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FEASIBILITY STUDY

ON

UGANDA OILSEED PRODUCTION

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FEASIBILITY STUDY ON UGANDA OILSEED PRODUCTION

I. BACKGROUND

A. General

Uganda lies along the equator in eastern central Africa. It is bounded by Sudan, Kenya, Tanzania, Rwanda and Zaire, and has a total area of 241,000 square kilometers of which 197,000 are arable land and the remainder are lakes and swamps. The country's elevation is relatively high and ranges from 1,000 to 1,200 meters above sea level, and its annual rainfall varies from 700 mm to 1,500 mm per year, depending on location. These characteristics contribute to making Uganda suitable for the production of a wide variety of crops and livestock.

The estimated population of Uganda (1980) was 12.6 million, 90 percent of whom live in rural areas and are largely dependent upon agriculture for a livelihood. The current population growth is estimated to be 2.9 percent.

Only recently the country has emerged from nearly a decade of military rule during which time production facilities and infrastructure deteriorated and economic activity declined. This period culminated in a devastating War of Liberation, during which looting and destruction completed the process of deterioration started during the military regime. It is important to note that the economic decline and emergence of magendo[1/] and the Liberation War are unprecedented in recent Ugandan history and that the series of droughts, though not unprecedented, was most severe and resulted in certainly unprecedented food shortage and famine.

Coffee, cotton, tea and tobacco are the main agricultural commodities exported from the country. The value of coffee exports have remained relatively stable during the past few years, but there has been a steady decline in cotton, tea and

1/ Magendo is a Ugandan term used to describe the pervasive system of black market operations.

tobacco. The thriving black market has greatly influenced the production of cash crops, particularly cotton, in a sharply declining manner.

B. Agriculture

In 1971, Uganda had one of the highest per capita incomes in East Africa, a well-developed infrastructure and a sound economy based on agricultural exports, principally cotton, coffee, tea and tobacco. Farmer organization, marketing and agricultural processing were well developed. The particular strength of Uganda's agriculture, apart from its ample rainfall, good soils, varied elevations and generally excellent climate, is the fact that it is primarily composed of small mixed farms which are readily able to alter their resource and product mix as conditions dictate. Accurate farm size distribution data are not available, but the media farm is estimated to be about 2.5 ha.

Agricultural production in Uganda showed continuous growth from the early sixties, followed by a period of stagnation and decline after 1972 up to the present (Table 1). Output of major export crops declined significantly between 1973 and 1980. The decline in cotton production has been very sharp; cotton output in 1980 was 15,000 bales compared to 429,100 bales in 1970.

The supply of farm inputs has been wholly inadequate for the last few years and although the situation may be improving slightly, it is still sporadic. The hoe and machete (panga) are the basic tools of the Ugandan small farmer, and currently are in short supply. The use of fertilizers has been negligible since 1979, and plant protection chemicals have been only sporadically used for export cash crops such as coffee. Imports of hand tools, fertilizers, chemicals and spare parts are likely to continue to be sporadic until local manufacture can be established or resumed.

TABLE 1

CROP PRODUCTION ('000 tons)[a]

	Peak Year		1980	Ratio of 1980/Peak Production (%)
	Year	Amount	Amount	
Export Crops				
Coffee (Robusta)	1969	232.5	130.4	56.1
Coffee (Arabica)	1972	20.8	4.8	23.1
Cotton (Lint)	1970	86.4	13.3	15.4
Tobacco	1972	5.0	3.0	60.0
Tea	1973	23.1	1.5	6.5
Sugar (Raw)	1968	152.0	15.0	9.9
Food Crops				
Bananas	1975	9,107.0	5,699.0	62.6
Cassava	1977	2,993.0	2,072.0	69.2
Maize	1976	674.0	286.0	42.4
Sorghum	1975	467.0	299.0	64.0
Beans	1976	337.0	186.0	55.2
Groundnuts	1969	265.0	65.0	24.5
Finger Millets	1966	1,136.0	459.0	40.4
Sweet Potatoes	1976	2,002.0	1,200.0	59.9

a/ Note that the figures for food crops are estimates of total production, while the figures for export crops are of official purchases only. With substantial and increasing "magendo" sales during the 1970s, the fall in production of export crops is therefore overstated.

Source: World Bank Report, Uganda, Country Economic Memorandum dated March 31, 1982.

The supply of seed and planting material has also been grossly inadequate, and these are commodities which cannot be as easily imported and distributed as the inputs mentioned above. Farm seed supply is one of the most serious constraints to agricultural production at present, and one which is fully recognized by the Government. Seed production is very low and seed quality is extremely poor due to lack of research for selection and screening of improved varieties.

II. PRODUCTION OF OILSEED CROPS IN UGANDA

All of the important annual oilseed crops have been, or can be, grown in the country. These include cotton, groundnuts, sesame (sim-sim), soybeans, sunflower and castor beans. Shea butternut, a slow growing tree which is resistant to grass fires, is indigenous to the northern part of Uganda, and is the dominant tree of the savanna zone.

A. Cotton

In the past, cotton has been an extremely important cash crop in Uganda. At its peak, there were 86,000 tons of cotton produced in 1970, and it has steadily declined ever since. Cotton is predominantly grown in the annual crop zones and takes its place in a rotation with finger millet and groundnuts. In the east, land preparation is carried out with ox-drawn plows, but all subsequent work is done by hand. The main labor bottlenecks are for weeding and picking. Experiments with tractor plowing, followed by hand operations, have not led to increased areas under cultivation per family. The most urgent technical need of the farming system is the development of an efficient ox-drawn seeder which could be used for both finger millet and cotton, and of ox-drawn implements for weeding. Most of the research carried out in the past has been concentrated on three issues: earlier planting, closer spacing and increased use of spraying to control pests.

Cotton has been produced by small holders from the beginning of the industry. Cottonseed is the major oilseed in Uganda, but may be replaced with other crops such as soybeans. The areas under cotton production surpass, while not reaching, the peaks of the 1960's and 1970's (Figure 1), that of the other less important oil seeds, for example sesame and groundnuts. Prior to 1971, Uganda was a net exporter of cotton, cottonseed oil and cake. Currently, the country is a net importer of cake and edible oil. The Government is trying very hard to help rehabilitate this industry by providing subsidies to cotton growers, and facilitating the rehabilitation of non-operational oil mills.

B. Groundnuts

With the decrease in cotton production, groundnuts and sesame are now the major crops for supplying vegetable oil and fats to the diet. These are the only crops that have shown any increase in acreage and production the past two years, over that for 1970 (Figures 1, 2 and 3).

During the 1960's, considerable breeding and agronomic research work was conducted. This led to the development and release of several improved varieties of longer and shorter maturity duration, the most important being Roxo, Red Beauty and Mount Makrela Red. However, there was not much progress in breeding for disease resistance. There is an urgent need for intensified research to evaluate improved germplasm for resistance to rosette, rust, leaf spot and other disease, and also to develop improved cultural practices.

Farmers have stated that the lack of good seed is the primary reason for lack of further expansion of groundnut production. This is no doubt true in many instances, but a more likely reason is the unavailability of groundnuts which are resistant to rosette, an aphid-transmitted virus disease

Figure 1 AREA UNDER OILSEEDS IN UGANDA, 1970 & 1980

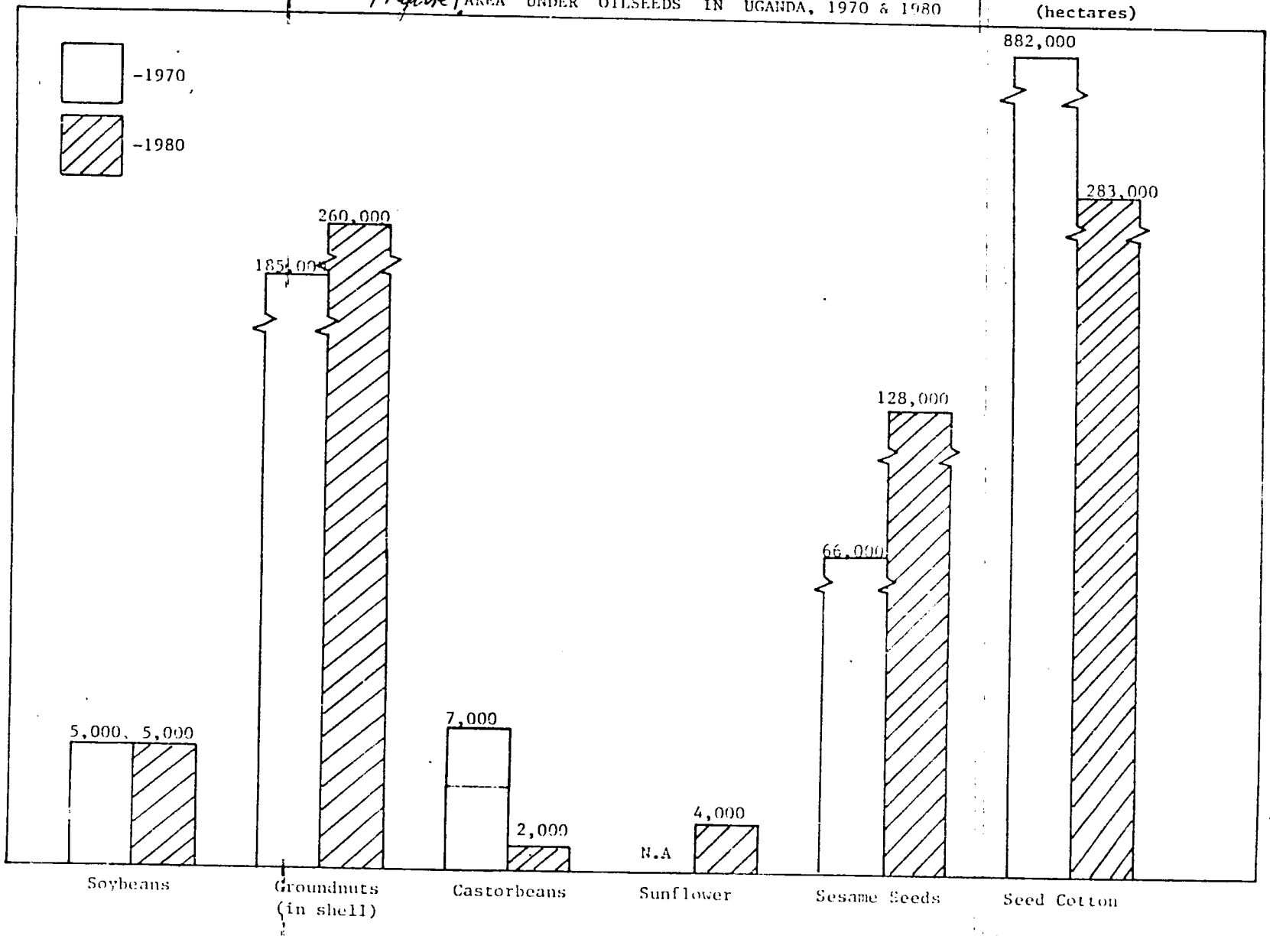

Figure 2. PRODUCTION OF OILSEEDS IN UGANDA, 1970 & 1980. (Metric tons)

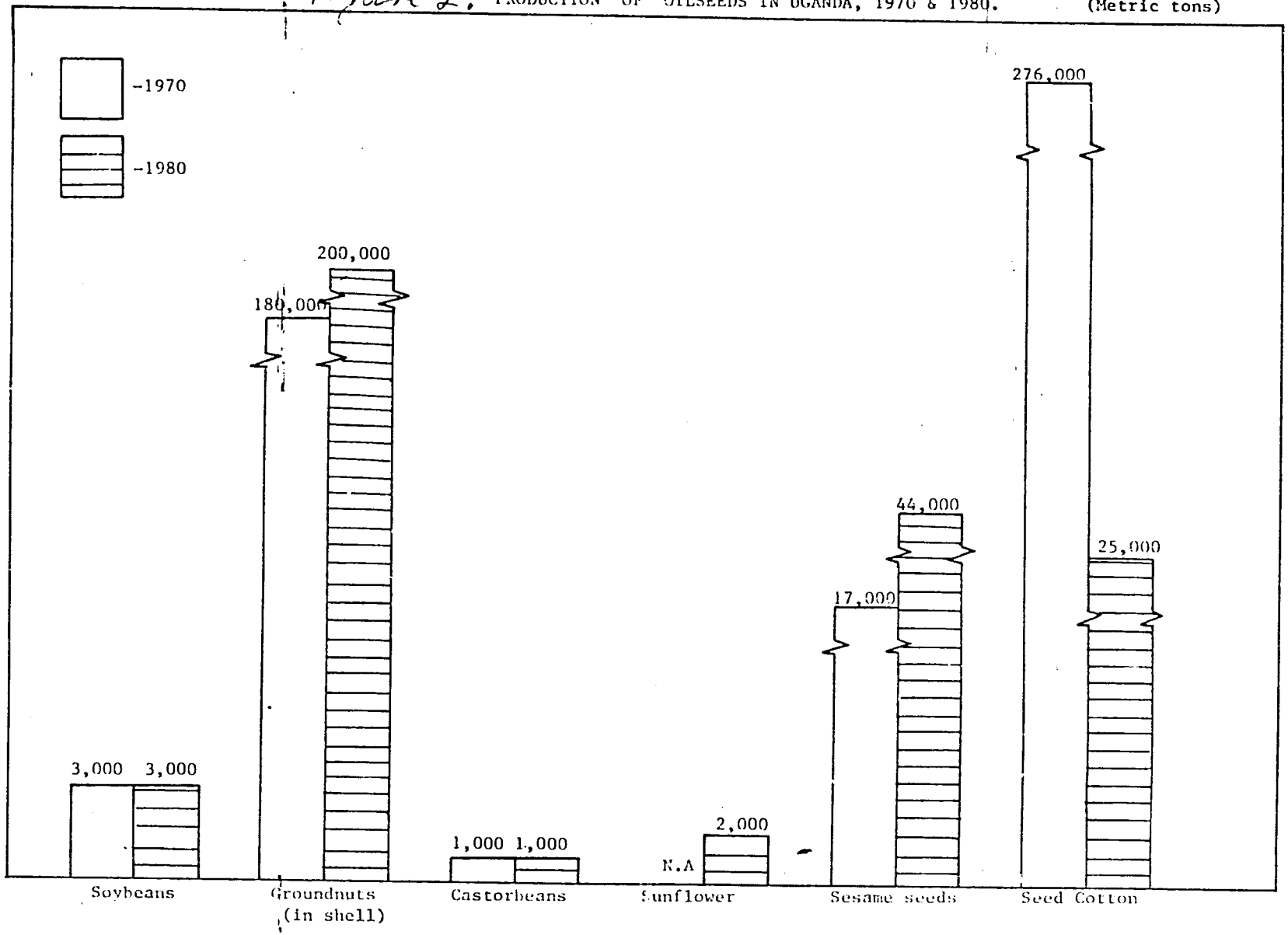

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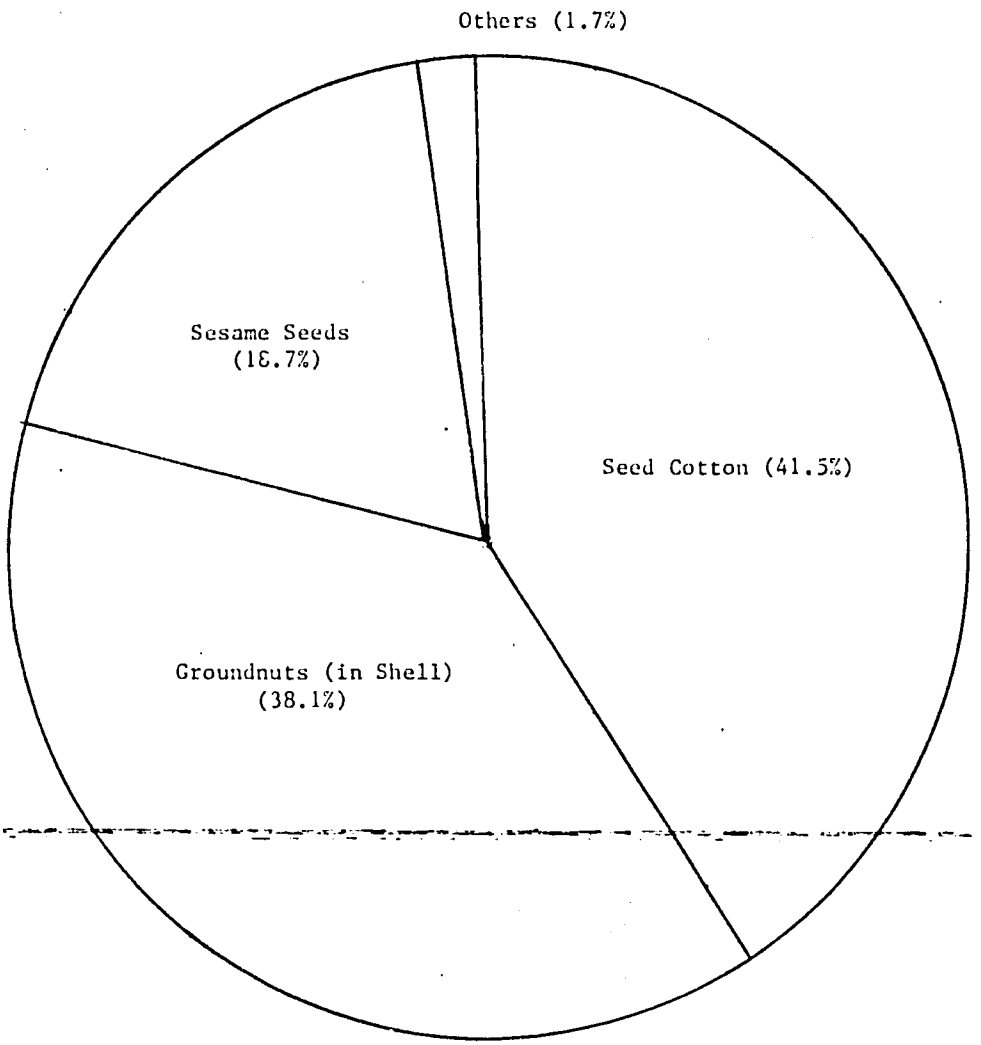
Figure 3. PIE DIAGRAM FOR ACREAGES UNDER DIFFERENT OILSEED CROPS IN UGANDA, 1980.



Notes: 1. Others (1.7%) include soybeans (0.7%), sunflower seeds (0.6%) and castor beans (0.4%).
2. This diagram does not include the acres planted with cottonseeds, and olive.

which can drastically decrease production. Early infection will even cause sterility and a complete loss of the crop. When this occurs, the farmers require new seed. Varieties which are disease resistant and agronomically acceptable are urgently needed. These can only come from the introduction of new germplasm, breeding and varietal selection. New varieties with these favorable characteristics, and improved cultural practices, could greatly benefit the farmers. Coupled with these, the relatively high market prices for groundnuts could significantly help in increasing groundnut production.

C. Sesame

Sesame has become more important in the northern and drier areas of the country.

Whole sesame seed can be used as a food crop, but in Uganda it is primarily used as a source of vegetable oil, and the cake as a source of high protein in feed. It is a relatively easy crop to produce as it requires no machinery for growth or harvest, but does require considerable hand labor for its production. Due to its seed shattering characteristics, the crop must be harvested in timely fashion and over a short period of time.

D. Soybeans

While cotton production has steadily decreased during the past decade, groundnuts and sesame have become more important crops for supplying both edible oils and fats in the diet, and cake for protein for livestock and poultry rations. As cotton faces the uncertain future with respect to the demand in world markets, there is a felt need to promote production of legumes. Their use in the crop rotation would contribute to maintaining soil fertility, and the grain is very valuable for improving the nutrition of humans and animals.

One legume crop which has been receiving more and more attention in the developing countries is soybean. Renewed interest started more than a decade ago when it was realized that the soybean was a cheap and rich source of protein to both humans and livestock. In recent years, soybeans have been providing more than a fifth of the world's fats and oils.

The soybean crop, for many years after its introduction into Uganda in 1913, was used primarily for green manure. It was not until the onset of World War II that soybean became valuable for its grain, as large quantities were needed for the army troops. There was a boom in soybean production in Uganda during the 1943-46 period. At the end of the War, the European market collapsed and, with the lack of contact with the Far East, the export market came to an end. Coupled with this lack of markets was the difficulty of incorporating soybeans into the local diets, and their relatively low yields. All of these led to a very unfavorable market situation and a consequent rapid decline in production. It appears that from 1950 onwards, that all serious experimental work was discontinued. About 15 years later, a country-wide collection of the old surviving lines was made. With this renewed interest in the crop, varieties from Tanzania and the United States were introduced and added to the collection.

Research on soybeans was carried out at the Kawanda Agricultural Research Station as well as Makerere University's Kabanyolo farm. Between 1968 and 1972, three varieties were released for seed multiplication and distribution to farmers. ~~These were: Bukalasa, 938 and Congo 72. After 1972,~~ most of the research on soybeans was discontinued, as the shortage of funds and decline in facilities prevented the continuation of the research reinitiated in 1965. The past records of soybean production in the country provides evidence for the great potential for this crop.

Soybeans and groundnuts are not new crops to Uganda farmers, and are found in many of the districts. Their production is mainly for home consumption or marketing in neighboring districts, and some groundnuts enter the export marketing channels.

Currently there is a renewed interest in soybean and groundnut production and processing. Potentially there is a great demand for vegetable oil, which at current prices is considered a luxury item for most Ugandans. Lack of foreign exchange prevents or limits the importation of many of the sorely needed agricultural inputs such as hand tools, chemicals and spare parts. In addition to these shortages, there is no source of improved seed. Agricultural research, which is so fundamental to developing improved varieties and cultural techniques, is at a virtual standstill.

E. Sunflower

Even though sunflowers have been grown in some parts of the country for several years, it has never been considered as a major oilseed crop. Its production is quite restricted to only a few areas of the country, these being in the drier regions. There is very little available data on research that has been done on sunflowers, or past production. However, there are indications that sunflowers are suitably adapted to other areas in Uganda, and through increased production it could become a major oilseed crop. Research on sunflower production should be stepped up in order to provide the data and information needed to support increased sunflower production.

III. ECONOMICS RELATED TO AGRICULTURAL PRODUCTION

The price policies of the Government during the 1970's placed farmers into a cost-price squeeze. Apart from Arabica coffee, sugar cane and finger millet all of which enjoyed positive margins (market price-cost), the margins were negative for the producers of all other crops (Table 1). However, where there were possibilities of selling the produce on the

open free market, the net return margins for all food commodities were positive.

The implications of the cost-price relationships were that farm products were officially under-priced. This situation has been a major constraint to agricultural development. In early stages of economic development, it is important to have a strong and prosperous agriculture. Industrial development can accompany agricultural development but it seldom can precede it. Ideally, agriculture structure follows a natural economic path; at low stages of development, the real price of capital is high and that of labor is low. Uganda's farming systems are labor intensive (Table 2). Size economies are small in this labor intensive agriculture, and there is no pressure towards large scale farms. Where labor is the major resource, it can be used over a diverse set of enterprises. A majority of Uganda farms are diversified accordingly, in producing both for subsistence consumption and for the market.

In this labor intensive agriculture, the farmers have a high degree of flexibility in changing the output mix. As the relative prices for such crops as cotton, tobacco tea and coffee decreased, farmers simply switched production to crops whose prices were more favorable and thereby managed to sustain their incomes.

Global demand for oilseeds, fats, oils and protein meal (cake) will expand along with increases in population and incomes. In developed industrial countries, the growth in oil consumption for food uses is expected to be more in line with population growth. In these countries, price and income elasticities of demand are low. It is in the developing countries, such as Uganda, that the consumption of edible oils is at a relatively low per capita level. In these countries, the price and income elasticities of demand for

TABLE 2

LABOR AND SEED REQUIREMENT TO PRODUCE SELECTED CROPS IN UGANDA 1975*

	Maize	Cotton	Soybeans 3/
(a) Labor, Man hrs/ha			
Seed bed preparation	259	353 1/	?
Planting	109	69	200
Weeding	350	404	300
Harvesting	218	596 2/	200
Total	1,049	1,422	
(b) Seeds			
Mkg/ha	10	10	25

1/ It also includes 155 hrs. for land clearing.

2/ It also includes 412 hrs. for thinning, spraying, sorting, marketing and uprooting stalks.

3/ Madhvani Estates estimates, October 1982.

* Planning Unit, Ministry of Agriculture and Forestry, Crop Production Costs and Returns Analysis 1975, Entebbe.

oils are high, and thus consumption of oil products is likely to increase at a faster pace.

Edible oils at current prices are a luxury to the average Ugandan, and therefore, he is not able to afford and use much in his diet. It is expected that as prices change that consumer habits will also change. One of the results could be an increase in the use of soybeans in food products.

Prior to 1971, Uganda was a net exporter of cotton, cottonseed oil and cake. At this same time, the annual production of edible oil was 18,000 metric tons; approximately 16,000 tons were used for home consumption and 2,000 tons were exported. Oil and cake were one of the major sources of foreign exchange.

During the 1971-81 period, Uganda's population has increased by over 20 percent. Thus it is estimated that the demand for oil has increased from 16,000 tons to somewhere between 20,000 and 25,000 tons. The edible oil processing capacity for 1982 is estimated to be 10,000 tons, or about one-half of the country's nutritional requirements. It is estimated that the 1982 cotton crop will produce approximately 72,000 tons of cottonseed, however, approximately 10-15 percent will be used for planting next season's crop. Therefore, if all of the remaining cottonseed were to be made available to only one mill, say Emco Oil Refineries, it would not be enough seed to meet the demand (Table 3). There is not much likelihood that cotton production in Uganda will ever approach the pre-1971 levels and, therefore, cottonseed alone could never again meet Uganda's requirements. To meet the edible oil requirements for human consumption, and the oilseed cake needs for livestock and poultry rations, Uganda must look to other oilseed crops to meet its requirements. Soybeans, groundnuts and sunflowers should be given careful consideration as alternative sources for vegetable oil and oilseed cake.

TABLE 3. Madhvani's Oil Mill Utilization with 300 Ton/Day Capacity (Metric Tons)

YEAR	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Full Capacity	80,000	80,000	80,000	80,000	80,000	80,000
Cotton Seed 1/	50,000	50,000	50,000	50,000	50,000	50,000
Soybean 2/	10,000	13,500	14,900	16,500	18,300	20,500
TOTALS	60,000	63,500	64,900	66,500	68,300	70,500
Oil Seed Needs 3/	20,000	16,500	15,100	13,500	11,700	9,500

1/ It assumes that all LMB oil mills will be rehabilitated and cotton seed production at 300,000 Tons
2/ Estimates taken from Table 4
3/ Additional tonnage needed for full capacity operation

Ugandan farmers are very similar to other farmers throughout the world in that they are flexible in the cultivation of crops, and will raise those which will produce an appreciable net economic return to them. During the 1950s and 1960s, a considerable expansion and increase in coffee production took place, mainly due to the stimulus of high coffee prices during the Korean War. The farmers quickly recognized the incentives of high returns and good access to markets, and raised coffee production substantially. During these two decades, the country as a whole did not suffer food shortages, and there was little incentive to devote much effort to food crops because any significant increases in production made them difficult to market.

With the decrease in cotton production, groundnuts and sesame are now the major crops supplying vegetable oils and fats to the diets. These are the only two oilseed crops which, during the past two years, have been grown on expanded acreages and have increased in total production.

Until groundnut varieties are introduced into Uganda which are resistant/tolerant to the ever present rosette disease, and which are adapted to native growing conditions, it is unlikely that there will be any further expansion in area and production of this crop. Unfortunately, the research in Uganda in groundnuts has come to nearly a complete standstill, and there is little expectation that research conducted within the country will be able to remove this primary constraint. However, material/germplasm which is known to be resistant and likely to be agronomically acceptable within the country, should be introduced immediately. Groundnuts are an excellent source of protein and oil for consumption in Uganda. Based on current demand and market, there is significant economic potential for groundnuts (Tables 3 and 4). There is also a large export market in neighboring countries.

TABLE 4: Projected Demand for Soybeans in Jinja-Tororo Area in Tons

YEAR	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Nuvita 1/	8,000	9,500	10,900	12,500	14,300	16,500
Madhvani 2/	2,000	4,000	4,000	4,000	4,000	4,000
South Bukedi Coop Union Tororo 3/	500	600	720	864	1,060	1,275
African Basic Foods Kampala 4/	250	300	450	600	725	800
Consumed as Food 5/	500	510	525	550	580	620
TOTALS	11,250	14,910	16,595	18,514	20,665	23,195
Acres Needed 6/	22,500	29,820	33,190	39,028	41,330	46,390
Seeds Needed (Tons) 7/	225	298.2	331.9	390.3	413.3	463.9

1/ Projection is based on Nuvita's projected needs for soybean oil meal (Appendix I)
2/ Madhvani's Feasibility Report (10)
3/ Based on personal interview and plans for a feed mill to be established in Tororo area.
4/ Projected from the Rehabilitation of the Economy of Uganda (11)
5/ An estimate
6/ A yield of 500 kg/acre is assumed
7/ Seeding rate of 10 kg/acre

Soybeans can also be produced in most parts of Uganda. With the current technology, the cost of production of soybeans is estimated to be 15 UShs per kg. Average productivity is 500 kg/acre, but yields of 800 kg/acre or more can be obtained under favorable soil and climatic conditions. In mid-October 1982, soybeans at markets in Jinja, Soroti and Lira were reported to be selling between 50 and 60 UShs per kilogram. At the same time, farmgate prices varied between 19 and 30 UShs/kg. During this same period, market prices at Kampala were: 90 to 100 UShs/kg for soybeans, 70 UShs for beans, 160 UShs for sesame, and 170 to 200 UShs/kg for groundnuts.

IV. PROCESSING FACILITIES AND MARKETING

Prior to 1971, a network of 19 edible oil factories was developed throughout the cotton growing areas of Uganda. These oil mills were mainly built to crush cottonseed and refine the oil. In addition, other oilseeds including groundnuts, sesame, soybeans, shea butternut and cashews were processed to supply the domestic market demands, and also provide an exportable supply of edible oil, soap and oilcake.

A. Lint Marketing Board Oil Mills

Presently there are 18 factories located at Jinja, Iganga, Mbale, Tororo, Soroti, Kampala, under the jurisdiction of the Lint Marketing Board. All of these mills are in a dilapidated and run down condition. Of these, only six are operating and then at only 15 to 35 percent capacity. The low level of production is primarily due to the short supply of raw materials. ~~Considering the lack of long-term maintenance and shortage of~~ spare parts, it is doubtful whether any of the mills could operate at full capacity unless considerable mechanical rehabilitation is done (Appendix II).

The Iganga Industries oilmill and soap factory is an example of the type of mill operated by the Lint Marketing Board,

built by an Asian businessman, and had a capacity to process about 15 metric tons of raw material per day, but is now operating at about 35 percent of capacity. Most of the machinery was manufactured in India, and currently much of the equipment requires spare parts and repair. At full capacity, a labor force of 450 is needed, but presently only 140 are employed. Lack of raw materials, both cottonseed and imported materials for soapmaking, was cited by the manager as the main reason for the low output. He did indicate that some raw materials for soapmaking were being imported through a loan from OPEC, and this imperta-tion will permit the manufacture of a high quality soap. The factory's products, refined cottonseed oil and soap, are marketed through the LMB. Cottonseed cake is sold to local farmers at UShs 20,000 per ton, which at Window I rates is $200 (UShs 100/$1).

Although lack of raw material, i.e. cottonseed, is cited as the main reason for low production, there are other problems. Some cotton growing areas are without any operational mills. For example, Lira, Apac and Masindi Districts do not have any oil processing facilities. With transportation facilities often lacking, and very expensive, in certain areas such as Lira, two or three years of previous cottonseed crop is still in storage awaiting processing. Also, the LMB appears to be having difficulties in organization, allocation of raw materials and their distribution.

B. Privately Operated Mills

Of the 19 existing oil mills in Uganda, the largest is Emco Oil Refineries at Kakira near Jinja. This factory began on a small scale in 1941, owned by the Madhvani Group of East Africa. The factory was expanded in 1967 when its capacity was increased to 50 tons of cottonseed per day. In 1971 the company was nationalized by the military government, and during the subsequent years was reduced to a non-functional entity by 1979 due to neglect and mismanagement.

In 1980, the management was given back to the Madhvani Group, with 51 percent equity participation retained by the Ugandan Government. The Group undertook the task of rehabilitation very seriously, and with a strenuous effort the plant was rendered marginally functional by the end of 1980. Even with the poor quality and inadequate availability of cottonseed, there was a production of 24,000 liters of oil in 1980, and about 45,000 liters in 1981.

Adjacent to the oil mill, Emco has facilities for making tin containers of various sizes for use in storing and marketing vegetable oil. At present the plant is also marginally functional due to neglect and mismanagement. One of the main problems is that none of the existing soldering machines are working, therefore all soldering has to be done by hand. If these facilities were rehabilitated, Emco could supply, not only their own requirements for containers, but also the container requirements of other mills that are presently experiencing difficulty in obtaining suitable containers. An initial supply of material (sheet tin) would most likely need to be supplied as well.

C. Cooperative Unions

The Cooperative Primary Societies and District level Cooperative Unions have been the marketing and cotton processing institutions in Uganda. The ginneries are owned and operated by the Unions which in turn sell the baled cotton and cottonseed to the LMB. It determines where the cottonseed is to be delivered, some to the Ministry of Agriculture Seed Dressing Station for next year's planting, and the remainder to nearby oil mills.

The South Bukedi Cooperative Union was recently given a non-operational oil mill for it to manage. Plans are to use the facility to produce by-products for poultry and pig feed using the oilcake from the factory, and at the same time establish a pig and poultry farm. This Union would like to diversify so

that it is not solely dependent on cotton. by purchasing other grains such as soybeans, to give their farm members an alternative cash crop. It appears that the LMB is not interested in handling oilseed crops other than cotton.

The Teso Cooperative Union in Soroti also has plans to move into oilseed processing. It has applied for the management of the Soroti Oil Mill. If approval is given, the Union would be in a position to buy and process other oilseeds such as soybeans, groundnuts, sesame and shea nuts. This Union has experienced difficulties with the LMB in that cottonseed is not allocated to the oil mill in due time, with the results of inferior quality seed and oil.

D. Feed Mill

There is only one feed mill operating in Uganda. At Jinja, Uganda Feeds Ltd. (NUVITA) produces a range of livestock and poultry feed. This mill is owned and operated by the Uganda Grain Milling Company, a conglomerate of sister companies: Uganda Millers Ltd, Bread Ltd and Uganda Maize Industries which mill wheat, produce bread and mill maize, respectively.

The feed mill has never produced more than half its annual capacity in any one year. One of the company's objectives is to produce feeds of high quality, and at the lowest possible cost, making maximum use of the locally available raw materials. Soybeans are considered an imported raw material even though NUVITA bought 1000 metric tons of soybeans from the local markets. Apparently traders/merchants bought the soybeans from farmers and then delivered them to the mill in bulk. NUVITA processed the beans into oil and cake, the former used in its baking, and the cake used in feed. It is highly significant that a quantity this great was marketed in the Busoga District. It appears that if there were a reliable market infrastructure in this district, that farmers would produce even greater quantities. Current high prices for many of the raw materials used in the

manufacture of feeds, especially those that are imported, pushes the prices to a level that is out of reach for many of the livestock producers (Appendix III). However, the poultry and dairy industries could use large quantities of feed if the prices and quality were stabilized. The feed industry is a vital one to Uganda s economy, and one which could be an important user of oilcake.

As will be noted in Appendix I, NUVITA's requirement for soybean cake has been projected to increase from 2,365 tons in 1982/83, to 4,500 tons by 1985/86. In view of the rehabilitation of the poultry industry with EEC assistance, and rehabilitation of the dairy industry with FAO assistance, requirements for soybean cake is likely to exceed NUVITA's current projections. Groundnuts are in such demand for food in Uganda and neighboring countries, that for the foreseeable future it is not likely that they can be relied upon as a source of raw material for feed.

In Table 7, production of soybean cake is projected to exceed NUVITA's requirements. Therefore, Uganda could expect to begin exporting soybean cake by 1984/85, provided an oilseed multiplication, production and processing campaign is launched in time to meet requirements, and as projected.

E. Produce Marketing Board (PMB)

The PMB was organized to be the sole marketing agent for a series of food grains and produce. Present indications are that it is generally non-operational, with the exception that it may be handling limited quantities of maize and wheat. (Based on past performance of the PMB, the team is of the opinion that the cooperatives should serve as the marketing agents for the farmers on a free market basis, i.e. based on supply and demand, returning to the farmer as much as the market will bear based on demand after a reasonable administrative and handling charge is applied.

V. POTENTIAL FOR INCREASED PRODUCTION

A. Demand for Oilseed Products

Uganda's oilseed industry has a long way to go to equal the supply of edible oil and other oilseed products produced prior to 1972. The increased population, and ailing poultry and livestock industries, needs three times as much oilseed as is currently available.

Both the functioning oil mills and feed mill are operating at only 15 to 30 percent capacities. The low rates lead to inefficiencies and marked increases in the per unit costs of processed products. One of the results of these inefficiencies is that a liter of edible oil costs up to an equivalent of U.S. $8, margarine U.S. $5 per 500 grams, and a bar of regular sized bath soap U.S. $.65.

Feed supplements, too, are increasingly difficult to obtain, and those who manage to buy them have to pay about UShs 20,000 (U.S. $200) per ton for cottonseed cake, and UShs 40,000 (U.S. $400) for a ton of soybean meal (Appendix I). Because of the high cost of feed and feed supplements (Appendix III), many farmers have ceased to use concentrates. As a result, the milk output per cow has declined appreciably, and commercial poultry enterprises have been forced out of business. The poultry producers that are still trying to "hang on" are substituting fish meal for plant protein in the poultry ration. This results in poultry meat with a fishy taste, and reduced palatability and market demand. An increase in the production/supply of oilseeds could reduce the processing cost of edible oil and the by-products, and in turn lower the prices of these products to more acceptable levels.

Interest in soybeans as a source of vegetable oil, protein for food and feed, has become a major concern of the Ministry of Agriculture and Forestry. The Report on the Reactivation of the Industrial Sector to the Ministry of Industry in

March 1981 recommended that a campaign for the production of soybeans on a commercial scale should be launched, and that licenses be granted to other businesses intending to manufacture soybean products.

B. Agronomic Potentials

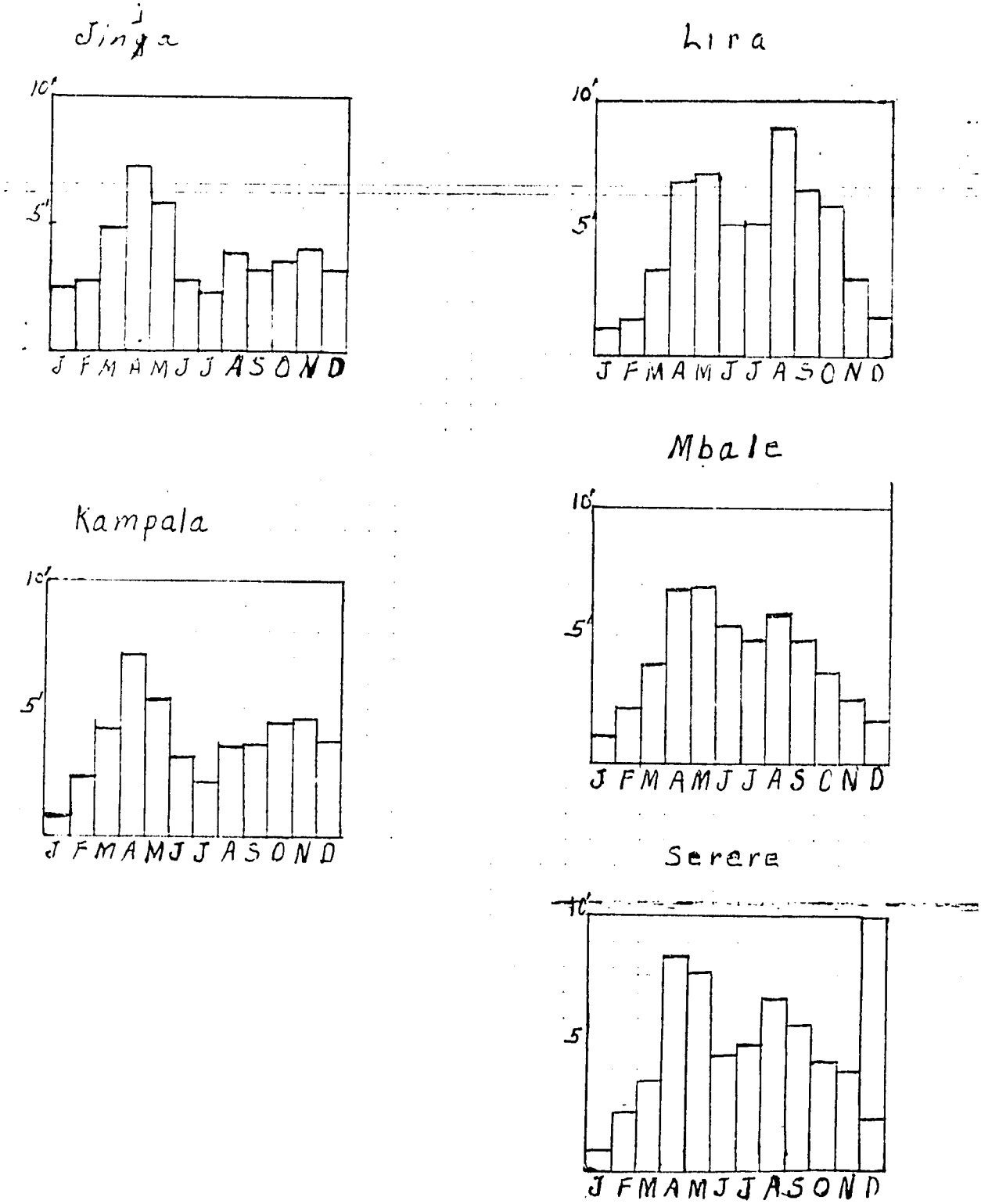
Production of two of the more important oilseed crops, soybeans and groundnuts, is largely dependent on soil type and fertility level, rainfall amounts and distribution, availability of agronomically acceptable cultivars, and a sound technical package for each crop.

Compared with the soils of most tropical areas, those found in Uganda are, on the whole, fertile. Those of the Mabira forests and the Lake Victoria crescent are among the most productive in the world, yielding two economic crops a year. Yet there are many contrasting soils in the country. The difference between the intensive agriculture of the lakeshore areas and the low productivity to the north, is related to soils as well as to rainfall patterns.

In general, most of the north has poorer soils than the south, but there are important exceptions. One of the largest continuous areas of really good soil in Africa, lies around Lake Victoria — deep, fertile, red clay loams. In the southwest, the soils are more brown than red, but only a little less fertile. The northwest has good soils, but generally those on the northern hill slopes are much lighter than those on the southern hills, and more gray or brown, giving smaller crop yields.

The distribution of crops in Uganda is mainly determined by the amount of rainfall and its distribution (Figure 4). Since the equator passes through southern Uganda, the distribution there is bimodal, with two rainy seasons from March to June and from August to November. Around the shores of Lake Victoria, the annual rainfall averages 1200-1500 mm, and is well distributed throughout the year. This is sometimes called the fertile

Fig. 4 Mean Monthly Rainfall at Selected Stations in Uganda



crescent. Farther north, the two rainy seasons merge into one, and the end of the year the dry season becomes longer and more severe. The northeast receives a lower rainfall of about 750 mm or less per year.

Only 22 percent of the land gets less than 750 mm of rainfall per year, the minimum required for productive agriculture. Seventy-two percent of the country obtains between 750 and 1250 mm of rain per year, and six percent obtains 1250 mm. Thus, whereas rainfall ranges from an annual minimum of about 375 mm in the extreme northeast to over 2000 mm on the Sese Islands, most of the country can rely on 750 mm or more in an average year.

C. Research

The brief discussion of legume crop research carried out previously in Uganda has been described above. For an increased production of oilseed crops, particularly soybeans, groundnuts and sunflowers, there must be a vigorous research program begun in the very near future. Research information will be the basis for increased production and productivity of these crops.

(1) Groundnuts

Formerly, groundnut varieties were developed, named and released to the farmers. New varieties will have to be bred and selected for suitability to the particular areas suitable for their production. Field trials in the districts where there is a potential for groundnut production should be carried out to determine the adaptability of the new material.

~~Landraces (varieties for which there is no known name),~~ collected from the different regions and parts of the country, offer considerable opportunity for finding inherited resistance to diseases and insect pests, for adaptation to specific ecological conditions of climate and soil, and for agronomic traits such as length of growing season, day length, height of plant and grain quality.

Groundnuts prefer moderate rainfall during the growing season, an abundance of sunshine and relatively high temperatures. The dates of planting, which utilize the favorable period as to the occurence of rainfall and sunshine, need to be determined. The two most critical growth periods, from the standpoint of limited rainfall, are at the time of germination and plant establishment, and again from flowering through harvest.

(2) Soybeans

Just as with groundnuts, an active research program for soybeans must be reactivated. It is unfortunate that there has been little or no research conducted on soybeans since the late 1960s.

The soybean is a member of the legume family and, when inoculated with a suitable strain of root nodule bacteria, it is capable of meeting all of its nitrogen requirements without the benefit of nitrogenous fertilizers. Early on, nitrogen-fixing bacteria which are efficient should be isolated for future increase and distribution to farmers.

Each soybean variety has a specific range of adaptation, particularly the length of day during the growing season. Unfortunately, there are relatively few varieties which are photo-period insensitive, i.e. they are relatively unaffected by the changing length of day that typified the temperate regions. Temperate zone varieties grown in the tropics flower and mature quickly without making the vegetative growth necessary for good grain yields. Certain strains or varieties are known which are not sensitive to length of day, and these should be immediately useful in a breeding and selection program in Uganda.

Ecological conditions should be given due consideration for soybean production, as combinations of high temperature and low rainfall are harmful, reducing both

productivity and oil content of the seed.

The time of planting must be taken into account, as germination is a critical period. Excess moisture or drought at that period reduces plant population, and even with subsequent favorable growing conditions, does not compensate for poor stands of crop.

VI. PROJECTIONS AND ASSUMPTIONS

A major constraint to this feasibility study has been the lack of readily available current data and information. To compensate as much as possible, the team has attempted to obtain as much information first hand as the short time-frame permitted, by contacting as many reliable sources at all levels as possible. Also, numerous reports of recent origin, e.g. World Bank report "Uganda, Country Economic Memorandum" dated March 31, 1982 and the "Uganda Agricultural Sector Assessment, USAID" dated March 12, 1982, were studied. Consequently, while not having enough data to do a more thorough economic analysis than has been done, based on information obtained the team is confident of the economic potential for a significant expansion of Uganda's oilseed production. In an attempt to illustrate this, projections have been made based on available information gained from field visits, and assumptions made based on the information and observations (Tables 5, 6, 7 and 8).

Soybean Production

As previously mentioned, the 1982 cotton crop is currently estimated to produce approximately 200,000 bales and 72,000 tons ~~of cottonseed. It is expected that at least 7,200 to 11,000~~ tons will be reserved for planting the next season crop, leaving only 61,000 to 65,000 tons available for processing into vegetable oil and cake. As seen in Table 3, Emco requirements alone exceed the supply of oilseed for processing. Assuming that all existing oilseed mills are rehabilitated, and new ones established where there are none at present, the demand for raw material for processing is likely to exceed demand for many years.

SOYBEAN PRODUCTION

Year	84/85	85/86	86/87	87/88	88/89	89/90	Cumulat. Total $ Valu
1/Projected Seed Requiement	225 T	298 T	332 T	390 T	413 T	464 T	
2/Value of Seed @ Ush 70/kg	15.75 m	20.86 m	23.24 m	27.3 m	28.91 m	32.48 m	
$ Value of Seed @ Ush 225/$1	.070	.093	.100	.121	.128	.144	
3/Net Product Value @ 65%	.046	.061	.065	.079	.083	.094	$521.6
4/Acres Planted from Seed Pr.	22,500 A	29,800 A	33,200 A	39,000 A	41,300 A	46,400 A	
5/Prod @ 500/kg Acre	11,250 T	14,900 T	16,600 T	19,500 T	20,650 T	23,200 T	
6/Farmgate Value - Ush 30	337.5 m	447.0 m	498.0 m	585.0 m	619.5 m	696.0 m	
7/Prod. Cost @ Ush 15/kg	168.75 m	223.5 m	249.0 m	292.5 m	306.25 m	348.0 m	
Net to Farmers	168.75 m	223.5 m	249.0 m	292.5 m	306.25 m	348.0 m	
$ Value @ Ush 225/$1	.750	.993	1.106 m	1.300 m	1.361 m	1.547 m	$7,057
Average Net Value/Acre	$33.00	$33.00	$33.00	$33.00	$33.00	$34.00	

1/Projected seed requirement by outgrowers is based on projections in Table 4.

2/Value of seed for planting is based on GOU price structure for soybean seeds at Masindi Seed Multiplication Center.

3/Net Value of Product assumes Ush 15/kg for production cost and Ush 9.5/kg for seed cleanding, drying, processing and storage costs.

4/Acres planted is estimated at 10 kg of seed per acre from tons of seed produced.

5/Production level used is based on information obtained on field visits and is believed to be conservative

6/Ush 30 per kg is used as the farmgate price as this was the price paid to producers by Emco Oil Refinerie in the Jinja area. Soybeans were selling on the Jinja market at Ush 60 per kg, and African Basic Foods paid Ush 37-40 per kg for soybeans in October 1982.

7/Ush 15 per kg is used as the production costs, although based on information obtained on field visits, th may be as low as Ush 10/k. Production costs includes cost of seed, production and harvest labor. No fertilizer or pesticides are used; therefore, cost of these inputs are not included.

TABLE 6

VEGETABLE OIL PRODUCTION

SOYBEAN

'ear	84/85	85/86	86/87	87/88	88/89	89/90	Cumulative Total
.cres planted from sd/prod	22,500	29,800	33,200	39,000	41,300	46,400	
'rod @ 500 kg/acre - tons	11,250	14,900	16,600	19,500	20,650	23,200	
'ons oil extracted @ 15%	1,688	2,235	2,490	2,925	3,098	3,480	
; incr prod over prv yr	-	32.4	11.4	17.45	5.9	12.35	
'alue of oil at Ush 550/liter - Constant	928.4 m	1.23 b	1.37 b	1.61 b	1.70 b	1.91 b	
et prod Value @ 65%	623.46 m	691.2 m	890.5 m	1.05 b	1.10 b	1.24 b	
Value @ Ush 225/$1-Const.	2.77 m	3.072 m	3.957 m	4.666 m	4.888 m	5.511 m	
'alue @ reduced price as prod increases	623.46 m	607.4 m	599.6 m	581.5 m	579.6 m	570.7 m	
Value @ Ush 225/$1-Decr.	2.77 m	2.70 m	2.66 m	2.58 m	2.58 m	2.54 m	15.83 m

reas planted are based on projections in Table 3 and Table 4, i.e. total tons seed produced and lanting rate at 10 kg seed per acre.

ons of oil produced at 15% extraction rate is believed conservative, and is used because of the ondition of the oil mills. Emco Oil Refineries extraction rate ranges from 15 - 19 %

n converting tons of oil to liters of oil, one kilogram is used as one liter.

et Product Value of 65% was obtained from Final Feasibility Report for the Rehabilitation of Emco Oil efineries Ltd, Kakira, Uganda.

urrent price of vegetable oil on the market ranges from Ush 550 to 800 per liter, and is affordable by an lite few. It is assumed that as production increases, prices will decline, and vegetable oil becomes more ffordable to steadily increasing numbers. It is assumed, for projection purposes, prices will decrease in irect proportion to increased production, percentagewise.

husly:

85/86	86/87	87/88	88/89	89/90
32.4	11.4	17.45	5.9	12.35

of Increased Production Over Previous Year: Prices are reduced cumulatively, using the percentage of in-reased production each year.

TABLE 7

MEAL/CAKE PRODUCTION
SOYBEAN

Year	84/85	85/86	86/87	87/88	88/89	89/90	Cumulati Total
1/ Acres planted from sd/prod	22,500	29,800	33,200	39,000	41,300	46,400	
Prod @ 500 kg/acre - tons	11,250	14,900	16,600	19,500	20,650	23,200	
2/ Cake prod @ 85% of sd/prod	9,563	12,665	14,110	16,500	17,553	19,720	
3/ Value @ Ush 20,000 T-Constant	191.2 m	253.3 m	282.2 m	330.0 m	351.1 m	390.4 m	
$ Value @ Ush 225/$1-Constant	.850 m	1.126 m	1.254 m	1.467 m	1.560 m	1.735 m	
4/ Value @ reduced price as production increases	191.2 m	201.4 m	215.5 m	208.9 m	208.2 m	205.0 m	
4/ $ Value @ Ush 225/$1-Decr.	.850 m	.895 m	.958 m	.928 m	.925 m	.911 m	$5.467

1/ Acres planted are based on projections of total seed produced contained in Table 5 and Table 6.

2/ Projection of cake produced at 85% of total seed production is based on 15% oil extraction and no waste after extraction.

3/ Value of cake/meal at Ush 20,000 ton is based on present import price of Ush 40,000 ($400) per ton/paid by Nuvita Feed Mill. Inland freight from port of Mombasa to JinjA IS $200/ton. Under present economic conditions in Uganda, price of domestically produced soybean cake/meal could easily start off at about Ush 30,000/ton and still result in significant savings to the feed mill and farmers. Therefore, projections using Ush 20,000/ton are considered conservative. _/at Window I rates. i.e. Ush 100/$1

4/ The price of soybean cake/meal is expected to decrease as production of soybeans increases. This decrease is projected to be in direct proportion to increased production. percentagewise, and is cumulative as illustrated below:

	85/86	86/87	87/88	88/89	89/90
The % of incr prod over prev yr	32.4	11.4	17.45	5.9	12.35

Prices are reduced cumulatively using the percentage of increased production each year.

TABLE 8

SEED MULTIPLICATION AND PRODUCTION
GROUNDNUT

Year	84/85	85/86	86/87	87/88	88/89	89/90	Cumulative Value
1/ Projected Sd Prod - Tons	500	575	650	725	800	875	
2/ Value of Sd @ Ush 100/kg	50.0 m	57.5 m	65.0 m	72.5 m	80.0 m	87.5 m	
$ Value of Sd @ Ush 225/kg	.222	.255	.288	.322	.355	.388	
3/ Net Product Value @ 65%	.144	.166	.187	.209	.231	.252	$1.189 m
Acres Planted from Sd Prod	5000	5750	6500	7250	8000	8750	
4/ Prod @ 1000 kg/acre - tons	5000	5750	6500	7250	8000	8750	
5/ Farmgate Value - Ush 100/kg	500.0 m	575.0 m	650.0 m	725.0 m	800.0 m	875.0 m	
6/ Prod Cost @ Ush 23.6/kg	1.180 m	1.357 m	1.534 m	1.711 m	1.888 m	2.065 m	
7/ Net to Farmers	498.[illegible] m	573.6 m	648.5 m	723.3 m	798.1 m	872.9 m	
8/ $ Value @ Ush 225/$1	2.22 m	2.55 m	2.88 m	3.215 m	3.546 m	3.88 m	$18,291 m
Average Net Value/acre - $	444	444	444	444	444	444	

1/ Projected seed production is based on a supply of 50 tons certified seed for multiplication planted at a sseding rate of 100 kg an acre. It is projected that acres planted for seed multiplication will increase by about 75 acres per year during LOP. Production is estimated at 1000 kg/acre.

2/ Seed value is based on GOU price structure for groundnut seeds, which is believed to be subsidized.

3/ Net Product Value assumes Ush 35/kg for production, processing, storage and handling costs.

4/ According to MOA, varieties resistant to Rosette disease will multiply itself about 10 times, i.e. for each kilogram of seed planted will produce 10 kilograms of groundnuts.

5/ Retail prices in Kampala vary from Ush 200 to as high as Ush 400 per kilogram, depending on which market the groundnuts are bought. It is assumed, as in the case of soybeans, the farmgate price is one-half the retail price.

(Continued on next page)

TABLE 8. (Continued)

6/ From the field, it was learned that production cost for soybeans was Ush 15/kg, including costs of seed which calculates at Ush 1.4 per kilogram of soybeans produced, leaving the balance of Ush 13.6 per kilogram for labor and other costs. Production costs for groundnut is calculated in this same way, assuming that labor and other costs for groundnuts is about the same as for soybeans, i.e. Ush 13.6 for labor and other costs, plus Ush 10 per kilogram of groundnuts produced, or a total of about Ush 23.6/kg.

7/ It is assumed that farmgate prices will remain constant during LOP, as projected increase in production is not expected to meet domestic and export demand.

8/ Window I exchange rate had reached Ush 100/$1 when Window II opened at Ush 300/$1 in August 1982. It is expected that the Ugandan shilling will find its real value at I Ush 225-250/$1 in the near future; therefore, Ush 225/$1 has been used in conversion.

In view of the fact that groundnuts are in such demand as a human food in Uganda and neighboring countries, and in view of the fact there is deficit production in both Uganda and Kenya, it is not believed likely that groundnuts will be available for processing into oil and cake in the foreseeable future. Therefore, other oilseeds will have to be looked to for meeting the vegetable oil and other by-product requirements.

Since the team is recommending implementing the oilseed program on a pilot project basis, concentrated in the Jinja-Tororo areas, projections focus on the potential in those areas only, for what is expected to be needed to implement the program and what is expected to be accomplished.

As less information is known about sunflower production in Uganda, and since there seems to be less historical interest in sunflower, the team is of the opinion that a quicker impact can be achieved if the program is first implemented with a primary focus on soybean and groundnut production. This does not mean to discount the future potential for sunflower as a source of vegetable oil and by-products. Sunflower production can, and probably will, be added to the program later as additional information and data relevant to its production in Uganda is obtained. Therefore projections contained in Tables 3 - 8 are based on soybeans and groundnuts only.

As illustrated in Table 4, it is projected that in 1983/84 there will be a need for at least 11,250 tons of soybean seed for processing in the Jinja-Tororo area. This demand is projected to increase to 23,195 tons by 1988/89, assuming that oil mills in the area will be rehabilitated and capable of operating closer to peak capacity, and that GOU with donor assistance is successful in rehabilitation of the poultry and livestock industries. Based on production of 500 kg/acre, it is projected that to produce tonnage needed, 22,500 acres will need to be planted, mainly by small farmers, in the first year, and this will need to increase to 46,390 acres by the sixth year (Table 4). Therefore the first year's seed requirements is projected at 225 tons based on a seeding rate of 10 kg/acre (Tables 4 and 5).

The team is doubtful that 225 tons of soybean seed adapted to Uganda's agronomic and ecological conditions can be located for import. Therefore, the team is recommending that four and one-half tons of certified soybean seed varieties that are adapted to Ugand be identified and imported for multiplication. This would be sufficient quantity to plant 450 acres, which in turn is projected to produce 225 tons of seed that could be planted by the small farmers (outgrowers). It is at this point that projections contained in Table 5 begins. The tons of seed required each year are based on projected production requirements in Table 4.

The first four lines in Table 5 pertain to seed multiplication only. An attempt is made to project the net economic benefits that would likely accrue to someone investing in production of certified seed. In Table 5, it will be noted that certified seed available for sale to the farmer is valued at Ush 70/kg. This is GOU price and is believed to be subsidized. It will be noted that in Table 5 the cumulative total net product value is projected at $521,600 for the six-year period, and the estimated capital requrement for seed multiplication purposes is given in Appendix IV as $838,686 (this includes crop production and harvest equipment as well as equipment needed to process and handle certified seed), which is a negative cost/benefit ratio for this particular activity. In looking at the overall cost/benefit ratio of the total oilseed package of 1:8.76, it is clearly evident that certified soybean seed is considerably under-priced. However, if price of seed to the farmer is to be increased, then the farmgate price of the soybean produced by the farmer will also have to be increased significantly. While this may price soybeans out of the market, consumer-wise, for the short and/or medium term, it would permit the farmer to share in the overall economic benefits on a more equitable basis. It also should stimulate a more rapid expansion of acreage in soybean production, and shorten the time for the supply of soybeans to meet requirements.

As indicated in Table 5, it is assumed that the 225 tons of soybean seed produced will be planted on 22,500 acres by small farmers. The farmers' production cost is estimated at Ush 15/kg. This estimate is based on soybean production cost on the Madhvani estate for Emco Oil Refineries which is stated as being Ush 10/kg, using a combination of capital intensive (land preparation and ~~cultivation with tractors) and labor intensive~~ methodologies (planting, harvesting and threshing by hand labor). It is assumed that small farmers will likely use more labor intensive methodologies, and therefore production cost is likely to be higher, even though much of the labor on the small farms is likely to be family labor. No fertilizer or pesticides are used, therefore production cost estimates do not include these costs. Farmgate value of soybeans used in Table 5 is Ush 30/kg. This is the price Emco Oil Refineries recently paid to farmers in the Jinja area for soybeans for processing into oil and cake. It should be noted, however, that elsewhere in this paper it is stated that NUVITA purchased 1,000 tons of soybeans through a middleman who paid the farmers only Ush 19/kg. The team considers this an artificially low price based on prices of soybeans elsewhere, and was a result of farmers lacking market information.

In Tables 5 - 8, Uganda shillings are converted at the rate of Ush 225/$1. While it is not known for certain what the rate of exchange will be at which the shilling finds its real value, it is thought by many that it will finally stabilize at a rate of about Ush 225-250/$1.

Vegetable Oil Production

Table 6 focuses entirely on projected vegetable oil production from soybeans. Projections do not include vegetable oil production from other oilseed crops such as groundnuts or cottonseed. As stated previously, it is not expected that groudnuts will be available for production into vegetable oil in significant quantities any time in the foreseeable future. Cottonseed was also not included as there was a need to isolate the

potential economic benefits possible from soybean production. In Table 6, oil extraction rate of 15% is used; however, at Emco Oil Refineries the extraction rate ranges from 15 to 19%. Because of the condition of their equipment. Efficiency should improve when the equipment is rehabilitated. All oil mills in Uganda use the extrusion method for oil extraction; therefore, significant quantities of oil is left in the cake.

The value of oil is projected at Ush 550/liter, while the real market price ranges up to Ush 800/liter. Net value product is estimated at 65% of gross value produc This percentage factor was obtained from a feasibility study on rehabilitating Emco Oil Refineries on the Madhvani estate. It is believed to be realistic under good management. The team recognizes that management and production efficiency at other maills may not meet the standards at Emco; therefore, net product value projected in Table 6 should be considered as potential, and not necessarily what actually will be. However, it should be reasonable to expect production efficiency at other mills to be close to that at Emco, once the mills are rehabilitated.

Table 6 reflects decreasing prices for vegetable oil as production of soybeans increases (See footnote No. 5, Table 6). Since increased level of production during the life of the project is not likely to meet projected domestic requirements, this may be whishful thinking on the part of the team. However, it seems logical that since presently only an elit few can afford vegetable oil at its current prices, as production increased to the point of surpassing that demand and absorption rate, stocks will begin to back up, thus pushing prices down to prices affordable at the next economic class level.

Soybean Meal/Cake Production

While perhaps the main focus in conceptualizing the oilseed multiplication, production and processing program was meeting basic human needs and improving human nutrition by increased production of oilseeds and supply of vegetable oil and soap at

Prices more reasonably affordable to a larger number of people, the value of soybean meal/cake produced is also very significant when looking at the economic benefits of meal/cake production alone (Table 7). However, if the spin-off benefits derived from increasing soybean meal/cake production resulting in improved/increased poultry and livestock production and improved human nutrition from a higher level of consumption of poultry and livestock products, the economic benefits would be even more significant.

In Table 7, meal/cake produced is projected at 85% of soybeans produced and processed into vegetable oil. The percentage fac tor of 85 is arrived at by assuming that as oil is extracted at the rate of 15%, there is no waste, and whatever is left is meal/cake. If oil extraction efficiency is improved, the amount of meal/cake produced will decrease, percentagewise.

It should be noted that in Table 7 the value of soybean meal/cake is projected at Ush 20,000/ton based on an import price of $400/ton paid by NUVITA. Of the $400/ton, approximately $200/ton is estimated as inland freight cost. Many of the agricultural inputs are imported at Window I rates (Ush 100/$1); Therefore, Window I rate is used in this conversion and projection.

As in the case of vegetable oil, it is assumed and projected that as production and supply of meal/cake increases, the price of meal/cake will decrease. For projection purposes it is assumed that prices will decrease in direct proportion to the percent of increased production, and the decrease in price will be cumulative.

Groundnut Seed Multiplication and Production

As previously mentioned, the demand for goundnuts as a human food in Uganda and neighboring countries is such that it is doubtful that groundnuts can be relied on as a source of raw material to be processed into vegetable oil and meal/cake in the foreseeable future.

Groundnut production has declined in recent years (Table 1) due to a lack, mainly, of varieties resistant to rosette and bacterial leaf wilt, lack of a source of seed with high viability, and the slow multiplication and high seed cost. For these reasons, it was not thought necessary to project requirements. This is because of the slow multiplication rate (one kg of seed planted = 10 kg production), the logistic constraints brought about by a high seeding rate (100 kg/acre), and the limited expansion of production that can reasonable be expected to be accomplished under the project during the life of the project. Therefore, it is not expected that domestic market demand will likely be met for a number of years.

Due to the scarcity of sizeable quantities of groundnut seed that is resistant to rosette and bacterial leaf wilt, and the high freight costs of importing large quantities of seed, the team is basing its projections on the assumption that an initial supply of fifty tons of groundnut seed that is resistant to rosette can be located and imported for multiplication purposes. Thus, projections in Table 8 are based on the import of this initial fifty tons to planted at a seeding rate of 100 kg/acre. This would result in 500 acres of groundnuts being produced for seed multiplication purposes the first crop season. Acreage in seed multiplication is projected to increase at 75 acrea each year during the life of the project.

The value of seed multiplied for farmers to plant is projected at Ush 100/kg (line 2 of Table 8), which is GOU groundnut seed price. This is thought to be highly subsidized in view of retail prices that were found to range from Ush 200 to 400/kg. And, it is thought that farmgate prices are about Ush 100/kg. Production is estimated to be about 1000 kg/acre. Net product value for certified seed produced, processed and ready for sale to the farmer, is estimated to be 65% of the gross value.

Production cost is estimated to be approximately Ush 23.6/kg. It is believed that production cost for groundnuts is about the same as it is for soybeans, with the main variable being the difference in seed costs. Therefore, if cost of producing soybeans is Ush 15/kg (cost of 1 kg seed to produce 50 kg soybeans is Ush 1.4/kg, which leaves Ush 13.6/kg of soybeans for labor), then the cost of 1 kg of groundnut seed to produce 10 kg of groundnuts is Ush 23.6/kg (Ush 13.6 for labor plus Ush 10 for seed).

Lint Marketing Board (LMB)

As indicated previously in this paper, the management, and ultimately the operation of the oil mills, are basically under the control of the LMB. The LMB has been making allocations of seed to the various mills that are operating, and has been primarily responsible for transporting seed from the cotton gins to the mills for processing. A major constraint that currently exists is the lack of transportation. At the present time the LMB is down to only four trucks that are operable. This has caused cottonseed to back up in storage in some places, while at the same time constraining oil production at some of the mills.

Recently LMB has turned over two oil mills to two cooperatives, and it has been indicated by LMB that managers of those and other mills are now free to obtain oilseed for processing from wherever they can and/or want. Therefore, the team is assuming that, in the future, those oil mill managers that are efficient in their operation will have the opportunity to obtain seed required at their mills for processing more on a free market basis, thereby increasing production at their respective mills.

The team is of the opinion that efficiency of oilseed processing would improve significantly if the operation of more of the oil mills were turned over to individual cooperative and/or private entrpreneurs.

VII. SUMMARY OF IMPLEMENTATION

Seed Multiplication - Soybeans

Soybean seed will be procured by USAID for seed multiplication purposes. USAID will also procure the farming equipment and the seed processing equipment needed in the production of certified seed. The soybeans will be multiplied by the Madhvani estate under the direction and supervision of their agronomist. The seed thus multiplied will then be sold to outgrowers by the Cooperatives.

It is likely that Emco Oil Refineries and other oil mills will sign contracts with individual cooperative societies or district cooperatives for so many tons of soybean for processing into oil and meal/cake. These cooperatives would, most likely, in turn sign contracts with individual cooperative members to produce soybeans. The number of contracts signed would depend on projected requirements, projected production, availability of certified seed on a timely basis, and interest on the part of the cooperatives and the individual farmers. The cooperatives would be responsible for collecting the oil seeds and delivering them to the mills for the mills to process.

Seed Multiplication - Groundnuts

Groundnuts will be multiplied at Makerere University's College of Agriculture Kabanyolo farm on about 200 acres, another 300 acres perhaps by an individual cooperative or on private sector land. USAID will procure the seed for this purpose, and also the farming equipment and handling equipment. Certified seed produced through this multiplication process will be marketed to producers through the cooperative infrastructure.

Outgrower Production and Marketing

The team is of the opinion that a production campaign for groundnuts is not required because the Ugandan farmers have traditionally grown groundnuts for many years, and groundnuts are

a major food crop. It is believed that if disease resistant seed of good quality are made readily available to the farmers, and they are made aware of this availability, they will buy the seed and produce.

As the farmers produce a surplus of groundnuts, the cooperatives should buy the surplus from the farmers. Thus the surplus would be collected and either marketed in areas of deficit production, or areas of high demand, and/or exported to neighboring countries to earn foreign exchange. It is likely, however, that demand in areas of production will be such that there will be little movement within the market infrastructure any time soon.

Production Campaign for Soybeans

The Ministry of Agriculture and Forestry, and the Ministry of Cooperatives and Marketing, will launch intensified in-service training programs, with USAID assistance, for the purpose of training their staff at the district level, who in turn train field staff, who then will train the farmers in soybean production methods and the economic advantages of growing soybeans.

USAID will provide technical assistance in the form of a project advisor, short term consultancies, materials for making training aids (flip charts, posters, and handouts), vehicles, motorcycles and bicycles for project transportation purposes.

VIII. RECOMMENDATIONS

Based on field studies and discussions with professional agronomists, district agricultural officers, managers of cooperatives, Ministry of Agriculture and Forestry staff, and lay people, there is a lot of interest in increasing oilseed production in Uganda. Economic projections and analysis indicate a significant potential for economic benefit (Cost/Benefit Ratio of 1:8.76) from an expanded and intensified oilseed multiplication and production program. The Ministry of Agriculture and Forestry, in cooperation with the Church of Uganda (a nationwide religious organization

that is engaged in rehabilitation and development activities), have been encouraging soybean production among small farmers in the Jinja area. Those involved with this program indicate that while presently only about ± 2,000 acres of soybean are being grown in the program area, there is a lot of interest among the farmers, and if there were enough good seed available, it would be relatively easy to increase acreage to about 10,000 acres in that area alone. Also, some of the oil mill managers have said that farmers in their area are also interested in producing soybeans, and the mill managers would like to have a source of soybeans for processing.

While cotton production is increasing, and cottonseed will again be a major source of vegetable oil, cotton production levels are not expected to reach past peak levels; therefore, cottonseed alone will not meet domestic requirements for oil and by-products in the future. If domestic requirements are to be met, and potential export markets developed, production of other oilseed crops will need to be drastically expanded. Therefore, the following recommendations are made:

A. Oil Seed Multiplication Scheme

An oilseed multiplication scheme should be established that is based mainly in the private sector, with private firms already engaged in agricultural production, and that have the required technical expertise needed for seed production and processing. By basing the scheme in the private sector, the success of the scheme would then not be dependant on government budget allocations and the bureaucratic process.

~~A seed multiplication scheme for soybean should be established~~ on Madhvani Sugar Ltd. land (Kakira) near Jinja, and a groundnut seed multiplication scheme should be established at a location to be determined later, perhaps on Makerere College of Agriculture farm. Sufficient acreage is available at Kakira to plant as many acres as are needed by farmers in the Jinja-Tororo-Kampala areas to supply soybean for the oilseed crushing mills, feed mills and

the soybean and soya products factory in Kampala. The Madhvani management is willing to plant up to 4000 acres of soybean seed for both oil processing and seed multiplication. They have two farm managers (agronomists) to supervise all operations from planting, weeding, roguing, cultivating, harvesting and threshing of soybean to meet the immediate expansion acreage expected from the launching of a vegetable oilseed program

Storage bins and warehouse facilities are available to receive field-run seed and for storing the seed after processing. Technical training programs are available to instruct technicians in roguing the growing crop, and also for running germination and purity tests on the cleaned seed. If the seed is unsuitable for planting for some reason, it could be processed into oil in the company oilseed mill.

Seed produced by Madhvani Internation S.A. should be made available to cooperatives for distribution to farmers. All seed distributed to the farmer should be treated with a non-toxic fugicide. This is especially true if plantings are made after the beginning of first rains.

Sufficient farming equipment and seed processing, handling and storage equipment should be provided at both the soybean multiplication and groundnut multiplication sites. Recommended equipment and its estimated costs is given in Appendix IV. This equipment should be provided as "credit in kind" to be repaid over a reasonable period of time agreed to by all parties and officials of GOU and USAID. Funds so generated, in repayment for equipment, would be deposited into a special acccount jointly agreed upon by USAID and GOU.

Research and extension activities started losing momentum beginning with the early 70s, and is currently almost non-existant. There have been no new varieties of oilseeds released since about 1975, and there has been no field testing since that time. Foundation seed of the last varieties released (such as KAB-I) have, for all practical purposes, been lost.

Sources of suitable disease resistant varieties of soybean and groundnut seed should be identified and imported for testing and multiplication purposes. Davis and Forest varieties of soybean that are produced in the southern part of the U.S., and have proven successful in initial tests conducted here in Uganda, might be a potential source. Amount of seed required, and estimated cost, is given in Appendix IV.

In order to sustain a viable seed multiplication program, it is essential that research, plant breeding and testing activities be reactivated. Much of this work was done in the past by the Makerere University College of Agriculture at the college farm. It is strongly recommended that assistance be provided to Makerere to reactivate these support activities. This assistance should also include the necessary equipment for Makerere to multiply goundnut seed. Equipment needed and estimated cost is given in Appendix IV. Cost of seed and equipment would be amortized over a period of time from revenue earned from groundnut seed multiplication, and funds would be deposited into the special account.

B. Outgrower Production Program

In conjunction with the oilseed multiplication scheme, an outgrower production program should be initiated to stimulate increased production of oilseed crops, especially in areas near oilseed processing mills such as at Jinja and Tororo. The Madhvani's have indicated that, while they are ready to devote approximately 4000 acres of their sugarcane estate to soybean production in support of their oilseed mill enterprise, they do not want to do this for the long term, but would rather that small farmers supply their oilseed requirements. Therefore, the Madhvani's are interested in increasing production among small farmers in the immediate area, and have indicated a willingness to assist in such an effort.

In addition, officials of the Ministries of Agriculture and Forestry, and Cooperatives and Marketing have also expressed interest in increasing oilseed production in support of better nutrition among the people, and revival of Uganda's poultry and animal industries. Therefore, in the case of an outgrower program, staff of these Ministries should play a very important role in farmer education and training, and in marketing of inputs and production.

The outgrower program should be concentrated initially on a pilot basis in the Jinja and Tororo areas where there is already considerable interest among farmers in those areas, and also because there are several oilseed processing mills, and a feed mill, that are already operating. Locating production near the processing facilities would help to hold down transport costs. After the program becomes firmly established in this area, it should be expanded to other suitable areas.

An active training program to train agriculture extension field officers, district cooperative officers and farmers on production technology and various aspects of the program should be launched before the first crop season that multiplied seed becomes available. This training should be timed/scheduled so that extension field officers and cooperative officers would have to organize and implement farmer training immediately after they, themselves, had received training. The farmer training should be timed/scheduled so that training would be completed just a few days before planting season starts. In this way, newly gained knowledge would be put to immediate use before it is forgotten over time.

Estimated number of days required for each type of training, number of people trained and costs are given in Appendix IV.

C. Price Incentives

As has been pointed out and illustrated in other sections of this study, The Ugandan farmers are very responsive to prices that provide them a satisfactory return for their efforts. Therefore,

if production of oilseed is to increase, the farmer must be assured of an adequate return from the beginning and continuing thereafter. To achieve this, the following is recommended:

(1) The Government continues to allow oilseeds to sell on a free market, with prices fluctuating according to supply and demand.

(2) That a market information service be organised and initiated by the Ministries of Agriculture and Forestry, and Cooperatives and Marketing to keep the farmers in all oilseed producing areas informed of demand and current prices.

(3) That a contract be signed with outgrowers that are interested in participating in oilseed production in sufficient time before each crop season, that guarantees the participating farmers a fair and equitable return on investment. It is believed that the farmer should receive a greater share of the economic value of the product than is currently the case.

(4) That oil mills, especially in the areas of major oilseed production be rehabilitated to insure that as farmers produce, there is a ready and adequate market for their product. Estimated funding for this purpose is given in Appendix IV. Spare parts necessary to rehabilitate these mills would be provided as "credit in kind" and funds to cover such cost would be deposited in the special account.

D. Technical Assistance

Considerable effort will be required to implement an oilseed multiplication and production program. It is recommended that USAID provide a project manager to provide assistance in coordination and re-activation of oilseed research, the seed multiplication program and the outgrower production program.

Other consultants such as oilseed mill specialist, plant breeders and agronomist, and perhaps entomologist and plant pathologist, will be needed on a short term basis. Estimated funding requirements for this purpose are given in Appendix IV.

E. Transportation

A key element to the success of an oilseed production campaign will be mobility for those responsible for implementing and supervising such a program. For this reason it is recommended that adequate transportation be provided by the project. Estimated transport requirements and costs are given in Appendix IV.

APPENDIX I. UGANDA FEEDS LIMITED, PO BOX 605 - JINJA

1.0 SITE:

The plant is situated on Tobacco Road Plot 1-7, Jinja. Close to the same site are two sister companies belonging to the Uganda Grain Milling Company Limited, namely Uganda Millers Limited and Bread Limited, who are wheat miller and bread bakers, respectively. Another sister company is Uganda Maize Industries, situated at Kawempe-Kampala.

2.0 PRESENT STATUS:

2.1 PRODUCTION CAPACITY:

According to the history of the factory, it has never produced more than half its annual capacity in any one year. Past production figures are as follows in tons per year:

1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78
25,737.1	24,693	22,473	13,921	10,747	9,685	8,453

1978/79	1979/80
4,712	4,716

Note: The production year begins with August and ends with July of the following year. Thus from August 1980 to November 1980 the production so far is 1,800 tons.

This feed mill is capable of producing 10 tons/hour, thus the full capacity per year is 60,000 tons (see Appendix I-a).

Although for 1980/81 we budgeted for 25% production capacity, we are currently producing at about 10% capacity. According to our budget for 1980/81, we require the following raw materials for the year:

	Raw Material Locally Available	Quantity in Metric tons/annum	Approx. Value UShs
1.	Maize	4,500.0	45,000,000
2.	Pollard	650.0	650,000
3.	Wheat Bran	1,000.0	1,000,000
4.	Maize Bran	2,000.0	2,000,000
5.	Molasses	500.0	2,500,000
6.	Cotton Seed Cake	880.0	1,760,000
7.	Common Salt	50.0	150,000
	Sub Total	9,580.0	53,060,000
	Imported		
8.	Barley	2,250.0	4,500,000
9.	Soyabean meal	1,125.0	4,500,000
10.	Fish meal	700.0	7,000,000
11.	Meat and Bone meal	700.0	7,000,000

12.	Dicalcium Phosphate	275.0	275,000
13.	Sunflower cake	500.0	1,000,000
14.	Limestone (Feed grade)	100.0	100,000
15.	Vitamineral Premixes	50.0	1,100,000
	Sub Total	5,700.0	25,475,000
	Grand Total	15,280.0	78,535,000

It should be noted that since we expected to import barley, soyabean meal, fishmeal, meat and bone meal, sunflower cake, dicalcium phosphate and Vitamineral premixes, the amount of foreign exchange required is the equivalent of 25,475,000 UShs, approximately.

2.2 RAW MATERIALS

Existing stocks in storage are likely to take us for another two months on the average.

Raw materials already paid for and expected soon are:

a) 160 tons sunflower cake - from Kenya
b) 15 tons Vitamineral premixes - from Pfizer Kenya
c) 10 tons Dicalcium phosphate - from Pfizer Kenya
d) 100 tons Dicalcium phosphate - from West Germany

There are a number of local raw materials available but the current market prices are extremely prohibitive as exemplified below:

Raw Material	Price/kg UShs
Maize	20
Sorghum	15
Cassava	15
Molasses	8
Cotton seed cake	4
Soyabeans (White)	35
Nkejje (Haplochromis) (Fish meal)	80

2.3 PACKING MATERIAL:

The finished product is packed both in 20 kg bags (paper) and 70 kg bags (jute). At this moment the supply of both has run out and our main supplier, Tororo Jute Bags and Hessian Mills is currently closed. We may, therefore, be forced to import jute bags to take us through 1981 worth approximately 1.5 million UShs in foreign exchange.

2.4 SPARE PARTS

The machines are in good condition but the following spare parts are required as a matter of urgency:

Type of Spares	Value
a) Multi-motor panel (Allen West)	USHs 100,000
b) 100 H.P. Grinder motor	100,000
c) Cubing Plant Spares	110,000
d) Molasses pumping equipment	50,000
	USHs 360,000

3.0 STRATEGY:

3.1 OBJECTIVES:

a) Our main objective is to produce feeds of high quality at the lowest possible cost making maximum use of the locally available raw materials.

b) To ensure that local feed stuffs are available and in sufficient quantitites at reasonable prices.

3.2 TARGET:

See section 2.1 for the budget for 1980/81. We expect an annual increase in production of 10-20% if the recommendations below are met:

a) The low production level of the factory is mainly due to shortage of raw materials especially the imported ones. An immediate allocation of foreign exchange to import raw materials to the tune of 25,475,000 USHs is necessary, not only to increase production but will create a substantial drop in cost price of the finished product.

b) The correct gauge of demand is the population of livestock and poultry in the country which actually consume the feeds. Veterinary Department should regularly be in touch with the factory not only to supply animal population census figures but also to make projections in numbers of animals are matched by corresponding increases in feeds production to sustain increased demand.

c) Projects should be started to increase production of local feed stuffs especially those which are foreign exchange saving either on Veterinary Department farms/ranches or through the Ministry of Agriculture and Forestry or directly with private enterpreneurs with assistance from government. In this respect the following are possibilities:

c) Continued.

i) Projects to be instituted for the growing of the following crops: Maize, Cassava, Soyabeans, Cotton. Nuvita on its part in the short-run intends to give incentives to competent private farmers for example getting them fertilizers, pesticides and other chemicals, etc. and purchasing their products.

~~ii) Rehabilitation of the Soroti Meat Packers factory~~ which will in turn supply Uganda Feeds Limited with meat and bone meal.

iii) Either rehabilitation of Tufmac for processing of fish meal and/or assistance be given to Uganda Feeds Limited to start a fishmeal processing plant on its premises on the shores of Lake Victoria near Jinja Town. It should be noted that Lake Victoria is heavily populated with various types of fish of which Nkejje (Haplochromis) is about 80%.

iv) Exploitation of the mineral limestone (Calcium Carbonate) discovered in Western Uganda near Kasese and said to be suitable for feeding animals.

v) Establish a quality control laboratory in the long-run for the factory.

d) Construction of storage silos and/or Warehouses at the factory premises is very much required in the next 2-3 years.

e) Transport: Three 10-ton trucks are required immediately to ease our transport problems.

(Signed)

UGANDA FEEDS LIMITED

APPENDIX I-a. (Page 5)

A. Summary of quantities (in tons) required per year at an annual growth rate of 15% in production.

Raw Material Locally Available	1981/82	1982/83	1983/84	1984/85	1985/86
1. Maize	7,200	9,900	12,600	15,300	18,000
2. Pollard	1,040	1,430	1,820	2,210	2,600
3. Wheat Bran	1,600	2,200	2,800	3,400	4,000
4. Maize Bran	2,600	4,125	5,250	6,375	7,500
5. Molasses	800	1,100	1,400	1,700	2,000
6. Cotton seed Cake	1,390	1,975	2,440	2,965	3,500
7. Common Salt	80	110	140	170	200
Sub Total	15,110	20,840	26,450	32,120	37,800
Imported:					
8. Barley	3,600	4,950	6,300	7,650	9,000
9. Soyabean Meal	1,720	2,365	3,010	3,655	4,500
10. Fishmeal	1,120	1,540	1,960	2,380	2,800
11. Meat & Bone Meal	1,120	1,540	1,960	2,380	2,800
12. Dicalcium Phosphate	440	605	770	935	1,100
13. Sunflower Cake	640	880	1,120	1,360	2,000
14. Limestone (Feed grade)	160	220	280	340	400
15. Vitamineral Premixes	80	110	140	170	200
Sub Total	8,880	12,210	15,540	18,870	22,800
Grand Total	23,990	33,050	41,990	50,990	60,600

B. Packing Materials

Jute Bags	340,000	470,000	590,000	720,000	850,000

C. Spares: as in Section 2.4 but also the normal consumable spares. e.g. bearings, V-belts, etc.

D. Experts: We shall require experts in feed manufacturing machinery during the rehabilitation period to assist us in over-hauling and up-dating our machinery.

E. Fellowships: Fellowships in the following field may be necessary for Uganda Tanda staff:

i) Management
ii) Nutrition/animal Feed Technology
iii) Feedstuffs storage

APPENDIX I-b. (Page 6)

Summary of Costs/Investment. (Note that the annual increase in production is 15%)

A. Raw Material Locally Available	Value in Million UShs 1981/82	1982/83	1983/84	1984/85	1985/86
1. Maize	72.0	99.0	126.0	153.0	180.0
2. Pollard	1.0	1.5	1.4	2.2	2.6
3. Wheat Bran	1.6	2.2	2.8	3.4	4.0
4. Maize Bran	3.0	4.2	5.3	6.4	7.5
5. Molasses	4.0	5.5	7.0	8.5	10.0
6. Cottonseed Cake	3.0	4.0	5.0	6.0	7.0
7. Common Salt	0.4	0.6	0.7	0.9	1.0
Sub Total	85.0	117.0	148.6	180.4	212.1
Imported					
8. Barley	7.2	9.9	12.6	15.	18.0
9. Soyabean meal	7.0	9.5	12.0	14.5	18.0
10. Fishmeal	11.2	15.4	19.6	23.8	28.0
11. Meat & Bone Meal	11.2	14.3	19.6	23.8	28.0
12. Dicalcium Phosphate	0.4	0.6	0.7	1.0	1.1
13. Sunflower Cake	2.0	2.7	5.6	6.8	10.0
14. Limestone (Feed grade)	0.3	0.5	0.6	0.7	0.8
15. Vitamineral Premixes	1.8	2.4	3.4	3.7	4.4
Sub Total	41.1	56.4	73.8	89.9	108.3
Grand Total	126.1	173.4	222.4	270.2	320.4
B. Packing Materials	4.0	5.6	7.0	8.4	10.2
C. Spares	0.9	0.5	0.5	0.5	0.5

DATE July 8, 1982

memorandum

REPLY TO ATTN OF Olavi Salminen, Mechanical Engineer
Life Ministry, Kampala

SUBJECT Assessment of Conditions of Oil Seed Processing Mills in Jinja, Busembatia, Tororo and Mbale

TO Mr. Willie Cook, Agricultural Development Officer
USAID/Kampala

Mr. C. B. Bagira, Secretary
Lint Marketing Board

The following trip report covers visits to oil seed processing mills at above listed locations:

June 29, 1982 - 1145. Departed Lint Marketing Board with Messrs Martin Mutyaba and Jack P.K. Batema (both of the Lint Marketing Board). The driver was Suleiman Muwanda of the USAID Mission. Mr. Mutyaba followed us to Jinja and left us there.

1415. Arrived at the first mill in Jinja, Iganga Industries. The Manager, Mr. Kayimba, was occupied so we looked around on our own. We went through the oil section which works in one shift. The oil seed is mainly processed from cotton seed.

Mechanical conditions of Iganga Industries, the oil seed section: In the Delinter section were five delinters (Indian construction) and none of them was running. The main reason being that the screw-transporter to which the delinters supplied the seed did not work. The bearings were worn out and the houses probably stolen. Because of the expensive cost for local spares, they have to wait for bearings and houses ordered from abroad.

The fan, delivering the seed from the screw to the Feeding Platform was out of order. It has never been opened. Probably the starter for the electrical motor is spoiled or the fan full of dirt.

On the Feeding Platform a man manually feeds the seed into two Decorticators (grinders). One was not running because the starter (Star Delta Switch) of the electrical motor was spoiled.

There were 10 expellers in the Expeller Room and 7 of them were working, the main fault, again, were the starters. Some of them probably had been stolen. The expellers are fed by hand.

There were three boilers with two of them working. The injector was cut of order on the first boiler and is not available in Uganda. The water supplying pump was leaking because

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of weak gaskets. One steam valve was badly leaking. I was told they had gaskets available.

The second boiler was from an old locomotive. The fire bars last less than three years. The water pump was out of order. Too old? The water supply was arranged by an injector. The third boiler was under construction since 1975 and left aside during Amin's time. It was delivered from Kenya. The boilers had a water cooling tank with two pumps but were not running ~~just now. There is a lack of raw material~~ (cotton seed). ~~There was nothing going on in the workshop. In the Refinery~~ section some steam valves were leaking. They were not old. New valves are already in Kampala. Repairing the valves would take a long time so they want to replace them. The pipelines were without "By-Pass" lines around the valves so they have to stop the steam supply while removing the valves. It was a Double Refinery.

The filter hulls in the oil filtering machine were of the wrong dimension. The filtering lasts up to 6 hours instead of 20 minutes. The elements are not available in Uganda.

The process meters were out of order in the vacuum system and the pipes partially rusted but it worked somehow.

1615. We met the Manager, Mr. Kayimba, who gave us information about the mill's capacity (oil section).

1. The mill is currently operating with one shift. Its capacity is 3.2 tons double refined oil in two weeks.

2. Assuming adequate supply of raw material the mill is capable of operating at 80% of total capacity.

3. Right now the mill's capacity is 40% because of lack of raw material (cotton seed).

4. The mill can, with adjustment, process oil seed such as soybean and sunflower.

5. At present the mill does not have soap making raw material. It lacks spare parts for the automatic soap making machinery. However, spare parts have been ordered.

6. There is no evidence of repair/rehabilitation of the mill taking place.

7. Spare parts have to be ordered from abroad because of high local costs.

8. Raw material is needed for soap making (caustic soda and coconut oil). There are 4000 drums (800 tons) of tallow for soap making in storage now.

We finished our discussions at 1700.

June 30, 1982

0910. We started in the Processing Room of the soap section of Iganga Industries. The steam pipes to the tanks for tallow, caustic soda and coconut oil were completely without insulation. The main pipes were old and several fittings were leaking. The pan for hand made soap was leaking. The main soap pump was working but to ensure no down periods, it should have available spare parts but doesn't. The pump supplying the reserve tank was very old. The bearing house had been welded once. This section was sensitive because there were no spare parts. A breakdown would stop the whole soap making process.

The Automatic Soap Plant has not been running since February because of lack of raw material and no spare parts. The automatic soap cutter was without spare belts. Some contactors in the control table for the weather unit (for drying soap) were broken and one electrical motor in the weather unit was burnt. It had already been moved from its original place in the unit.

The automatic plant came from Italy and the spares should be ordered from there but the mill cannot afford to order them.

There was a lack of chemicals and apparatus in the Laboratory.

The Spare Store had mainly spares for expellers. It was lacking tools, belts, bearings, spares for the automatic plant and electrical spares (starters and rewinding wires).

Mr. Godrey Mpalaka (Chemist) gave us the information about the capacity of Iganda Industries, Soap Making Section.

1. The capacity is 2 tons a shift (working in one shift).
2. They could work in 3 shifts if raw material was available.
3. There is a present a lack of raw material.
4. The factory has an automatic soap plant but it is not running due to lack of raw material. Consequently rehabilitation is not necessary. Their biggest problem is lack of spares. They have enough workers but no raw material (caustic soda and coconut oil).

We finished our discussion at 1025.

Comments (for both sections)

Machines run until they break. The bearings are not lubricated regularly. The gaskets in valves and pumps should be checked more often. There are many leakings in the pipe fittings. The starters for the electrical motors are very old. Some housing for the bearings and starters have probably been stolen.

1035. We arrived at the O.K. Oil Mill in Jinja.

This mill is strictly controlled by the government. At present they don't have raw material. The workers were sitting down and the doors to each section were locked. We spent an hour trying to find the policeman who had the keys. Finally he appeared and we started going through the mill.

In the Tin Plant there were machines for making three different kinds of oil tins. One bigger and one smaller size of square tins and one size of round tins. The sheets used now were from Holland but most were from Japan. They were 0.3 mm thick and delivered in the sizes 580 x 780mm for top and bottom of the tins and 480 x 790 mm for sides. The sheet waste was about 5%. Most of the machines were from Germany and India. There was one machine for cutting the bottom and the top for the bigger tins and one for pressing the profile in them. The profile was not deep enough. The pressing part needs to be replaced. There were two machines for pressing the edges together. One did not press tight enough. The spares were lacking.

The Flanging Machine did not adjust the height of the tin satisfactorily. There was a lack of spares.

The two seaming machines, fitting the bottom and the top to the sides, were working but the rolls and the center plate were worn.

There were also seven old-fashioned pressing machines (Indian) with one common electric driving motor but they were not running because the starter was broken.

The tin plant is working in one shift.

Capacity: 2000 bigger square tins/day
2500 smaller square tins/day
500 round tins/day

The round tins are not common.

The tins were tightened around the edges by soldering to make sure they would not leak.

The battery room for production of hardening ghee (hydrogen) has not been working properly since 1974 because the water distiller is out of order and because of lack of raw material.

One of the two compressors for the hydrogen tank was not running because the pistons or the valves were worn out.

The generator for the batteries was working except for the gas compressor.

In the cold room the compressors were working but leaking ammonia so the room was not in operation.

There was one steam pump out of order in the refinery (it lacked spare pistons and packings). One pump was without a motor. One soap stock pump has not worked since 1977.

The neutralizer/bleacher/deodorizer system is cleaned every two months. The filtering machines were working. The neutralizer was working in the ghee refinery although some pipes were leaking. The electrical motor was switched on by hand because the starter was broken. They lacked palm oil for ghee processing. The second bleacher pump was leaking badly and needs new gaskets. Some pipe flanges were leaking badly. The pump, from the converter supplying the filtering machine, did not work because it missed asbestos ropes. New filter cloths are needed.

In the laboratory they need chemicals and apparatus. In the electrical workshop they had a steam engine-driven generator which is not running because of lacking commutator brushes. In the control board several switches are missing.

They asked for a lot of tools (such as megatesters, speedometers, screwdrivers, socket sets, spanners, etc.). They were also missing motor bearings and winding wires.

The soap factory was working manually, the soap stock a by-product of cotton seed. The soap stock was just neutralized by caustic soda. The soap stock dryer has too small a fan for working satisfactorily.

The expeller rooms:

Part One: There was one decorticator (grinder) and 7 expellers. Four of the expellers missed starters, probably stolen. They also lacked motors and flatbelts. The decorticator in itself was o.k. but it missed the starter. Three expellers could be run.

Part Two: The electrical motor for the decorticator was lacking. There were 8 expellers. Four could be run and four expeller motors were missing the starter coils.

The Boilers: There were four boilers and two of them working. Mainly they had problems with the fire bars. They last for less than three years. One boiler had leaking steam pipes. Three of the four water supply pumps were out of order, mainly lacking pistons and gaskets.

The boilers use a recirculating water system. Two pumps were connected to the water cooling pool. The system was running.

The mechanical workshop also wanted a lot of tools such as tool box, rings, fix spanner, box spanner, screwdrivers, hack-saw frames, etc.

The welding generator was working. They wanted new wires and gas for the cylinders.

~~In the spare store (for the workshop) were pipe fitting sets.~~

The manager, Mr. Kayimba, gave the following information about the O.K. Oil Mill:

1. The mill is not currently working.

2. The oil section is now capable of operating for only 25% of total capacity assuming adequate supply of raw material.

3. The mill lacks raw material (cotton seed) and spare parts.

4. The mill can process, with adjustments, oil seed such as soybean and sunflower.

5. It has a manual soap factory which is not running due to lack of raw material (caustic soda).

6. No repairs or rehabilitation is now taking place.

7. Mainly the mill has electrical and mechanical problems. Spare parts are lacking.

8. If the electrical generator is used then efficient operating is possible. The mill can be working in three shifts if raw material is supplied on a continuing basis. The raw material should be there after one week and then the mill can start working.

We finished our discussions at 1700.

Comments: ~~The oil expellers were lubricated regularly and~~ kept in good shape. The serious problem was that a lot of starters and electrical spares were missing (or were stolen).

July 1, 1982

Busembatia Oil Mill & Refinery

0830. Arrived at mill. Met the manager, Mr. Michael Byantalo, who gave us the following information:

1. The mill is currently operating in one shift and with a low capacity. The oil production is 400 x 18 KG containers per two weeks. The oil is double refined. They get 4-5 tins of 18 KG oil from one ton of cotton seed. That means 8% oil from the seed. The cotton seed from Northern Uganda gives 10%.

2. With full capacity of three shifts they are able to crush 30 tons of cotton seed/day. Now they are working in one shift crushing 10 tons/day.

3. The capacity is low because they have not enough raw material.

4. The mill can process oil seed such as soybean and sunflower.

5. They are planning to extend the refinery for soap making. They are getting the soap stock as a byproduct from the cotton seed.

6. No evidence of repair/rehabilitation of the mill is taking place now.

7. They are missing raw material (cotton seed). Spare parts are ordered. The soap making equipment is under construction locally. The workshop is not working at all. The tin plant was destroyed. The general problem is transport. They have no lorry at all.

Mechanical conditions:

There are two boilers in a larger and smaller size. They are Fire-Tube type of English construction and both working well although very old dating from 1952 and 1948. One steampump supplied water to both of the boilers. The pump was working but leaking due to lack of steam ropes. The larger boiler was missing tubes. The leaking pipes had been welded (closed). The main steam valve was leaking as was a steam pipe fitting. The pipe insulation was thin. The second steampump for the water supply was used for spare parts. Lack of steamropes and pipes.

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The smaller boiler had no insulating around the steam pipes. A very old steam engine was driving 9 of the 12 expellers. The engine, an English one, dated from 1942 but was working well. The maintenance was good although it needs new piston rings and steamropes. The problem is they can't get new rings for such an old machine. A huge flatbelt was used in the transmission over to the expellers. It is difficult to get that type of belt. One very old pump supplied the water for the whole of the recirculating system. It was leaking and lacked gaskets. There had been three pumps in the recirculating system but now only one because of lack of motors. Three pools cooled the water.

There was one decorticator and three rotary screens in the decorticating section. Two screens were not running. The motors needed rewinding. The decorticator was running but seed is escaping because the grinding plates were worn out. New ones were obtained locally. The bearing houses needed replacing (40 years old).

The steam engine driven expellers in the expeller room were working well; however there is a problem with the large driving flatbelt. How to get a spare belt? The separate flatbelts for each expeller would cost 900 shillings a foot in Kampala.

Some steampipes to the expellers were leaking (in the fittings). It's hard to get bearing spares to the old expellers (40 years old).

Some pressure meters were not working. The three electrical motor driven expellers were without motors. They needed rewinding as did the two motors for he cake cutters.

The third electrical motor driven expeller needed a new kettler (a container in which to boil liquids) and a driving shaft.

A large petrol engine was used for driving the refinery (this was kept clean). The piston rings should be replaced. A small petrol engine starts the big one. The small one was very old and needed to be replaced but there was one for spares. The refinery was running well. They get a lot of soap stock and plan to add soapmaking equipment. There were two filtering machines. Some clothes needed replacing.

The vacuum system is cleaned every three years and is working properly. One steam driven pump lacked steamropes and the steam pipes had no insulation.

The laboratory had neither chemicals nor apparatus.

The tinning section had only three manually working seaming machines and two were broken.

The spare store was in fairly good shape. They had bearing houses, bearings, expeller parts but no flatbelts.

The workshop was down.

A common steam engine for driving all the machines was put aside in 1976 and an electrical motor put in. It is now missing the electrical motor. The workshop needs 5 electrical motors and ~~full rehabilitation. They have no tools and no gas in the cylinders. Old steel machine parts could be sold for remelting in the~~ steel industry. Winding wires for the electrical motors are needed.

We finished at 1040.

Comment: The best maintenance and cleanest industry so far.

Tororo Oil Mill

1220. Arrived and first met the Assistant Manager, Mr. Calistus Leonara Onyango who gave us the following information:

The Oil Section:

1. The mill is currently working with reduced capacity. They are crushing 5 tons of cotton seed/shift. Working on one shift.

2. With three shift work it is capable of operating up to 75% of total capacity assuming adequate supply of raw material. The lack of raw material causes the reduced capacity.

3. The mill can process oil seed such as soya beans and sunflower.

4. The mill has manually working soap making equipment but it is not working because of lack of raw material and spare parts.

5. No repair/rehabilitation is taking place.

~~6. Spare parts and raw material are needed.~~

The Soap Factory: (Manual) - Mechanical Conditions:

This is the largest in the country. The entire raw material store place was empty (space for 6000 tons). The water supply is from groundwater and pumped to a store tank. The tank was leaking.

There were three production rooms. The two soapboiling pans missed motors as did the mixing pan for coconut oil. Two starters were missing.

The pump supplied both the soapfactor and the oil mill from the caustic soda tank. The soapfactor produces sodium silicate and supplies it to other mills.

12.50. Met the Manager, Mr. John Mutasa. He gave us the following information about the capacity in the Soap Section:

1. While the factory is running it breaks down about once a week due to lack of raw material. The soap stock is from cotton seed. The capacity is 800 bars/week on one shift.

2. If raw material is continuously supplied they can do 500,000 cartons per year. 1 carton = 8 bars.

3. The capacity is reduced because of lack of raw material.

4. At present there is no repair/rehabilitation.

5. Electrical spares are especially needed. Motors (rewinded) and starters are needed. Winding wires are needed for the electrical motors. If raw material is supplied the factory could be continuously operating.

1430. Started going through the oil section.

The Delinter Section

The six delinters stopped in 1972. The motors need rewinding and several starters were lacking. Motors were missing from the two screw transporters. The fan supplying the seed to the decorticator was missing. The decorticator was running but the grinding plates were worn out. Local plates last only a short time. Longer lasting plates could be obtained from abroad (Britain).

Expeller Room

There were five expellers, two from India and three from Britain. They were 40 years old. It is difficult to get spares. Two expellers were running. Two expeller motors needed rewinding. One expeller had trouble with the feeding. The starters for expeller 2, 3 and 4 were without spares.

~~The refinery was not working because the pump supplying the crude~~ oil through the filter to the refinery was broken. This refinery is a semirefinery. The refining filters were working but lacking clothes. Steam valves and fittings were leaking and gaskets needed replacing.

The Boiler

There was one boiler (from 1950) and it was working. The steampipes were insulated quite well. The boiler was a watertube type and the water supplied by an injector. There was an old pump used before and it lacked spares.

Workshop

The lathe was without a motor. The welding generator was without brushes. The drill machine worked. They had some secondhand spares in the workshop. All the spares in the store were second-hand.

The Laboratory

They used the laboratory in Iganga Industries.

The Main Store

They had some new expeller spare parts, some bearings and one flatbelt.

We finished at 1535.

Comment: The soap factory is one of the largest in the country but it is lacking raw material. The large store for raw material was empty (space for 6000 tons). The mill needed a lot of electrical spares, especially winding wires for rewinding the electrical motors.

July 2,1982

New Alliance and New Budaka in Mbale

0910. Arrived at New Budaka (late because of flat tire). We met the manager, Mr. Balaza, and the manager of New Alliance, Mr. Wamimbi. The factories are located close together so the managers shared the same office building.

Mr. Balaza gave us the following information on New Budaka:

~~Oil Section~~

1. The oil section is not working at all. They are lacking raw material and electrical motors.

2. The mill can process oil seed such as soybean and sunflower.

3. The soap factory is manual.

4. One repairing is going on. The caustic soda tank in the soap factory was placed under ground. It must have been leaking although it is vulcanized inside. The soda has been corroding this area so the wall is cracking. They are now digging up the tank. It would be better to place the tank above the ground and especially pay attention at the vulcanizing of the tank inside. (My comment).

5. They need raw material and winding wires (for the electrical motors). Also they are lacking filter cloths and tools for the workshop.

Soap Factory

1. The capacity is now low with one shift working. They produce 960 bars/month, only 2% of the total capacity.

2. They can operate up to 90% of the total capacity assuming adequate supply of raw material. (Then would work two shifts).

3. The capacity is low because of the lack of raw material and electrical spares (winding wires for the electrical motors).

Mechanical Conditions of Budaka Oil section:

There were plenty of store rooms for the cotton seed. They did have two decorticators. One of them has been moved to Tororo.

Expeller Room No. 1:

There were 6 expellers but all the electrical motors were missing. The motors needed rewinding. The coils were removed from the starters.

Expeller Room No. 2:

There were 3 expellers. The expellers were o.k. but all the starters for the electrical motors and one motor were missing.

The Refinery: (Double refined oil

The refinery stopped in 1977.

The neutralizer was missing the motor. The steam pipes were in good shape. Some filter cloths were lacking. The crude oil pump was broken. The deodorizer had earlier been using a separate boiler but later on had been connected to the main boilers. One electrical motor driving two oil pumps was missing the flatbelt.

The Boilers

There were three boilers and one was working. The first boiler, not working, was placed outside. The rainwater had flushed off most of the insulation on the boiler so it used much husk for heating up. It missed one water level glass.

The second boiler (also not working) was placed inside. The roof was leaking and it missed a part of the insulation. The first and second boilers had a recirculating water system. There was one water cooling pool and a tank placed high above the ground feeding the boilers. The electrical motor for the pump, supplying cooled water to the tank, missed driving belts.

Only the third boiler was working and it was connected to the soap factory. The boiler missed one level glass and some steam ropes. The fire bars were o.k. The steam pipes were missing insulation. The boiler was supplied with water from the town. The water was led to a separate cooling tank and injected into the boiler.

The Packing Room

There were three manually working packing machines. The shaft was not moving in the first machine. A flatbelt was missing in the second. The third packing machine was working.

The Processing Room

The caustic soda pump missed gaskets and the caustic soda tank was being repaired (the pump and the tank were located outside). The two soap boiling pans were running well. The mixing pan needed new bearings.

New Alliance Mill

Mr. Wamimbi gave the following information on the mill:

The mill has only an oil section.

1. The mill is currently operating at a low capacity, 33% of total capacity. With one shift it is crushing 120-150 tons cotton seed/month.

2. The mill is capable of operating up to 70% of total capacity assuming adequate supply of raw material.

3. The mill can process oil seed such as soybean and sunflower.

4. It does not have soap making equipment (New Budaka makes the soap).

5. There is no evidence of repair/rehabilitation taking place now or at any time before our visit.

6. Mainly they are lacking filter cloths, winding wires for the electrical motors and tools for the workshop.

Mechanical Conditions

The mill had neither delinters nor decorticators. There was one dust screen and it ran very well. The cyclone was leaking through the maintenance door.

The Expeller Room

There were two expellers for the flour and three expellers for the cake. One cake expeller motor needed rewinding. One steam-pipe in a cake expeller was leaking a bit. Mainly the expellers were in good shape.

The workshop had some secondhand spares but it lacked tools and winding wires.

The Refinery (Semi-refined oil)

The refinery was not working. The crude oil pump motor needed rewinding. Filter cloths were lacking and the bleacher vacuum system was not working.

The Boilers

The boilers were two and one was working. The working boiler had a leaking release valve. The steam pipes lacked some insulation. The boiler not working missed the release valve and one of the level glasses. The boilers had a separate water cooling tank. The water was supplied from the town. From the tank the water was pumped and injected into the boilers.

The Spare Store (For New Alliance and New Budaka)

There were some expeller spares. They missed bearings, houses, winding wires and flatbelts.

We finished at 1230.

Comment: It must be frustrating to work with so many limits. Although they worked hard to keep the process running. We had not enough time to reach Soroti so we left out the visit to Soroti.

Uganda Feeds Limited

NUVITA

AN ASSOCIATE OF THE UGANDA DEVELOPMENT CORPORATION LIMITED

P. O. Box 895, Jinja, Uganda

PLANT: TOBACCO ROAD, JINJA
TELEGRAMS: NUVITA
TELEPHONE: 20171

Your Ref: **Our Ref:** **Date:** 9th August, 1982.

SELLING PRICE LIST

	70 Kg.	20 Kg.
Chick & Duck Mash	2,243.00	618.55
Growers Mash	2,044.25	561.80
Layers Compleat Meal	2,144.45	590.40
Breeders Mash	2,271.25	626.60
Broiler Mash	2,377.50	657.00
Broiler Follow on Mash	2,253.65	621.60
Pig creep Pellets	2,165.90	596.55
Sow and Weaner Meal	2,005.65	550.75
Pig Finishing Meal	1,935.40	530.70
Mice Pencils	1,979.55	543.30
Rabbit Pellets	1,961.15	538.00
Guinea Pig Pencils	1,961.15	538.00
Hound Meal	2,255.00	621.95 10Kgs. 310.95
Calf Early Weaner Pellets	2,068.65	568.75
Young Stock Pencils	1,767.05	482.60
Dairy Meal/Cubes	1,648.40	448.70

Seed Cleaning, Drying, Handling and Storage Equipment - Soybeans		$ 150,000
Production and Harvesting Equipment - Soybeans		
1. 100 - 110 hp Row Crop Tractors $49,000 C/F Jinja x 5 =	$ 245,000	
2. 5-bottom, heavy duty mounted, 2-way Mold-board Plows $12,650 C/F Jinja x 5 =	63,200	
3. Non-folding 11'6" to 13'10" Disk Harrow $10,000 C/F Jinja x 4 =	40,000	
4. 9 Trailing Peg-tooth Harrow, 6' to 42' $3,968 C/F Jinja x 2 =	7,936	
5. 6-row Mounted Planter $21,620 C/F Jinja x 3 =	65,000	
6. 6-row Mounted Cultivator $5,500 C/F Jinja x 5 =	27,500	
7. Combine, 13' to 17.5' Cutter Head $110,000 C/F Komka x 2	220,000	
8. Grain Wagons, 6-ton capacity $10,000 C/F Jinja x 2	20,000	688,636
9. Spare parts to Rehabilitate Container Plant		50,000
Oil Mill Rehabilitation		
Spare parts for 18 Mills		500,000
Transport Requirements		
1. Station Wagon for Project Manager/ Project Coordinator ~~$12,000 C/F Kampala x 1 =~~	~~12,000~~	
2. Pick-ups for Senior Agr. Officers/ Sr Coop Officers at Dist. level in Proj. Areas (Jinja-Tororo) $12,500 C/F Kampala x 4 =	50,000	

3. Motorcycle for Asst. Agr. Officers & Asst. Coop Officers in Proj (Jinja-Tororo) at Dist. level $1300 C/F Kampala x 8 =	$ 10,400	
4. Bicycles for Extension Field Officers in Proj Areas (Jinja-Tororo) $75 C/F Kampala x 150 =	11,250	$ 83,650

Technical Assistance

1. Project Manager/Coordinator:		
Salary = $57,500/yr x 4 =	228,800	
Housing = $1500/mo x 48 =	72,000	
Household Furnishings =	10,000	
Surface Shipment of HHE =	10,000	
Air Freight Shipment of Personal Effects = 450 lbs x $5 =	2,250	
Intl. Travel = 4 round trips x 2 persons x $2500 =	20,000	
Travel and Per Diem in Country = 250 Days x $42 =	10,500	
Education Allowance = 2 children x $16,000/yr x 4 =	128,000	
Vehicle operating exp = 1000 mi/mo @ 25 mi/gal = 250 gal/mo x $2/gal (Window II rates) = $500/mo x 48 mo =	24,000	505,600
2. Consultancies:		
365 man days x $250 =	91,250	
Per Diem = 365 man days x $42 =	15,330	
Intl. Travel = $2500/trip x 6 =	15,000	121,580

Certified Seed

1. Soybeans		
$4\frac{1}{2}$ tons (178 bu) @ $12/bu + Inland freight in U.S. = $450 + Sea freight = $450 + Inland greight in Africa = $900 =	3,936	
2. Groundnuts		
50 tons @ $1000/ton = $50,000 + Freight @ $400/ton = $20,000 =	70,000	73,940

Production and Harvesting Equipment - Groundnuts

1. 100 - 110 hp Row Crop Tractors $49,00 C/F Jinja x 6 =	294,000
2. 5-bottom, heavy duty mounted. 2-way Mold-board Plows $12,650 C/F Jinja x 6 =	75,900

3. Non-folding 11'6" to 13'10" Disk Harrow $10,000 C/F Jinja x 6 =	$ 60,000	
4. 9 Trailing Peg-tooth Harrow, 6' to 42' $3,968 C/F Jinja x 3 =	11,904	
5. 6-row Mounted Planter $21,620 C/F Jinja x 4	86,480	
6. 6-row Mounted Cultivator $5,500 C/F Jinja x 6 =	33,000	
7. Groundnut Thresher $110,000 C/F Jinja x 2 =	220,000	
8. Grain Wagons, 6-ton capacity $10,000 C/F Jinja x 4	40,000	$821,284
Seed Cleaning, Drying, Handling and Storage Equipment - Groundnuts		150,000

Equipment Requirements at Makerere College of Agriculture Farm

1. 70 - 80 hp Row Crop Tractors $35,640 C/F Kampala x 2 =	71,280	
2. 4-bottom, mounted Mold-board Plows, 2-way $10,120 C/F Kampala x 2 =	20,240	
3. Non-folding 10'4" to 13'8" Disk Harrow $9,000 C/F Kampala x 2 =	18,000	
4. 9 Trailing Peg-tooth Harrow 6' to 42' $3.968 C/F Kampala x 2 =	7,936	
5. 4-row Mounted Planter $14,420 C/F Kampala x 2 =	28,840	
6. 4-row Mounted Cultivator $3,670 C/F Kampala x 2 =	7,340	
7. Groundnut Thresher $10,000 C/F Kampala =	110,000	
8. Seed Lot Equipment =	250,000	513,636

Diesel Requirements - Makerere - 200 Acres - 70-80 hp tractors

1. Land Preparation (Breaking) 30 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 144,000 =	640

2.	Disking and Harrowing 15 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 72,000 =	$ 320	
3.	Planting 20 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 96,000 =	427	
4.	Cultivating 1st cultivating, 30 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 144,00 =	640	
	2nd cultivating, 20 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 96,000 =	427	
	3rd cultivating, 20 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 96,000 =	427	
5.	Harvesting 20 days x 10 gal/day x Ush 240/gal x 2 tractors = Ush 96,000 =	427	
6.	Miscellaneous Requirements 500 gal x Ush 240 = Ush 120,000 =	534	3,842
			517,478

Extension Inservice and Farmer Training

1.	150 Extension Field Officers x 14 days x Ush 2000/day x 2 crop seasons = Ush 8,400,000 =	37,340
	Travel for 150 Extension Field Officers @ Ush 1000 each x 2 crop seasons = Ush 300,000 =	1,400
2.	Farmer Training for 60,000 Farmers x 3 days each x Ush 500/day x 4 crop seasons = Ush 120,000,000 =	532,000
	Travel for 60,000 Farmers x 300 = Ush 18,000,000 =	80,000
3.	150 Cooperative Officers x 5 days x Ush 2000/day x 2 crop seasons = Ush 3,000,000 =	13,340
	Travel for 150 Coop Officers @ Ush 1000 each x 2 crop seasons =	1,400

4. Training Materials

320 Flip Charts, 7 reams 27" x 34" x $40 ==	$ 280	
Handouts 150 reams 8½" x 13¼" x 15 =	2.250	$ 668.000
Total.....		$3.220.118
Contingency and Inflation @ 25%.....		1.082.554
GRAND TOTAL.....		$5,412,772