INVESTIGATING THE POTENTIAL OF SEA FREIGHTING TOWARDS INCREASING SWEETPOTATO EXPORTS FROM EAST AND CENTRAL AFRICA:

Shipment simulation trials, preliminary report by PRAPACE

In Uganda, where production on-farm has at least tripled as result of many (93% in 3 sampled districts) farmers adopting improved varieties. The problem now is mainly of low market prices and hence low income. Farmers are risk-averse and will not produce a more commercial sweetpotato without a guaranteed market. Efforts now are geared to linking the sweetpotato farmer to markets hence the study simulating freighting of sweetpotato in refrigerated containers by sea. The study involved a number of partners that included the International Potato Centre (CIP), Makerere University, an International shipping company SDV-Transami Uganda (LTD), Uganda Horticultural Exporters Association (HORTEXA), a coalition of agricultural researchers, farmers and NGOs.

Methodology:A simulation of refrigerated conditions in a freight container were undertaken from the premises of the freighting company SDV-Transami at Ntinda/Nakawa (plot M.611, Ntinda Road). The consignment was held at 14^{o}C, 90% RH for 50 days.
Sea freighting cargo to for example the far Northen Europe ports like Rotterdam/Amsterdam in the Nederland may take 30-35 days. That the trial lasted 50 days was to take into account of any possible delays of the cargo in transit.

Packaging: Eighteen metric tons of sweetpotato purchased from HORTEXA and BUCADEF farmers was packaged in 1800 waxed boxes each (see plate blow) of ten kilograms. The boxes were packed in a refrigerated container held for 50

Plate: The type of waxed box in which the roots were packaged

days at **14^{o}C and 90% Relative Humidity**.

Though up to nine export varieties were packed, only four featured in the experiments carried out. They are Ejumula, Kakamega, Kala and # 93/29. The other varieties that featured in the container include; Naspot 1, Kasujja, and New Kawogo. The later two are already being exported by air and are popular on the basis of their red skin color and good taste.

At harvest, some farmers were asked to dehaulm (cut off vines) the crop one or two weeks before commercial harvesting (advice from PRAPACE) as a method of in-ground curing and was one of the experimental treatments.

Observations made: Prior to locking the sweetpotato up in the container at the beginning of the experiment, a sizeable sample of sweetpotatoes was drawn from the consignment from which, ß-carotene content, and weight were taken. Another sample was drawn from the container at the end of the experiment (Day-50) and the same observations were made. ß-carotene content was obtained by High Performance Liquid Chromatography.

Results:

Export of sweetpoato by sea is technically and economically feasible. Fifty days after storage in the refrigerated container, many samples that had been handled properly still looked visually fresh.

But also many of the samples that had not been well handled, had really gone bad

Varietal performance:

- **Nine varieties (see attached pamphlet) including the orange-fleshed Kakamega that is widely adapted in the ECA region and Ejumula that is to be released in Uganda this year, are earmarked for export. The rest of the varieties are Kala, Naspot 1, Naspot 2, #93/29, Kasujja, New Kawogo Nakakande, and Jowelia. All but Kasujja are improved types that are abundantly produced on-farm and are already being exported by air to Europe** together with other high value horticultural crops like Vanilla and Hot Pepper. Production of widely adapted varietie like Kakamega greatly favors the export trade in that if for some reason farmers in one country e.g Uganda fail to produce enough to meet a quota, then farmers in Kenya or Rwanda can fill the gap.
- **Variety SPK stored best of all in that it did not experience significant levels of degeneration in terms of weight loss, rotting and sprouting. With proper post-harvest handling notably curing through dehaulming two weeks prior to harvest, Kakamega or SPK04 lost only 2% of its original weight and only 4% were lost to soft (Pythium) rotting**. At least three types of rotting (see plates below) were observed. These need to be identified by post-harvest pathologists for documentation.

Usually the rotting was restricted to the tips of the root especially where it (the root) gets cut from the stem. In most cases it is not really extensive damage but renders the root not fit for sale in an export market.

Varieties like #93/29 that produce considerable amounts of latex tend to heal better as the latex forms a black tar-like wax that seals the tip hence blocking entry of rot-causing pathogens. (There is therefore urgent need for work to investigate the curing process)

In contrast to Kakamega, the variety Ejumula that deteriorated most lost 13% of its original weight, while 32% was lost to rotting. There was not any significant sprouting observed on all varieties except #93/29 that tended to do so.

The study also showed great need to stress the importance post-harvest handling, particularly the process of curing as this greatly affects the quality for export. Samples that were dehaulmed two weeks prior to harvest stored three times better than freshly harvested samples. The practice is also recommended for SP storage by INERA in D.R.Congo.

Table 1:Storability of different varieties at 14^{o}C and 90% Relative Humidity for 50 days different post-harvest handling

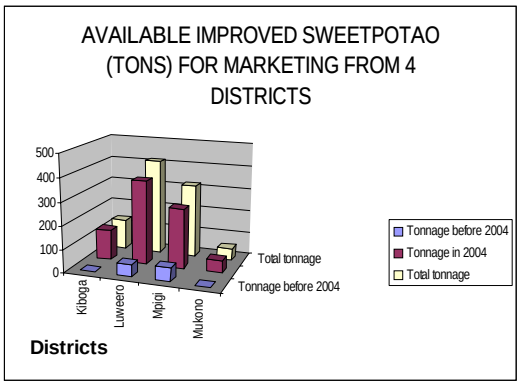
Variety	No Dehaulming			Dehaulmed 2 weeks before harvesting		
	% Weight loss	% lost to rotting	% lost to sprouting	% Weight loss	% lost to rotting	% lost to sprouting
Kakamega	4	30	0	2	4	0
# 93/29	8	64	3	10	39	1
Kala	11	57	0	9	21	0
Ejumula	15	87	0	13	32	0
Mean	9.5	59.5		8.5	24	

Profitability of the business

- A farmer producing for the export market can get between US$ 489-2500/ha planted of any of the nine improved varieties since these can produce 7 to over 20 tons per hectare of fresh roots. If the farmer was to produce for the domestic market, he would instead get between US$ 54-1194 (see table 2).

- From the same harvest from a hectare, an exporter freighting by sea would get between US$ 394-6,902 probably selling at a competitive price of US$ 1.01. It the same farmer was to air freight his cargo, he would have to more than double the selling price for the venture to be profitable. At US$ 2.25, the exporter would earn US$ 1,612-8,523. In Belgium one Kilo of sweetpotato shipped from South Africa costs between 1.50 and 2.25 Euro while in London a kilo of sweetpotato from Brazil costs 3 pounds.

- A network of farmers was mobilized and prepared to start exporting starting March 2003. They are currently producing for the domestic market supplying schools and hospitals (see figure below and farmers'list attached.). There is particular group of twenty farmers who are being groomed for the export trade.



- After 50 days of storage, sweetpotato samples were given to two panels to test for taste. One panel was composed of Africans, Ugandans in particular, and another was composed of Caucasians, Belgians in particular. In general, the African panel scored the sweetpotatos between Fair and Good while the Caucasians scored it higher between Good and Very Good. This is good news since the produce is intended to be marketed in Europe.
- The Caucasian testing panel from Belgium reported after-cooking discoloration on Ejumula. They expressed the desire in future to have sweetpotato that has little or no after-cooking discoloration. They also expressed the need for a manual or some form of literature showing how to prepare and cook sweetpotato. They in general advised that some extra campaign has to be done to sensitize people in Europe on sweetpotato.

Major persistent problems

- Sweetpotato is not accorded high priority by the Ministry of Agriculture implying reduced investment compared to other crops
- There is still lack of clearly differentiated market segments for quality potatoes of commercial varieties and consumers are not used to grading

- Farmers typically grow a mixture of varieties with the sector still largely being farmer-driven from a food-security perspective, not consumer-driven with commercial perspective

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Table 2. Gross margin analysis (per hectare) for a farmer in Central Uganda[1] growing improved sweetpotato varieties for domestic and export markets

ITEM	Type of markets			
	Domestic[2]		Export[3]	
	Low yields	High yields	Low yields	High yields
Yield per hectare (kg)[5]	7,000	21,000	7,000	21,000
Price per kg (Ug. Shs)	250	250	400	400
Gross output	**1,750,000**	**5,250,000**	**2,800,000**	**8,400,000**
Variable costs (Ug. Shs[4])				
1. Land preparation				
- Two rounds	200,000	200,000	200,000	200,000
- Ridging/heaping mounds	100,000	100,000	100,000	100,000
2. Planting material (60 bundles of 600 vines)	300,000	300,000	300,000	300,000
- Transporting planting material	50,000	50,000	50,000	50,000
3. Labor requirements				
- Planting 10 Man days (MD) @ Ug. Shs. 6,000	60,000	60,000	60,000	60,000
- Weeding 3 times 10 MD @ Ug.Shs. 12,000	120,000	120,000	120,000	120,000
- Harvesting, sorting, grading & packing 10 MD @ Ug.Shs. 15-30,000	150,000	450,000	300,000	900,000
Transport produce to Export Company/inland container port in Kampala @ (Ug.Shs. 50,000/ton)	350,000	1,050,000	350,000	1,050,000
Sub-total	1,330,000	2,330,000	1,480,000	2,780,000
Miscellaneous costs @ 3% of sub-total	39,900	69,900	44,400	83,400
Total variable costs	1,369,000	2,399,900	1,524,400	2,863,400
Gross margin per hectare	381,000	2,850,100	1,275,600	5,536,600
Interest 20% @ of working capital	273,800	479,980	304,880	572,680
Gross margin including interest (Ug. Shs/ha)	107,200	2,370,120	970,720	4,963,920
Gross margin including interest (US$/ha)	54	1,194	489	2,500

[1]Source, the sweetpotato Coalition project targeting Kiboga, Luweero and Mpigi districts
[2] Institutions of learning, hospitals, local and super marktes etc.
[3] Sweetpotato exported by air and sea freighting
[4] Ugandan shillings

Table 3. Gross margin analysis (per productivity from hectare) for an exporter in Kampala exporting improved sweetpotato varieties by air and sea freighting to markets in Europe

ITEM	Mode of freighting			
	Air		Sea	
	Low yields	High yields	Low yields	High yileds
Yield per hectare (kg)[5]	7,000	21,000	7,000	21,000
Price per kg (Ug. Shs) or US$2.25 for air and US$1.01	4,500	4,500	2,000	2,000
Gross output	**31,500,000**	**94,500,000**	**11,900,000**	**42,000,000**
Variable costs (Ug. Shs[4])				
1. Purchase of sweetpotato from farmers @ Ug.Shs 400/Kg	2,800,000	2,800,000	2,800,000	2,800,000
2. Purchase of packaging materials (720/2,120 waxed collugated boxes @ 2,000 Ug. Shs)	1,440,000	4,240,000	1,440,000	1,440,000
3. Travel & subsistence allowances for quality control officers monitoring quality at harvest on-farm	20,000	20,000	20,000	20,000
- Travel allowance for one officer				
- Subsistence allowance for 2 nights	100,000	100,000	100,000	100,000
Transport produce to Export market in refrigerated container to a port like Amsterdam in Northern Europe @ (Ug.Shs. 662,000/ton by sea and 2,648,000/ton by air)	18,536,000	55,608,000	4,634,000	18,536,000
Sub-total	22,896,000	62,768,000	8,994,000	22,896,000
Miscellaneous costs @ 3% of sub-total	686,880	1,883,040	269,820	686,880
Total variable costs	23,582,880	64,651,040	9,263,820	23,582,880
Gross margin per hectare	7,917,120	29,848,960	2,636,180	18,417,120
Interest 20% @ of working capital	4,716,576	12,930,208	1,852,764	4,716,576
Gross margin including interest (Ug. Shs/ha)	3,200,544	16,918,752	783,416	13,700,544
Gross margin including interest (US$/ha)	1,612	8,523	394	6,902