The Matilong pilot site in Amuria is situated 45 km north of Soroti Town, linked by a murrum road. Transport facilities are less developed compared with Serere and few traders come to Amuria to buy chips. Hence there are additional transport costs to move flour from the pilot site into Soroti Market at 3000/= per bag.

Prospects at the Kampala market

In November, 1998, the research team investigated the cassava flour sales in Nakawa market, one of Kampala's major flour markets, see prices, **Table 3**. Traders, store keepers and kiosk holders in Nakawa indicated that white, clean cassava flour which is white and free from contaminants, i.e., usually dried on rocks instead of on the ground, is in strong demand. The highest quality flour is sold at a premium price and is preferred by traders as it sells faster.

The major areas of cassava flour supplies to Kampala markets at the moment are from:-

- Palissa District (mainly 'dried chips' and drying processing)
- Kasese District (fermented and dried processing)
- Soroti & Kumi Districts ('dried chips' drying processing)
- Nebbi District (fermented cassava flour)

Table 3 Prices of Cassava Flour in Nakawa Market

Nakawa Market (first week November'98)	Whole sale (traders/storekeepers)	Kiosk holders
Fermented flour (grey colour or with soil particles)	190 - 210	300
Dried Flour (clean and without soil particles)	230 - 250	300 - 350

Samples of the cassava flour produced by Matilong were taken to Kampala by the postharvest team and sold to Kassamill a commercial miller at Nakawa market. Part of this flour was packed as the popular "Atap" , cassava flour mixed with sorghum, and sold to supermarkets in town and some bags were sold to a kioskholder within the Nakawa market. The Nakawa trader informed the team, which included the Matilong spokesperson, that the improved cassava flour was very popular with his customers and colleague kioskholders. The main advantages were that the Matilong flour was white, starchy, odourless and 'heavy'. Many of his customers came back to him and asked where to get more of this flour. The kioskholder recommended the flour as a "hot cake" product saying that it sold much quicker than the ordinary flour and that he had sold 3 bags in one week compared with 1 bag per week for the normal flour.

Investigating higher value markets and prospects for vertical integration

In August of 1998, one of the postharvest research team started a support project to investigate the potential for linking the sales of high quality flour from one of the processing sites to a secondary processor i.e. in the confectionery, glue or starch markets. One such market is to substitute imported wheat flour with high quality cassava flour. This will reduce production costs for the processor, stimulate demand for cassava market and may in time lead to a reduction in imports of high cost wheat flour.

From an initial survey it was found that 70% of bakeries in Kampala had at one time tried to use cassava flour as a substitute for wheat. Currently all bakeries had ceased using cassava flour as they had all

encountered problems with flour quality and supply. However, one major manufacturer of biscuits, Britannia, showed interest in incorporating the flour into their process. The company has tested the flour and found that biscuits were of very high quality and have indicated need for a supply of 5 tonnes of high quality cassava flour per month. The only processing site with capacity to deliver this level of flour was Matilong. Preliminary discussions on price, quality and distribution conditions were held between representatives from Matilong and the biscuit manufacturer. Matilong is somewhat wary about losing funds again and have suggested that they will supply the flour milled and bagged in 100 Kg bags, to be sold at 250-270 Ush/kg from their store in Soroti. This price is well above the break-even point based on Matilong's figures, and this price will enable them to start paying back the loan of 2,500,000/= and invest in new equipment. Similar studies are also investigating prospect of substituting starch with high quality cassava flour.

Achievements of the Matilong / IITA/ NARO / DFID project

The establishment of a cassava processing site with the Matilong group has been an interesting and beneficial partnership. Matilong has gained in terms of developing new skills in crop processing and has access to a potentially lucrative income generating agri-business. In areas such as Katakwi, where employment opportunities are limited the processing equipment provides a possibility for transforming cassava from a famine reserve into a cash crop. The summary information in **Table 4**, shows some of the advantages and disadvantages so far.

Table 4 An Overall evaluation of the processing technology & achievements up to date

Advantages	Disadvantages
<ul style="list-style-type: none"> ■ The Matilong team is highly motivated and has mobilised its members to processing work ■ The introduced equipment worked well ■ Production is high volume (1000 kgs flour per day) ■ Quality of flour was very good (cyanide levels and consumer's acceptability) ■ Processing was an income generating business ■ The processing provides employment ■ There are strengthened linkages between the CBO, researchers, food traders and fabricators of equipment, ie the private sector. ■ Spin off effects: creating a production capacity of high quality flour for industrial processors 	<ul style="list-style-type: none"> ■ Cost of production is high due to investment cost of equipment ■ Cost of processing is high especially peeling ■ Technical bottlenecks include peeling and drying ■ Market information is insufficient, need more information on prices, trends and volumes ■ Market structure is unknown more information is needed on traders, new markets, consumers demand and acceptability, new markets, quality standards ■ Levels of profit is low due to falling cassava prices ■ New products need active/expensive promotion actions and demand testing with consumers and industries, there is a need to access additional risk funds to

<ul style="list-style-type: none"> ■ High quality flour enable traders, shopkeepers to generate premium prices or increase sales ■ High quality flour is now available for consumers 	<p>promote the use of cassava and cassava products.</p>
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Addressing the problems – Next steps

Recommendations to Matilong

- The group needs to re-analyse production costs in a real world situation rather than consider the pricing within a "project mode".
- Matilong should establish a level of profit or break even point which is acceptable to the group and the workers.
- Matilong may consider moving to a piece work rating system rather than a daily rate.
- The group needs to develop a sales strategy with linkages with Kampala. A sales strategy should include aspects such as quality control, packaging, branding their produce, storage regimes to avoid losses in quality due to insect damage and distribution systems. The market survey showed that the sellers were aware of the flour but were not aware of the group and therefore could not commit to a contractual arrangement.
- Matilong should be involved in the market surveys so that they obtain the information they need.
- Matilong are an ideal partner to test the initial delivered equipment vs. New equipment, particularly if they are to supply the biscuit factory with a 5 tonne monthly consignment of flour

Next steps for the Postharvest team in the Matilong project will be to:-

- Conduct further market analysis to establish a strong and profitable link between the processing group and the buyers. This may be realised by selling into the general flour market or selling into a niche market such as the biscuit manufacturers.
- Enable Matilong to generate the funds from sales to pay back the loan to DFID
- Set up a sales strategy for the Matilong group.
- Identify new market options such as glue and starch.
- Tailor the process to the identified markets, ie higher output lower quality products or vice-versa.
- Re-analyse the production and processing costs with the Matilong group compared with a farmer in Teso using the traditional fermentation method and the short cut method.
- Evaluate the use of chipping machines and mills to increase the profitability of the process