# FEASIBILITY STUDY

ON AN

OILSEED PROCESSING PLANT

AT

SOMAFCO

IN CENTRAL TANZANIA

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## 1. SUMMARY

As part of Solomon Mahlangu Freedom College (SOMAFCO) objectives of self-sufficiency in foodstuffs and to extend their extra curricular activities, considerable interest was shown at The Curriculum Development Workshop of January 1982, into establishing food processing activities at Mazimbu (Morogoro) and Dakawa. At the request of the AFRICAN NATIONAL CONGRESS (ANC), a feasibility study was undertaken to establish the food processing possibilities at Mazimbu and Dakawa and with a particular emphasis on oil processing, the subject of this report. This study was financed by 'Stichting Hivos' of the Netherlands and under the auspices of Patrick van Rensburg of the 'Foundation for Education with Production'.

With both edible oil and feedingstuffs in chronic shortages and prices rapidly escalating, the possibility of utilising home grown seeds has been considered for some time. The objectives of this study was to establish the feasibility of an edible oil extraction plant, determine the optinum size of plant and type of technology taking into account the current and the future needs; and to prepare an 'Action Plan' for the implementation of the project taking into account raw material supply, technical factors, infrastructural requirements, staff training needs and the establishment of linkages with other agroindustrial activities at SOMAFCO.

On the basis of the assumptions employed in this study, the projections show an oil project at SOMAFCO to be highly viable with an internal rate of return of 49.5%. However, the difficulties of operating in rural Tanzania can not be overstressed and an apparently lucrative venture could well fail for reasons totally beyond the control of the project.

The contents of this report was based on discussions with members of SOMAFCO, small and large oil processors at Morogoro, parastatal organisations involved in promoting village industries and also a review of the literature on the Tanzanian oil industry.

## 2. INTRODUCTION

### 2.1 SOMAFCO

Solomon Mahlangu Freedom College (SOMAFCO) of The AFRICAN NATIONAL CONGRESS (ANC) is sited at Mazimbu near Morogoro and currently has 1,500 members (of whom 500 are students) and will expand to 3,000 members over the next five years. The farm at Mazimbu has 3,44 acres of land bordering on the Ngerengere river. A furhter sit eat Dakawa, lying 40km to the north has recently been acquired and consists of 7,5oo acres which will eventually support 5,000 people. Besides the school at Mazimbu, there are a number of production units, carpentry, building, engineering, electrical, textiles and agricultural production units arable, piggery and horticulture. With greater emphasis been laid on self-sufficiency in foodstuffs, the agricultural sector is undergoing considerable developments to achieve this goal. One of the recent outlays has been the construction of a multi-purpose 'feed mill', which will cater for both humah and animal requirements. (A flow diagram of the storage, handling and milling facilities is given in Appendix 1). It is within this structure that the first phase of the oil processing plant will be installed, taking full advantage of the available housing, storage, handling facilities and some of the existing equipment. Furthermore the oilseed meal will be incorporated with the other milling offals and maize for compounding into feedingstuffs, directly on the same site, which will maximise operational efficiency.

The second phase of the oil processing project will be to install another plant at Dakawa to provide for the needs of the new settlement.

## 3. SOCIAL AND POLITICAL IMPLICATIONS

### 3.1 Social Considerations

With 80% of the Tanzanian population living in rural areas, the Government recognises the importance of rural industrialisation for a sound economy. Small oil mills not only offers paid employment to rural people thereby supplementing their agricultural incomes, reinforcing their capacity to participate in the money economy, prevent urban migration and keeping them occupied during the periods of slackened agricultural activity; but equally important brings to the rural people certain technical skills which are invaluable in transforming rural life.

Oil is an essential commodity in ones diet and is in severe shortage especially in the rural areas. In the absence of imports of edible oils, the shortage will have to be met by increased domestic production, and althogh the fragmentation of the oil industry is against national interest, nevertheless any means of alleviating the shortage is encouraged.

Setting up a small oil mill at SOMAFCO, will have its own economical and social benefits:-

i. Ensure a consistent and readily available supply of low cost vegetable oil and high quality protein source for inclusion into foodstuffs. Even with MOPROCO multi-purpose oil mill only a few kilometers away, oil is difficult to obtain and the meal even more so

ii. considerable direct financial savings and minimise the high transport and handling costs currently experienced

iii. partly meet the project's objective of self-sufficienty in foodstuffs

iv. create productive employment and introduce technical skills, that could form the basis for other succesful agroindustries at Mazimbu and later at Dakawa

v. form an ideal project for 'on the job training' facilities for the students.

vi. with increasing diesel shortage in Tanzania, sunflower oil could form an alternative forn of fuel at the farm.

3.2 Rural Industrialisation

With an economy based on the agriculture, the development of agroindustries can be considered the backbone of its development. The food industry is by far the most important manufacturing activity, accounting for about 42% oftotal value. Furthermore, the Tanzanian Government see the extension of this industry to the rural areas, where the majority of the people live as chief means of strengthening their economy. The Government has set up a number of organisation to promote rural industries, notably Small Industries Development Organisation (S.I.D.O.) and the Tanzania Food and Nutrition Centre (T.F.N.C.). Both establishments along with U.N.I.C.E.F. are actively involved in assisting and establishing small oil mills in rural Tanzania. S.I.D.O. (Ministry of Industries) express the view that processors whom are able to grow their own seed rather than compete with larger mills for seed from other growers should be given every support to do so, in effort to encourage oil production and bridge the vast gap between demand and supply. S.I.D.O. have a number of training units in oil processing and soap making, the nearest school to Morogoro is at Chanzuru village which lies between Kimamba and Kilosa towns. S.I.D.O. have even assited in setting up a small mill for an entrepreneur at Morogoro itself. Ironically MOPROCO the large multi-purpose oil plant have also given considerable assistance to this project. The view 'established food industries should assist small-scale unit to improve and controll the quality of their products' was expressed by the Minister for Industries Mr. Msuya at a recent T.F.N.C. workshop.

U.N.I.C.E.F. and T.F.N.C. are currently undertaking a joint feasibility study on village food processing in the Iringa region and are assisted by Kilosa and Vyole Agriculture Institute, to identify food and nutrition problems and to encourage village food processing and in particular oil processing. It is recommended that SOMAFCO should collaborate with these parties to take full benefit of their experience.

3.3 Food and Health Regulations

It is beyond the scope of this report to go into any depths about food and health regulations, other than to draw attention to their existance in Tanzania. The Tanzanian Bureau of Standards, established under the Standards Act No. 3 of 1975 has as its functions:- NB

i. To prepare frame, modify and amend standards
ii. To uhdertake measures of quality control of commodities of all descriptions and to promote standardisation in industry
iii. To assist industries in setting up and enforcing quality control procedures
iv. to make arrangements or provide facilitieas for thhe examination and testing of commodities any material or substance from which and the manher in which they may be manufactured, produced, processed or treated NB
v. to grant, renew, suspend, vary or cancel any liscence issued for the for the use of any standard mark.

The standardisation of food is undertaken by the Agriculture and Food Divisional Standards Committee of The Bureau represented by 'The Tanzania Food and Nutrition Centre'; the 'Government Chemical Laboratory' and the 'Ministry of Health'.

Edible fats and oils is regarded as a priority area for standardisation, with set procedures for the following:-

i. Test methods and sampling procedures
ii. labelling, packing and packaging
iii. codes of hygenic condition for food processing units.

Until recently, the majority of the food industry in Tanzania had virtually no food quality control systems and there is considerably work to be done before the standards set by The Committee become effective. It is well advised to contact Mr. A C Mosha/Mr Lukoo of T.F.N.C. to obtain further details on the exact requirements for a small oil processing plant. Naturally any test procedure would need to be simple, reliable and reproducible. A test is basically to assist organoleptic observations and give prior warning of a falling standard. General awareness and constant vigilance can not be surpassed by any complex testing procedures for small scale production.

## 4. NATIONAL OVERVIEW OF THE TANZANIAN OIL INDUSTRY

### 4.1 Marketing Boards

The marketing of oilseeds is controlled by the two major parastatal marketing organisations, The Tanzania Cotton Authority (T.C.A.) and The General Products Export Corporation (G.A.P.E.X.).

G.A.P.E.X. controls the five scheduled oilseeds, simsim (sesame) sunflower, groundnuts, soyabeans and copra, whereas the T.C.A. handles the cottonseed, whom in turn sell to crushers.

Cottonseed forms the major oil source in the country (see fig 4.1), but over the last decade, there has been a dramatic decline in cotton production.

I.N.D.CENTRE/Tanzania Investment Bank attributed the shortage to the price offered to farmers being too low as compared to the International prices. A review of the cost/benefit to the farmer shows poor return for cotton as compared to other crops such as rice and maize. With increasing cost of fertilisers and insecticides to the grower, it is increasingly difficult for the farmer to obtain high enough net returns. The return to the grower has to be increased, before any significant cotton production will be seen again in Tanzania. Likewise the production of the other oilseeds has been low in recent years for similar reasons.

Excluding cottonseed, sunflower continues to form the bulk of GAPEX's purchases. Oilseeds supply has experienced a remarkable downward movement over the last ten years period.

Fig. 4.1.1 Oilseeds available for local crushing (in '000' tons)

| Oilseed | 1970/71 | 71/72 | 72/73 | 73/74 | 74/75 | 75/76 | 76/77 | 77/78 | 81/82 |
|---|---|---|---|---|---|---|---|---|---|
| Groundnut | 2.8 | 3.3 | 3.4 | 1.3 | 0.5 | 1.5 | 1.5 | 1.5 | - |
| Sesame | (0.8)*1 | (1.9) | 2.2 | 3.4 | 2.2 | 5.9 | 6.3 | (1.4) | - |
| Sunflower | 3.4 | 0.4 | 2.3 | 3.8 | 3.6 | 10.7 | 10.9 | 9.1 | - |
| Cottonseed | 140.0 | 120.0 | 140.0 | 120.0 | 130.0 | 70.5 | 70.5 | 70.5 | 65.0 |
| Copra | 7.5 | 10.7 | 11.9 | 10.0 | 10.0 | 2.9 | 3.0 | (0.1) | - |

*1 Negative figures represent export figures.

Source : 1970/75 figures - TFNC
1975/78 figures - TISCO

On the world market, prices for oilseeds fell substantially during 81-83, but have since increased dramatically in face of the world shortage of oilseed. The major cause of this was the US crop disaster whereby total oilseed production by the US was 32% less for 1983/84 than in 1982/83. Although money prices offered by The Marketing Boards have been increased yearly, real prices have drastically dropped. During 1982-83 season, the average increase in prices of the five scheduled oilseeds (sunflower, groundnuts, sesame, copra and soya) was 43 per cent above 81-82 level. For 83-84 season, tha average increase in prices have been recommended at 35 per cent.

Fig 4.1.2 Oilseed prices

| Oilseed | Price : Shs/ton 82/83 season | Price : Shs/ton 83/84 season | % increase |
|---|---|---|---|
| Sunflower : Record | 2,900 | 4,000 | 38 |
| : Jupiter/white | 2,600 | 3,500 | 35 |
| : others | 2,500 | 3,200 | 28 |
| Groundnuts | 5,800 | 8,800 | 38 |
| Sesame | 5,700 | 7,000 | 23 |
| Copra | 4,200 | 6,000 | 43 |
| Soya beans | 3,000 | 4,5000 | 50 |
| Castor beans | 1,700 | 2,000 | 18 |

Source : MDB (DSM)

One of the main causes in the fall in real terms of these crops, has been the escalating domestic inflation which started in the 70s. Estimates by National Consumer Price Index give inflation rates of 30%. Individual commodities such as feeedingstuff show 55% inflation. While the farmers' market basket continues to be costly, his purchasing power on the other hand declines. As far as domestic oilseeds prices are concerned, farmers appear to be moved by the high revenues from the parallel markets. It is often possible to have tenfold increase on most commodities in the street markets and substantial amount of oilseeds is being crushed locally at the village level. Consequently these markets limit the oilseeds passed on to GAPEX. The current single channel marketing system is likely to be accompanied by alternative marketing channels, but on an agreed basis.

The cost of operating GAPEX and to a lesser extent TCA are tremendous , whereby expenses of 100% or more of the seed value are incurred. For 1981/82, GAPEX marketing and operating cost per tonne of sunflower seed was as high as Shs 2,905, whereas the producer price for the same period was Shs 1,800.

Transport charges is a continual problem and the cost of operating GAPEX will continue at 100% of the seed cost for 1983/84 season. GAPEX realises the inadequacy of the system and is prepared to allow the direct sale of seed to the crushers. Furthermore GAPEX wishes to be subsidised to give incentive to the farmers to grow more seed, but the government is unwilling.

| | 1982/83 GAPEX costing | 1983/84 MDB's costing estimates |
|---|---|---|
| Producer price | 2,900 | 4,000 |
| Service expense*1 | 2,395 | 2,400 |
| GAPEX cost*2 | 391 | 390 |
| Value of Goods FOB ex-store DSM | 5,687 | 6,790 |
| Selling price to crushers | 5,900 | 7,000 |

*1 Service expense; the cost of transporting seed to GAPEX stores, handling storage.

*2 GAPEX cost : Administration cost of GAPEX.

4.2 Crushers

During the 1983-84 season, the general performance of the oilseeds processing industry in Tanzania remained gloomy, with the total crushing capacity in the country placed at 160,000 tons, but the total available oilseeds were 80,000 tons, half of the estimated total capacity. Most of the big oil mills are operating far below their normal capacities and many of the smaller operating units have been forced to close down. The location of existing oil mill is shown in Appendix 2.

Fig 4.2.1 Amount of oil available from seeds crushed in oil mills

| | Quantity in (000) tons | | | | | |
|---|---|---|---|---|---|---|
| Oilseed | 1976 | | 1977 | | 1978 | |
| | For Crushing | Oil Equ | For Crushing | Oil Equ | For Crushing | Oil Equ |
| Cottonseed | 70.5 | 10.2 | 70.5 | 10.2 | 70.5 | 10.2 |
| Groundnuts | 1.5 | 0.7 | 1.5 | 0.7 | 1.5 | 0.7 |
| Sunflower | 10.7 | 2.6 | 10.9 | 2.6 | 9.1 | 2.2 |
| Sesame | 5.9 | 2.5 | 6.3 | 2.6 | -1.4 | -6.4 |
| Copra | 2.9 | 1.7 | 3.0 | 1.7 | -0.1 | - |
| Total Oil Production | | 17.7 | | 17.8 | | 12.5 |

The oil mills are faced with not only a severe shortage of raw material at a high price and often of poor quality, having been stored in unsuitable conditions, but also have their own processing problems. Often illadvised with equipment installed that is unsuitable to this environment, along with incorrect maintenance procedures and lack of technical know how have resulted in low extraction rates and general poor effeciency of operation. Essential parts are difficult to procure from overseas due to foreign exchange limitations and Machine Shops are far and few between to give adequate support to the industry.

With low throughput and high overhead costs, production costs for the crushers have soared over the last few years:-

Fig 4.2.2 Crushers production costs/tonne of oil for 1983

| Oil source | Shs/kg |
|---|---|
| Sunflower oil | 42,50 |
| Cotton seed oil | 52,10 |
| Kapok oil | 38,80 |
| Soya bean oil | 94,50 |

Source : GAPEX

Over optimistic and prestigious plants have been erected and without a clear understanding of the problems entailed. Seed supply has been grossly over estimated. A typical example of this was FAO's Investment Centre recommendation to modernise the cotton seed processing industry in Western Tanzania. The mission suggested.phasing out of some 110 existing expellers and replacing them with two solvent extraction units. Any saving incurred through improved processing efficiency was quenched by the vast transport and handling cost of such operation; a factor completely overlooked.

A visit to the Moproco plant which was a capacity of 100-150 tons of seed/day operating at 30% utilisation revealed a similar story (annual capacity : 45,000 tons of seed and 45,000 tons of incoming cake for solvent plant and a refinery of 9000 tons). Under the recommendation of the preinvetment study, five Indian expellors were purchased which are achieving 50% of their rated capacity (continuosly under repair) and 80% of their rated extraction efficiency. *NB

Any saving in initial invetment in an Anderson expeller has proved worthwhile. Moproco is currently ~~is currently~~ installing hydrogenation plant and like many others large plants, overcapitalisation with ever increasing overheads is a common problem.

A similar pattern can be seen in the 'Cashew Nut Authority Tanzania' (CATA) whereby large plants have proved ineffective. Back in the early 70s, the World Bank funded an ambitious project of 12 cashew nut processing plants sited throughout the country with a total capacity of 40,000 tons is nearly all exported for the confectionary trade. The whole cycle of events from the grower to the consumer is characterised by unsufficient seed supply, excessive operational cost of marketing boards and uneconomically operated crushers resulting in an expensive and limited commodity. It therefore seems that the only solution to the whole problem is to revert to the use of small oil expelling plants distributed throughout the country. Small expellors may be inefficient in their energy consumption, extraction rates and labour involvement, but at least they are manageable and are not faced with tremendous operational cost of the large processors. A visit to a small oil plant (0.5 tonnes/day) at Morogoro showed that it was a more suitable economy of scale and appropriate to the national development strategy adopted by the country. Such an operation would bring the maximum socio-economic benefits to the majority of the population, by bringing about greater equity of the distribution of income and improvement of the quality of life in the rural areas. A small oil expeller (1.0 tonne/day) would give an optimum utilisation of capital, labour and raw materials at SOMAFCO.

## 5. MARKETING

### 5.1 National Vegetable Oil Marketing Situation

The vegetable oil market in Tanzania is characterised by gross under supply. Calculations shows Tanzania's per capita consumption of oil at being 2.0g/capita/day (0.74kg/annum), which according to GAPEX is 36 per cent of the actual demands, given at 5.5g/capita/day. Even latter figure is extremely low in comparison with other states to the south and with UNCTAD's projected world average per capita cosumption as reaching 10.4kg/annum in 1985.

Although there are no absolute dietary requirements for fat, sufficient dietary fat is needed to provide essential fatty acids and the lipids-soluble vitamins.

Furthermore fat contributes to the texture and palatability of foods. To sustain a reasonable diet, nutritionist recommended that the total fat intake in the diet should provide at least 20-25% of the total calories i.e. approx 60g/capita/day.

Fig 5.1.1 Fat per carput per day (grams) for Tanzania

| Year | Vegetable products | Animal products | Grand total |
|---|---|---|---|
| 66-68 | 18.7 | 12.3 | 31.3 |
| 69-71 | 18.0 | 12.3 | 30.3 |
| 75-77 | 21.8 | 11.8 | 33.7 |
| 78-80 | 21.6 | 11.8 | 33.4 |

Source : FAO Production yearbook 1981 (vol 35)

The Industrial Studies and Development Centre (ISDC) in Dar es Salaam gives significantly lower estimates and which are probably more realistic.

Fig 5.1.2 Estimated total consumption of edible oils and fats in Tanzania (000) tons

| ITEM | 1976 | 1977 | 1978 |
|---|---|---|---|
| Oil from seeds crushed | 17.7 | 17.8 | 12.5 |
| Oil from fresh coconut for home use | 8.0 | 9.0 | 8.0 |
| Imports | 11.7 | 8.5 | 8.0 |
| Oils from groundnuts eaten fresh | 32.6 | 32.6 | 32.6 |
| Less exports | (2.1) | (0.9) | (1.2) |
| NET TOTAL | 67.9 | 66.0 | 62.6 |

Source : Industrial Studieas and Development Centre

Based on the above average/capita consumption of 3.74kg oil/capita/annum (10.2g oil/day), ISDC estimated the growth in the oil market as follows:

Fig 5.3.1 Projected demand for oils and fats in Tanzania

| Year | Population (000) 3% growth rate | Projected consumption per capita (g/day) 5% growth rate | Project demand (tons) |
|---|---|---|---|
| 1978 | 17,552 | 10.2 | 63,350 |
| 1979 | 18,078 | 10.7 | 70,600 |
| 1980 | 18,621 | 11.2 | 76,120 |
| 1981 | 19,179 | 11.8 | 82,600 |
| 1982 | 19,755 | 12.3 | 88,690 |
| 1983 | 20,347 | 12.9 | 95,800 |
| 1984 | 20,958 | 13.6 | 104,040 |
| 1985 | 21,587 | 14.2 | 111,890 |

Source : ISDC (1978)

Althogh the population increase has not been so high, but the differnce in demand and supply has widened even further .
The marketing of oil in Tanzania is controlled by the parastatal marketing board - Regional Trading Company (RTC). As found from visiting both large and small oil plants, the national market would gladly receive any oil that is available, whether crude, semi refined or refined oil.
Although the main objectives as outlined earlier in the report is to provide oil for the needs of SOMAFCO, rather than compete on the open market, but to provide economic linkage and services with the Tanzanian communities neighbouring on Mazimbu and Dakawa can only be to the interest of both parties. Initially the oil plant will have an over capacity and it would be advantageous to maximise the utilisation of capacity by selling surpluses to the public. All the oil meal will be absorbed for compounding feedingstuffs at the farm.

5.2 Vegetable Oil Requirements at SOMAFCO

The oil processing facilities at SOMAFCO are phased into two stages to be inline with the increase in population at both Mazimbu and Dakawa over the next six years. The first plant is designed to meet the needs of Mazimbu at its peak demand and also to cater for the initial needs at Dakawa. If selling to the public is considered beneficial, the plant could be run for long hours.
The diet of the people of SOMAFCO can not be considered in the same light as that of Tanzania, as the greater portion of their daily fat intake would be in the form of processed or 'visible' fat. In estimating SOMAFCO's oil requirements, consumption figures that would be more typical of this type of diet as may be found in other Southern African states (SADCC) and that recommended by FAO (WFP) daily rations of 25g/capita/day has been taken.

Fig 5.2 Oil requirements at SOMAFCO

| Phase | Year | Site | Population | Oil req*1 kg/annum | Other proc*2 req:kg/annum | Total SOMAFCO req:kg/annum | Plant cap*3 oil output kg/annum | Difference sale to public |
|---|---|---|---|---|---|---|---|---|
| 1 | 1983/84 | MAZIMBU | 1,500 | 13,700 | 2,600 | 16,300 | 38-47,000 | 26,000 |
| 2 | 1989/90 | MAZIMBU | 3,000 | 27,400 | 4,200 | 31,600 | 38-47,000 | 10,900 |
| | 1989/90 | DAKAWA | 5,000 | 45,625 | 10,800 | 56,425 | 47-61,000 | - |

*1 Oil requirements based at 25g/capita/day

*2 Other process requirements :-

Groundnut processing (redskin salted nuts, oil consumption at 9% of nut oupput)

Bread Production (oil consumption at 1% of bread output)

*3 Plant capacities:-

i. 80-100kg $hr^{-1}$/8 hr day/245 day/annum (157-196 tons seed) = 47-59 tons oil
80% efficiency = 38-47 tons oil

ii. 100-130kg $hr^{-1}$/8 hr day/245 day/annum (196-255 tons seed) = 59-76 tons oil
80% efficiency = 47-61 tons oil

80% utilisation of capacity may be cosidered over optimistic when considering the difficulties that faces any industry in rural Tanzania.

## 6. PRODUCT DETAILS

### 6.1 Raw Material

#### 6.1.1 Agricultural prospects

Naturally, it is beyond the scope of this report to evaluate the returns/hectare of the five main oilseeds. The available data is rather incongrous and normally refers to small operations.

Fig 6.1.1 Traditional small holder farmers - return to labour, farmers net income (gross margin) and production costs comparative table for 1982-83

| | | Return/labour day | Gross margin farmers net income Shs/ha | Production costs Shs/ha |
|---|---|---|---|---|
| Sunflower | Jupiter | 10.0 | 1,022 | 18 |
| | Mixed | 10.3 | 983 | 17 |
| | Record | - | - | - |
| Groundnuts | | 9.0 | 1,452 | 288 |
| Sesame | | 11.1 | 1,371 | 54 |
| Copra | | 9.6 | 651 | 609 |
| Castor | | 7.7 | 425 | - |

Source : MDB

The returns for sunflower and soya bean for commercial farming is shown in the appendix 3.

A meeting held with the members of the Food Science Department at the Agriculture faculty of the University of Dar es Salaam, which is sited at Morogoro expressed their preference for groundnuts as an oil seed source. The following expected yields for the different crops were given:-

| | Yield kg/hectare | |
|---|---|---|
| Soya beans | | 2,000 |
| Groundnuts | | 2,000 |
| Sunflower | 600 | 1,000 |
| Sesame | | 600 |
| Maize | | 3,000 |

From the work done by the plant breeding station of Tangero, groundnuts gave the best results in the Morogoro region on both good and marginal lands. The sunflower breeding programme has tended to concentrate on yield rather than oil content. Furthermore sunflower is less drought tolerant than groundnuts and with the inpredictable rainfall which can be between September-November and February - May, with short dry spell in between, can result in two successful crops or total crop failure. However for commercial farming sunflower is more economical, without the high capital outlay or alternatively the high labour cost that is involved with groundnuts. Morogoro is well suited for the growing of sunflower and is one of the main growing areas in Tanzania, with a production of around 1,400 tons/annum.

6.1.2 Processing considerations

For small scale cold press extraction, sunflower is by far the most suitable oilseed. The difiiculties of using other oilseeds that are avaiable in the area can be summarised as follows:-

Fig 6.1.2 Processing suitability of various oilseeds

| Oilseed | Processing difficulties |
|---|---|
| Groundnuts | Extra capital required for seed scorcher and increased production cost by using expensive fuel for burner<br>Groundnuts can be sonsidered too valuable a commodity for oil production and better used for other applications.<br>Beside utilising low grade nuts, there is little prospects for using groundnuts for producing oil. |
| Sesame | Abrasive raw materials and consequently high wear. Also extraction rates are generally low. |
| Copra | Unsufficient supply at Mazimbu, but if a source could be found, it would certainly be worth considering. |
| Castor beans | The beans are too hard for a small press, resulting in high wear. Meal can not be used for feedingstuffs. |
| Soya beans | Low oil content, uneconomical to process on a cold press. |
| Cottonseed | Crude cottonseed oil is not palatable and low efficiency of operation on a small scale press. |

For the purpose of this study, it has been assumed that sunflower seed will provide the bulk of the required throughput. For an efficient and economical operation, high oil yielding sunflower seed must be used. Low oil yielding seed with its high hull content gives poor return and wear on the equipment is high. Dehulling or decortication is a difficult operation on a small scale operation and only partly effective. By using high oil yielding seed, decortication is unnecessary and infact deleterious in that hull the hull improves the compressive forces in the expellers. Some reservations were expressed as to the suitability of local varieties for oil processing, but have since been found to be satisfactory.

Moproco indicative oil content for different sunflower varieties

| | | |
|---|---|---|
| Sunflower | Record (black) | 37% |
| | Mixed | 32% - 35% |
| | Jupiter | 30% |

Sunflower seed analysis* on a small taken from a crop of 'Record' seed at Mazimbu September 1983

| | | |
|---|---|---|
| Protein (N x 5.7) | 19.07% | Kernel : Hull ratio = 75:25 |
| Oil | 45.22% | |
| Moisture | 8.99% | |

* Analysed at Western Research Labs (UK)

Record seed can be purchased at the Tanzanian Seed Company

'X go down' (wholesale) 11.05Sh/kg

(retail) 12.55Sh/kg

An attempt to locate a seed supplier of high oil yielding sunflower seed at Arusha, a division of the RoyalDutch/Shell was unsuccessful and if the 'Record' variety fails to give a consistent 30% oil yield, further effort should be made to find varieties.

## 6.2 Process

### 6.2.1 Seed reception and seed cleaning

The harvested sunflower will be brought to the processing plant intact on the flower head to be threshed on a

'Standard Rdiva Thresher' and then cleaned on an 'Alvan Blanch Winnower' to remove any extraneous matter, inparticular sand and any ferrous material. Large pieces of trash can cause breakages, excessive wear and overloading of the processing machinery. The seeds are first passed over a magnetic separator for the removal of tramp metal and then transferred to a multi-screen aspirated seed cleaner; the large pieces of trash being discarded at the top screen and the finer particles fall throuhg a lower fine screen. The winnower would also remove the majority of any undesirable matter such as gums or resins that can sometimes develop in the sunflower head during severe growing conditions and impart bitter flavours to the oil. The cleaned seed will then be transferred to a receiving pit and then by elevator and conveyors to a silo (Skiold Type 708).

6.2.2 Seed storage

Bulk storage in silos offers the best conditions for controlled storage of seeds and with the feedmill already equipped with seed handling systems and drying facilities, silo storage is an obvious choice. Proper storage facilities for the seeds are necessary to ensure that spoilage does not occur from the effect of mould, insects or overheating, since damaged seeds are extremely difficult to process. The seed moisture must be kept low ($< 9\%$) and infestation can be controlled by the use of an automatically dispensed fumigant, phostoxin which is in a solid ~~a solid~~ form and consists of aluminium phosphide, ammonium carbamate and paraffin. When the seed is required for processing, it can be transfrred from the silo using a grain auger into the hammermill and then taken by a trolley bin or another elevator into a service bin/hopper (locally made) sited above the expeller.

6.2.3 Decortication

Provided that high oil yielding seed is used which has a low husk content, decortication is considered unnecessary for a village scale processing. Infact some husk or fibre is required for developing high compressive forces and temperature in the barrel to obtain good && extraction rates.

Using low oil yielding seed with its accompanied high husk content drammatically lowers the profitability of the operation. However, if the circumstances arose that some low oil yielding seed had to be used, decortication would then be necessary to improve extraction rates. 'CeCoEo' have recently developed a centrifugal - forced power husker type LO which is a considerable improvement on their earlier models (modified cotton delinter). To the writer's knowledge, there is no other commecially available small decortication.

6.2.4 Pre-treatment

Size reduction using a hammermill with a coarse sieve (0.5 mm) CM3 has the effect of weakning oil cell structure and makes the oil readily available for expulsion. Varying seed size has been shown to cause ceasing of small oil expellers as found by TRDI'S field trials on The Simon Rosedowns' Mini 40 in Zambia. Also the crushing of the seed results in increased throughtput in the expeller. Conditioning of the prepared meats by adjusting the moisture content while keeping the meats hot for a predetermined period in a cooker also improves the oil extraction process, but the capital outlay for the cooker and its operational casts can certainly not be justified at this level of operation. Fuel is an expensive commodity and would far outweigh any gains from the additional oil recovered. Furthermore 'cooked-flavours' tend to be carried over to the final product, as adequate control on small scale scorchers is difficult.

6.2.5 High pressure continous screw press

Basically, the screw press consists of a horizontal, interrupted h helicul worm assembly rotating, the worm assembly moves the meats from the feed end of the press to the discharge end, expelling the oil through the slots between the bars of the cage. During the movement of the meal between the feed and discharge ends the volume displaced between these sections decreases, thus compressing the meal and causing the resultant pressure to expel the oil. The cake is discharged from the press, through a choke, forming an annular opening of variable size.

6.2.6 Oil clarification

The oil that is expelled from the screw press will contain a proportion of solid material or meal, known as 'foots', which has to be removed from the oil by screening, followed by transferring to settling drums and the final clarification is achieved using a filter press. Although the foots and the filter cake are high in oil, efforts to recover this oil using an absorbent material such as oil-cake is not worthwhile in the writer's opinion, as the foots will readily pass through the cage bars.

The clarification of the oil greatly enhances the appearance of the oil and this view is also shared by TRDI after their field trails on the Mini 40 in Zambia. For selling internally a double pass through the filter press should be adequate, but to get complete clarification can be tedious and expensive on small presses in that the filter clothes and paper need to be constantly changed. Improved results can be obtained using filter aids, but their availability in Tanzania is limited.

The winterisation of the oil is not considered necessary as the crystallization of the low melting point glycerides is unlikely to occcur with sunflower in such climatic conditions. Allowing the oil to settle in storage tanks (galvanized water tanks) will remove the majority of gums and any crystallized glycerides if any does occur. If storage tanks are sited on a raised platform, the oil can then be easily dispensed into drums for selling.

6.2.3 Expelled cake

The deoiled cake from the screw press contains approximately 12% residual oil. A lower oil content cake can be obtained by a high pressure screw press or alternatively passing the feed through the press twice. Generally for small expellers, neither practises are worthwhile, as the wear and power consumption and thecake becomes burnt and of lower nutritional value for feeding purposes. It is advisable to cool the cake down to 5°C above ambient conditions before storage to avoid any possibilities of spontaneous combustion or mould growth.

The size of the cake on discharge from the screw press is normally too large for the effi¢ient cooling. It is therefore broken down to pieces approximately 30 mm square before being passed through t the cake cooler. Naturally, the cake could be left dispersed over the factory floor, but a cooler could rigged, utilising the air fans that are on site. Cake leaving the cooler will then be transferred to the indoor Silo type FBH 3, to be later utilised for compounding into feedstuffs.

6.3 Packaging

Refined and semi-refined sunflower oil is sold in a variety of packages and the following retail prices are the official figures in Tanzania as for September 1983.

| Pack size | Refined and deodorised oil | Equivalent price/ton | Semi-refined oil | Equivalent price/ton |
|---|---|---|---|---|
| 100g | Shs 5.00 | 50,000 | Shs 4.55 | 45,500 |
| 1L | - | - | 58.40 | 62,796 |
| 1kg | 59.45 | 59,450 | - | - |
| 2kg | - | - | 105.30 | 52,650 |
| 4kg | 215.15 | 53,788 | 195.80 | 48,950 |
| 5L | - | - | 25,945 | 55,795 |
| 18kg | 908.35 | 50,464 | 824.00 | 45,778 |

*Manufactured by MOPROCO.

Details of the manufacturers and pricing of packaging materials are appended.

The bulk of the oil produced for internal use will be sold in 18kg drums/bails, which will reduce production costs. These containers can also be easily cleaned and reused. With shortage of packaging raw materials, a consistent supply of packaging could be difficult especially for the small processor. However, if selling the oil t to the public was beneficial, smaller packaging units of 2kg/1L units would be required. Naturally labelling and corrugated boxes would be required for these units, which would increase production costs.

For the 18kg drums, the oil could be weighed out on a platform balance and for the smaller units could measured out by volume to a set level on the container.

6.4 Quality assurance

As explained earlier in the report, vegetable oil is subjected to the standards laid down by the Agriculture and Food Divisional Standards Committee of The Tanzania Bureau of Standards. Details of these standards are obtainable from the 'Tanzania Food and Nutrition Centre'.

For internal use, testing procedures may be overlooked initially, but general house keeping and cleanliness at all times should be practised. Provided the seed has been kept under good conditions, the crude oil produced should of satisfactory quality. The only test that may be worth considering would be to determined the free fatty acids (FFA) of the oil, which would be an indication of the onset of rancidity. At a later date when other food processing activities have been established at SOMAFCO and there is a need for a laboratory for routine testing and also for trainign purposes, both oil, and moisture analysis on the seed and protein, oil and moisture content on the meal could be carried out.

For refined oils, specifications are fuller and may include one or more of the analytic criteria:-

| Specification | Sunflower |
|---|---|
| Saponification value number | 190 - 194 |
| Iodine value | 125 - 140 |
| Specific gravity | 0.924 - 0.926 |
| FFA | 0.5 - 5 |
| Unsaponifiable matter | 0.3 - 0.9 |

7. PLANT DETAILS

7.1 Equipment Survey

A survey of the sources and types of equipment available was carried out, with special consideration on important aspects such as efficiency of equipment in terms of energy consumption and extraction rates, price, servicing, reliability, level of technology and general reputation of manufacturers.

Based on these criteria, 'CeCoCo' models proved to be the most suitable for this project. Furthermore 'CeCoCo' manufacture the complete system rather than just expellers.

To purchase all the individual items from various sources would be difficult and costly. The Mazimbu plants has a certain amount of overcapacity for 'bridging-over' before the second plant comes into operation and thereafter it may be considered beneficial to have economic and social ties with Tanzania neighbouring the two s sites. The savings incapital costs of installing a plant with less capacity are disproportionate to the revenue forgone with resultant diseconomics of scale.

It is worth drawing attention to the UN report ID/122 and to Tropical Development and Research Institute evaluation on the Mini 40 expeller in Zambia (Report R112(L) ) in which both experts draw the same conclusion on their economic evaluation of oil process. Their sensitivity analysis shows the economics of the operation to be sensitive to variations in oil yield and the cost of the seed, rather less sensitive to variations in wages, throughput or cake price, andcomparatively insensitive to the cost of the press. On this basis, the extra capital investment required to improve process efficeincy and quality of finished product is also worthwhile.

From discussions with both large and small processors in Tanzania, reliability of & equipment is of paramount importance and although Indian and Chinese equipment may serve well in their own environment with adequate infrastructural support, this is certainly not the case here.

Fig 7.1 Comparative table of expellers evaluated

| Manufacturer | Country of Origin | Model | Kg hr Capacity | Price TSh | One set of Spares*1 | Total Price TSh | Performance |
|---|---|---|---|---|---|---|---|
| Simon Rosedowns | England | Mini 40 | 40 | 53,735 | 8,816 | 62,551 | Satisfactory, but there are few unresolved design faults*2<br>- cage rings<br>- drive mechanism<br>- guards<br>+ generally poor support from manufacturers |
| IBG Monnforts and Reiners | W. Germany | Komet Double Spindle DD/85 | 50 | - | - | 66,338 | No knowledge of the unit |
| CeCoCo | Japan | New Type 52 | 40 | 40,462 | 4,495 | 44,957 | CeCoCo equipment is well tried and proven in field. Although there are design faults, they are generally robust and reliable. |
| | | Type H-54 | 80 | 77,278 | 7,776 | 85,054 | |
| | | Type EX-100 | 100 | 105,710 | 13,851 | 119,561 | |
| Khuller | India | | 50*3 | Low priced | | | Low extraction rate and generally unreliable |
| | China | Model 7YB 78 | 50 | unavailable - low priced | | | Inefficient - low extraction and high energy consumption and poor workmanship. |

*1 Spare parts : Cage bars/rings and spacers
Worm Shaft
Taper/Choke Ring.

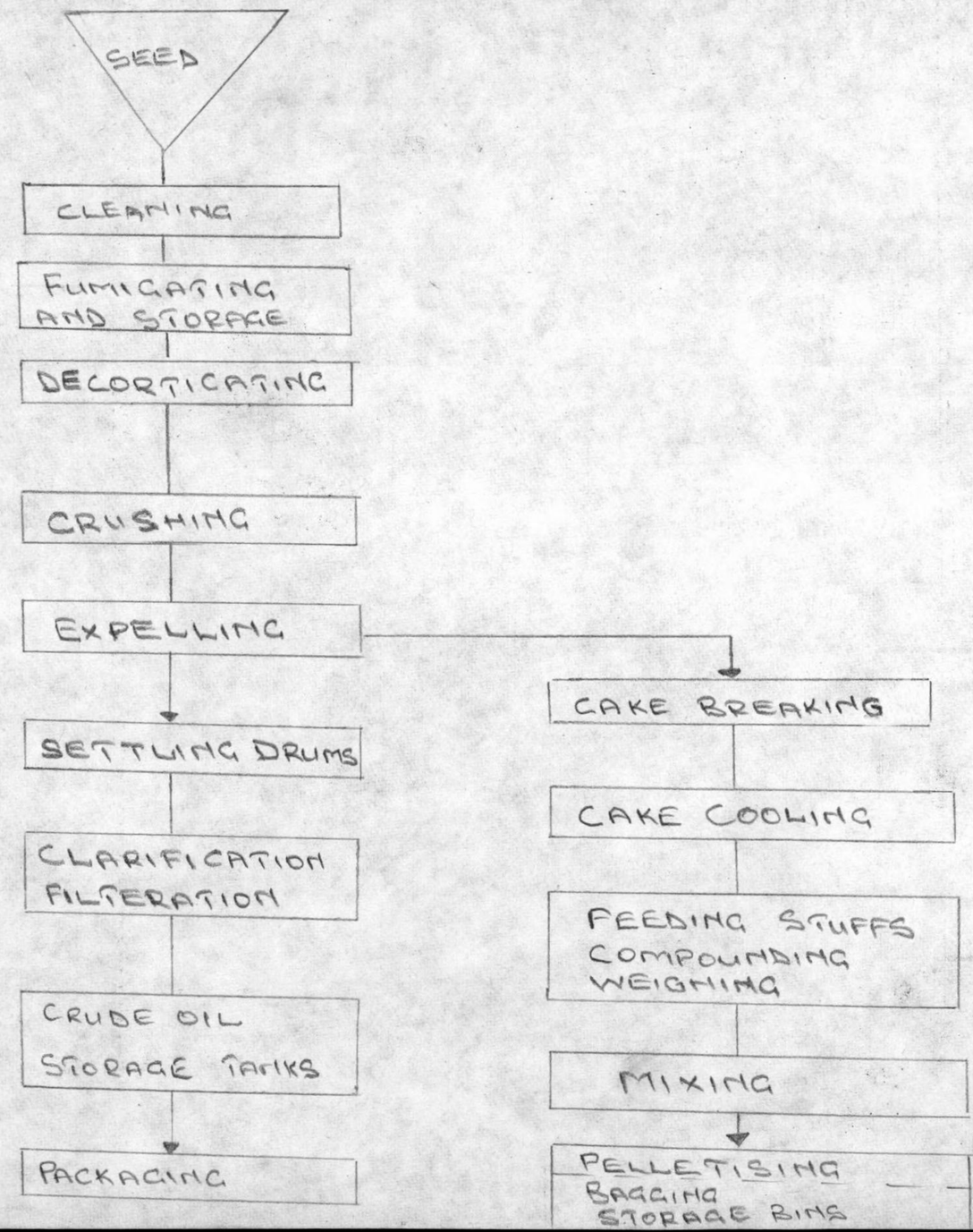
*2 TRDI and IDRP's experiences in Zambia

*3 Other unit sizes available.

7.2 Plant Layout

Sunflower Seed Processing General Flow Chart

| Model | Electrical Power (kw) | Labour Req |
|---|---|---|
| Alvan Blanch Winnower Type 3SW/2 | 0.75 | Harvest labour |
| CeCoCo Decorticator Type LO | (4.0) | 1 |
| Existing Equip Hammer Mill Type CM3 | (15.6) | |
| CeCoCo Screw Press Type H54 | 7.5 | 1 |
| CeCoCo Filter Press Type B | 0.75 | 1 |
| | | 1 |
| TOTAL | 28.6 | 4/5 |



7.3 Equipment Specification

| Unit Operation | Description | Capacity kg $hr^{-1}$ | Kw Power Requirements | RPM | Kg Net Weight | $M^3$ Shipping Measurements |
|---|---|---|---|---|---|---|
| Decortication (Optional) | 'CeCoCo' Power Husker Type LO, Centrifugal-forced Rubber Ring Type, with flat main pulley and steel made machine bed (300mm high) | 800-1000 | 4 | 2,700 Accelerator's Shaft | 100 | 0.85 |
| Crusher (available) | Skiold Hammermill Type CM3 | 1200 | 15.6 | ± | - | - |
| Expeller | 'CeCoCo' Screw Type Oil Expeller Type H.54 mounted on a stell made common base, include standard spare parts and accessories | 80-100 | 7.5 | 30 Worm Shaft | 500 | 1.8 |
| Filter Press | 'CeCoCo' Filter Press Type B, 12" x 12" x 14 chambers, complete with $\frac{3}{4}$" bore cam pump and standard accessories, mounted on a steel made common base | 160L | 0.75 Geared | 200 Main pulley | 445 | 1.4 |
| Settling Drums | Locally available | 200L | - | - | - | - |
| Storage Tanks | Galvanised corrugated tanks with stop cock valve at base | 1000L | - | - | - | - |
| Platform Scale | 'Avery' Type 3205ABA 2 x 2 with backrail | 250kg±0.2 | - | - | - | 0.3 |
| Cake/Pellet Cooler (optional) | Locally constructed | - | - | - | - | - |
| Pelletiser (optional) | 'Alvan Blach' ABP1/15 | 150-500 | 11 | - | 555 | 1.65 |

## 7.4 Plant Location, Utilities and Implementation Plan

### 7.4.1 Plant location

The plant will be located within the 400m$^2$ multi-purpose feed mill and will form an intergral part of its operation. The area required for the equipment and oil storage along with adequate working space is in the order of 35-40m$^2$ . An additional silo, Skiold Type 708 of 219m$^3$ capacity (that will hold approximately 100 tons of seed) is needed, which will be fitted with the existing grain handling and drying systems.

### 7.4.2 Utilities

i. Electrical : Power requirements will be 12-15kva.
3 x 3 phase, 50 Hertz, 400 volts. A.C. Motors.
2 x 1 phase, 50 Hertz, 240 volts. A.C. Motors.

ii. Water : Cleaning purposes 2m3/day. (Plans are underway to get treated water fron the mains supply at Morogoro.

iii. Maintenance/servicing : a rigorous maintenance programme should be adapted in order to maintain satisfactory plant efficiency. Both throughput and extraction rates will fall dramatically with poorly maintained equipment and could even make the operation unavailable. It is intended that all the routine services will be done by the operators, and any engineering work at the 'Machine Shop' of the College.

Also MOPROCO have a well equipped machine shop and have offered to give full support to the project. They are able to 'build' and machine wormshafts and should also be able to give useful guidance on less specialised engineering work. Although a 3 year supply of parts has been recommended on purchasing the equipment, it may well be possible to nearly produce parts locally from thereon. Naturally, the feasibility of this alternative, needs to be evaluated when more information is available.

Similarly the cost of importing filter cloths and paper for the filter press can be overcome by using locally available materials from the Canvas Mill in Morogoro. Linen and cotton sail cloths and cotton flannel make good filter cloths. Brown creped paper purchased in large sheets/rolls or similar materials will do as filter paper; MOPROCO may be able to assist or advise on the purchasing of this material.

7.4.3 Implementation plan

From a time a decision has been reached to proceed with the project to commissioning of the plant is about 10-12 months. An indicative timetable is shown on the following page. In the financial evaluation of the project, year one has been taken from the end of commissioning, but full capacity is not achieved until the third year of operation.

Fig 7.4.3 Implementation plan

| Months | 1 2 3 4 5 6 7 8 9 10 11 12 |
|---|---|
| Evaluation of Feasibility Study by Stichting Hivos, SOMAFCO and FEP. Decision to proceed | ——— |
| Preparation of Specification Document & Placing of Order | — |
| Design, Manufacture and Deliver Equipment* to site | ——————— |
| Mechanical Erection | (Silo) |
| Electrical and Water Reticulation | ——— |
| Commissioning and Training | ——————— |

*A six month period has to be allowed for delivery of equipment from the time of placing an order. CeCoCo specify time of shipment at 4 months, a 4/6 weeks for shipping and at least a further month has to be allowed to be cleared through customs and delivered to Mazimbu.

7.5 Labour Requirements

7.5.1 Training

A four month period has to be allowed for traihing; a month or so could be spent at the SIDO's oil processing and soap making at Chanzuru or alternatively at the Kilacha Production and Training Centre at Himo near Mushi in Northern Tanzania.

Furthermore TFNC offer training in oil processing and spending a few days at MDPROCO would give valuable insight to the more commercial setups. A further two months or so getting first hand experienced operating and familiarising themselves with the equipment should be sufficient. It will take a year or so before the operators are fully conversant with the equipmentand able to achieve the best performance. Initially, at least two people should be sent for training one of whom will manage the plant and the other milling activities at the feed plant, such as compounding the feedingstuffs or some other affiliated field. Also over the last two months period, the operatives will need to be trained in running and maintaining the equipment.

7.5.2 Labour requirements

| Work Force | Phase 1 (1-5 yrs) | Phase 2 (5-yrs) |
|---|---|---|
| Manager | 1 | 2 |
| Book-keeper/sec | 1 | 2 |
| Unskilled workers | 4/5 | 10/12 |

Working days/year 235 (2 weeks shutdown at the end of each year, 2 w weeks staggered holiday)

Plant operating days/year 240 (1 week for plant cleanup). During the initial years when the plant will not be up to full capacity the labour force will be expected to get involved in the other agricultural activities. Also, it is anticipated students will come for training on regular basis from the College. If need be, a double shift system could be arranged so as to increase productivity if the demand ever exceeded supply of oil.

8. SECONDARY PRODUCTS

8.1 Oil meal

As a secondary objective but of equal importance to achieving self sufficiency in vegetable oil, is having a protein-rich source for feedingstuffs. Sunflower meal is a high quality protein source, but care must be taken in formulating nonruminant rations to provide adequate lysine and energy for maximum production, because sunflower is low in these two factors. To maximise the utilisationof oilcake, its inclusion can be increased to 25% for ruminant feeds, but with its high oil content (10-12%), it is not recommended for nonruminants.

Obtaining feedingstuffs through the local dealers at TAFCO in Morogoro has always been difficult with their limited supplies and going to National Milling at Dar es Salaam is equally exasperating. Even after placing the order, there is no guarantee to obtain the correct feedingstuffs there either. Furthermore, as might be expected, the shortage in supply has been followed by rapidly escalating prices, which makes a mockery of prices control on farm produce.

For instance, chicken feed rose by 140% in September 83 - Layers Mash TSh 2,120 - 5,240/tonne

Boilers Feed TSh 2,800 - 6,740/tonne

Added to this problem is the transport cost which has risen from 75C/tonne/km ten years ago to5TSh for today and being that feedingstuffs is a relatively high volume product, transport cost takes a high proportion of the total cost.

The multi-purpose feed mill is fully equipped to produce feedingstuffs as can be seen in Appendix 1. Details of formulations for various stock is given in Appendix 4 which were prepared by TRDI for Tanzania. Also SOMAFCO have their own stock nutritionist. In addition to the nutritional requirements of feedingstuffs, there is also the need to structure the physical characteristics of the food to best suit the digestive tracts of differing species. This the food particle shape can range from a mash to a wide variety of formed feed shapes. These feeds not only need to be of a specific particle size spectrum but each particle must be of an optimum size, if made from a single ingredient, or are derived from mixes that subsequently have to be made into formed feeds. The plant does not contain a pelletiser, but a suitable ($0.5t/hr^{-1}$, 12kw) unit can be obtained from Alvan Blanch if considered necessary at a later date. It is proposed that all oil cake, approximately 90 tons will be utilised on site. The stocking level at the farm will be as follows:-

i. 100 dairy cows (Frisian herd), Zero grazzed
ii. 1,500 pigs/annum (weaners)
iii. 20,000 poultry/annum (broilers)
iv. 200 goats.

The other material for the feedingstuffs will naturally depend on their availability, but the proposed plans for the cropping at Mazimbu during 84/85 is as follows:-

| Crop | Area (ha) | Expected yield kg/ha | Total tonnage |
|---|---|---|---|
| Sunflower | 150 | 1000 | 150 |
| Sorghum* | 150 | 2000 | 300 |
| Maize* | 330 | 3000 | 990 |
| Beans | 60 | 2000 | 120 |

*Part of these crops will be made into silage.

If initially there is a surplus of oil cake, there is always a ready market for oil cake in Morogoro. As an indication of prices paid for oil cake in September 83. MOPROCO purchasing price for decorticated sunflower.

oil cake (12% oil) TSh 3,750

MOPROCO purchasing price for undecorticated sunflower

oil cake TSh 2,750

MOPROCO selling price for decorticated sunflower

oil cake (5%) TSh 4,000

8.2 Soap

The second by-product of vegetable oil manufacturing is soap production. The usual free fatty acids (ffa) content of oils varies from 0.5 to 5 per cent; during the conventional refining process is neutralised with caustic soda. However, neutralisation of the oil is not considered necessary in this instance unless the seed is badly deteriorated. As alternative oil source, that is less suitable for human consumption could be used. The soap would be soft and quite dark, but is well suited for cold water washing. Soft soap can be produced on relatively inexpensive equipment, only a kettle and steel forms to cool the soap are required. Afterwards the soap can be cut into appropriate sizes and packaged.

9. FINANCIAL AND ECONOMIC ANALYSES

9.1 Financial Summary

The financial projections of this project over the first seven years of operation is shown in Fig 9.5.1-9.5.4. The seventh year been taken as the first year when both oil plants are up to full capacity.

The profitability of the plant has been assesed on the following financial ratios:-

- The ratio of the net profit in a normal year of full production to sales revenue which measure the operations performance is 40.4%
- The net profit for a normal year of operation expressed as a percentage of the value of the original invetment which measures the financial performances of the capital is 238%
- The payback period, which is the period required for the cumulative sum of the cash flows to equal the initial investment is 26 months.
- The break-even number, the minimum throughput required to cover the overheads of the plant is 13 tons of seed (3,700 kg oil) ie. 8% of full capacity
- The internal rate of return is 49.5%.

## 9.2 Capital Costs

Fig 9.2 Comparative capital requirements for an oil expelling plant of 80-100kg $hr^{-1}$ capacity located at Mazimbu for processing sunflower seed and groundnut respectively (costs as for Sept 1983).

| Equipment | Electrical Power Requirements (kw) | Cost (Z$) Utilising Sunflower seed FOB KOBE | Cost (Z$) Utilising Groundnuts | $M^3$ Ship Measurements |
|---|---|---|---|---|
| Thresher (Standard Rdiva) | 2.0 | Available | - | - |
| Winnower/Seed cleaner | 0.75 | 12,608 | 12,608 | 1.6 |
| Seed scorcher Type L | 0.75 | - | 57,105 | 2.1 |
| Screw Press Type H54 | 7.5 | 85,050 | 85,050 | 1.8 |
| Filter Press Type B | 0.75 | 66,825 | 66,825 | 1.4 |
| Settling Tanks (4 x 1000) | - | 4,800 | 4,800 | - |
| Platform Balance (Avery) | - | 9,700 | 9,700 | 0.3 |
| TOTAL EQUIPMENT COST FOB | 11.75 | 178,983 | 236,088 | 7.2 |
| Freight & Ins CIF DSM (Est:Shs 2700/$m^3$) | | 13,770 | 19,440 | |
| Port charges @2.5% | | 4,474 | 5,902 | |
| Clearance & Trans to Mazimbu @5% | | 8,950 | 11.804 | |
| Erection 3% | | 5,370 | 4% 10,000 | |
| Contingency (Pre-operating cost) @ 10% | | 21,155 | 28,383 | |
| Spare Parts : for 4800 hrs running (3 yrs) | | 232,702 | 311,557 | |
| Expeller : 6 worm pieces Shs 3,645 | | 21,870 | 21,870 | |
| 6 Cage Bars Shs 3,827 | | 22,963 | 22,963 | |
| 18 Taper Ring Shs 304 | | 5,468 | 5,468 | |
| Filter Press : for 1600 hrs running (1yr) | | | | |
| 6 sets Filter Cloth 1,583$ | | 9,498 | 9,498 | |
| 30 sets Filter Paper 170 | | 5,103 | 5,103 | |
| | | 297,604 | 376,495 | |

Extra silo to existing at Skiold Feed Mill (TYPE 708) 219 $m^3$

Assuming that the plant can operate close to the predicted levels adopted in the tables, the project is highly viable. However, these financial projections are based on many assumptions and uncertainities and give a distorted picture of the actual operating conditions in rural Tanzania with its countless difficulties. The purpose of the financial analysis is not so much to show the project's financial potential, but to demonstrate that by forming micro economy, almost divorced from the national economy and its difficulties, it is possible to avoid the vast production costs that faces the oil industry of Tanzania.

It is clearly evident that by basing the analysis on the general market prices for seed, oil and cake, the returns for a relatively efficient plant become exorbitantly high and one can only conclude that a small plant of this nature can be the only solution for the rest of the Tanzania oil industry until suchtime the infrustructure exists to support large commercial plants.

Although it is advisable to operate the oil plant at SOMAFCO on commercial basis, a more realistic pricing should be established after the first year or so, when exact production costs will be known and targets can be set for reinvesting to fund the second oil plant (if the foreign exchange can be obtained). The oil project will ensure supply of a major food commodity to the community and furthermore form the basis on which the stock rearing at the farm can be started by providing a protein rich meal as a by-product. The oil project will no doubt form the nucleus for the agricultural activity at Mazimbu and Dakawa.

9.3 Working Capital

| | | |
|---|---|---|
| Stocks : | Raw Materials | 2 months |
| | Packaging Materials | 2 months |
| | Spares | 2 - 3 years |
| | Finished Goods | 1 month |

9.4 Schedule of Costs and Revenues

Plant capacities ; Mazimbu 80-100kg $hr^{-1}$ (126-157 tons of seed/annum)

Dakawa 100-130kg $hr^{-1}$ (157-204 tons of seed/annum)

Costing has been based on one tonne of oil and operating at a 30% extraction rate using 45% oil content seed (without any decortication). The financial projections assume the following seed throughput giving the respective oil and cake yields:-

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Processed Seed (kg) | 45,000 | 54,000 | 155,000 | 155,000 | 250,000 | 303,000 | 340,000 |
| Oil Yield (kg) | 13,635 | 13,300 | 47,000 | 47,000 | 75,000 | 92,000 | 103,000 |
| Cake Yield (kg) | 31,500 | 37,490 | 108,000 | 108,000 | 175,000 | 211,000 | 237,000 |

I. Revenue : 1 tonne of crude oil = Tsh 34,000*

1 tonne of oil cake = Tsh 2,750

*Government control retail price as for Sept 83, less 25% tax.
Actual market prices are much higher.

| II. Operating costs | | Tsh/ton of oil |
|---|---|---|
| a. Raw materials | | |
| Sunflower seed/tonne | | 4,000 |
| Plus storage costs paid to the farm | 10% annum | 200 |
| Plus seed waste and process losses (foots) | at 7% | 300 |
| Seed cost/tonne of oil | 4,500 | 14,850 |
| b. Utilities | | |
| Electricity, 210kwh/tonne of oil | 0.70/kwh | 147 |
| Water, $5m^3$/tonne of oil | $6.00/m^3$ | 30 |
| | | 177 |
| c. Labour | | |
| Manager, 1 | 8.00/hr x 45 hrs | 360 |
| Administration, secretary/book-keeper, 1 | 5.00/hr x 45 hrs | 225 |
| Unskilled workers, 4 | 2.50/hr x 45 hrs | 450 |
| | | 1,035 |
| d. Maintenance and spares | | |
| Assumed to be 8%/annum of equipment cost (based on full capacity of plant) | | 440 |
| 2%/annum building cost | | 45 |
| | | 485 |
| e. Packaging | | |
| It is assumed that the cake will be bined and that the oil will be sold in 20L drums | | |
| 54 x 20 drums/tonne of oil | 21.21/unit | 450 |

Note : Prices of other packaging materilas is given in Appendix 5.

f. Transport — Tsh/ton of oil

Delivery of oil to the project at Mazimbu and Dakawa 5.00/tonne/km x 20 — 100

III. Depreciation and financing charges

a. Depreciation

Assumed rates are:-

Building (occupying 10% of feed mill floor area); 96,680 5% = 4,834/annum — 112

Equipment 232,702 10% = 23,270/annum — 549

561

b. Loans

Assuming a loan is granted by NBC having been approved by SIDO, to be used as working capital and to be repayed over the first year, 140,000 11% — 179

c. Pre-operating costs

| | | |
|---|---|---|
| i. | Financing charges (1% of equity) | 2,500 |
| ii. | Start-up costs (trial runs) | 4,000 |
| iii. | Staff costs during pre-operating period 4 months/1 manager | 5,120 |
| | 2 months/4unskilled | 3,200 |
| | 1 month/1 secretary | 800 |
| iv. | Training cost, 2 personnel (Fees, Accommodation and Transport etc) | 7,000 |
| TOTAL PRE-OPERATING COSTS | | 23,000 |

Note : The contingency figure for capital requirements would cover such items as pre-operating costs.

IV. Taxation

State Tax has been taken as 25% of profit, and depreciation has been discluded from the expenses to determine the net profit for taxation.purposes.

V. Inflation

The rate of inflation has been taken as 32% and the Discounted Cash Flow has been based on the above lending rate plus inflation.

VI. Exchange rates

As of October 1983, exchange rates for Tanzanian Shilling

| | |
|---|---|
| American Dollar | 0.0823 |
| Dutch Guilder | 0.2412 |
| Pound Sterling | 0.0549 |

## 9.5 Financial Projections

**Fig 9.5.1 Profit and loss A/C (prices as for 1983/84)**

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Vegetable Oil | 463,760 | 554,200 | 1,598,000 | 1,598,000 | 2,550,000 | 3,128,000 | 3,502,000 |
| Oil Cake | 86,652 | 103,098 | 297,275 | 297,275 | 481,250 | 581,900 | 651,475 |
| TOTAL INCOME FROM SALES | 550,412 | 657,298 | 1,895,275 | 1,895,275 | 1,895,275 | 3,031,250 | 4 804,950 |
| Expenditure | | | | | | | |
| Raw Materials | 202,500 | 243,000 | 697,500 | 697,500 | 1,125,000 | 1,363,500 | 1,530,000 |
| Power | 2,025 | 2,430 | 6,975 | 6,975 | 11,250 | 13,635 | 15,300 |
| Water | 409 | 489 | 1,410 | 1,410 | 2,250 | 2,760 | 3,090 |
| Maintenance and spares | 6,612 | 7,906 | 22,795 | 22,795 | 36,375 | 44,620 | 49,955 |
| Packaging | 15,707 | 18,777 | 54,144 | 54,144 | 86,400 | 105,984 | 118,656 |
| Labour | 6,136 | 7,335 | 21,150 | 21,150 | 33,750 | 41,400 | 46,350 |
| Administration | 7,976 | 9,535 | 27,495 | 27,495 | 43,875 | 53,820 | 60,255 |
| Transport | 1,364 | 1,630 | 4,700 | 4,700 | 7,500 | 9,200 | 10,300 |
| TOTAL COST OF PRODUCTION | 242,729 | 291,102 | 836,169 | 836,169 | 1,346,400 | 1,634,919 | 1,833,906 |
| Depreciation | 28,104 | 28,104 | 28,104 | 28,104 | 57,078 | 57,078 | 57,078 |
| Profit before Interest and Tax (PBIT) | 279,579 | 338,092 | 1,031,002 | 1,031,002 | 1,627,772 | 1,017,903 | 2,913,966 |
| Interest | 15,387 | - | - | - | - | - | - |
| Taxation | + 76,920 | 91,549 | 264,776 | 264,776 | 421,213 | 518,745 | 742,761 |
| NET PROFIT | 187,272 | 246,543 | 766,226 | 766,226 | 1,206,559 | 1,205,559 | 2,171,205 |

Fig 9.5.2 Sources and application of finds

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Sources of funds** | | | | | | | |
| Equity (grant) | 250,000 | - | - | - | - | - | - |
| Local Loan | 139,882 | - | - | - | - | - | - |
| Cash | - | 199,376 | 201,008 | 671,882 | 1,164,423 | 675,540 | 1,639,518 |
| Funds from Operations : | | | | | | | |
| Net Profit | 187,272 | 246,543 | 766,226 | 766,226 | 1,206,559 | 1,499,158 | 2,171,205 |
| Plus Depreciation | 28,104 | 28,104 | 28,104 | 28,104 | 57,078 | 57,078 | 57,078 |
| TOTAL SOURCES OF FUNDS | 605,258 | 474,023 | 995,338 | 1,466,212 | 2,428,060 | 2,231,776 | 3,867,801 |
| **Application of funds** | | | | | | | |
| Capital Costs: Building | 31,000 | - | - | - | 966,749 | - | - |
| Equipment | 235,000 | - | - | - | 241,401 | - | - |
| Working Capital : Raw Materials | 33,750 | 40,500 | 116,253 | 116,253 | 187,470 | 227,250 | 254,997 |
| Packaging | 2,610 | 3,128 | 9,025 | 9,025 | 14,400 | 17,664 | 18,030 |
| Spares | 65,000 | 43,333 | 65,000 | 43,333 | 130,000 | 86,666 | 130,000 |
| Fin. Goods | 38,522 | 46,172 | 133,178 | 133,178 | 212,500 | 260,678 | 291,822 |
| Loan Repayments | - | 139,882 | - | - | - | - | - |
| Cash Balance | 199,376 | 201,008 | 671,882 | 1,164,423 | 675,540 | 1,639,518 | 3,172,952 |
| TOTAL FUNDS APPLICATION | 605,258 | 474,023 | 995,338 | 1,466,212 | 2,428,060 | 2,231,776 | 3,867,801 |
| CUMULATIVE CASH POSITION | 199,376 | 201,008 | 671,882 | 1,164,423 | 675,540 | 1,639,518 | 3,172,952 |

Fig 9.5.3 Cash flow

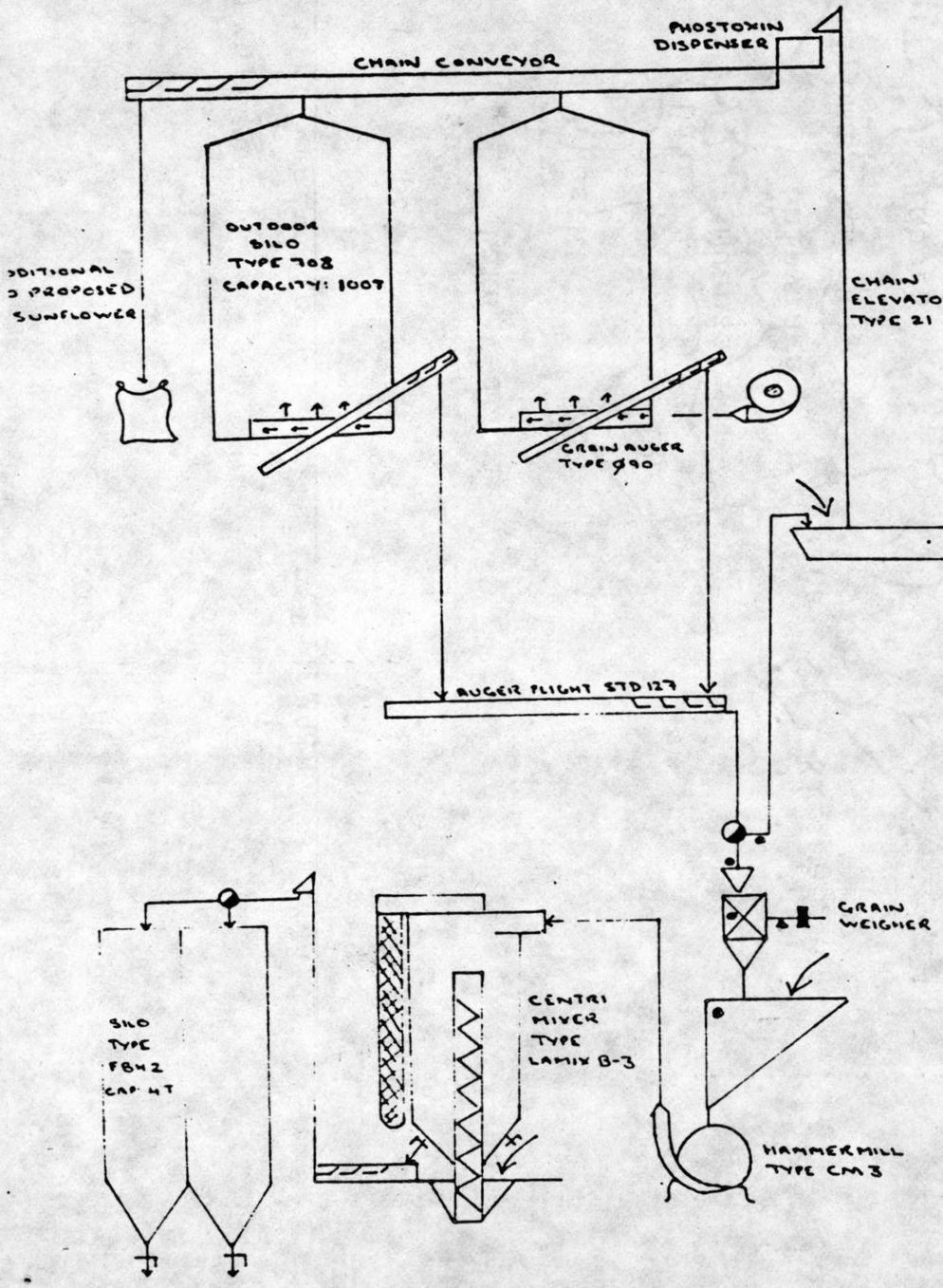
| Year | Investment | | Profit before Interest and Depreciation | Net Cash Flow | DCF Discounted at | | | |
|---|---|---|---|---|---|---|---|---|
| | Capital | Working Capital | | | 11% | Value | 43% | Value |
| 0 | -266,000 | -139,882 | - | -405,882 | - | -405,882 | - | -405,882 |
| 1 | - | -133,133 | 279,579 | 146,446 | 0.901 | 131,947 | 0.699 | 102,366 |
| 2 | - | -323,456 | 338,092 | 14,636 | 0.812 | 11,884 | 0.489 | 7,157 |
| 3 | - | -301,789 | 1,031,002 | 729,213 | 0.731 | 533,054 | 0.342 | 249,390 |
| 4 | - | -544,370 | 1,031,002 | 486,632 | 0.659 | 320,690 | 0.239 | 116,305 |
| 5 | -1,208,150 | -592,258 | 1,627,772 | -172,636 | 0.593 | -102,373 | 0.167 | -28,830 |
| 6 | - | -694,849 | 2,017,903 | 1,323,054 | 0.535 | 707,834 | 0.117 | 154,797 |
| 7 | +1,190,500 | +2,729,737 | 2,913,966 | 6,834,203 | 0.482 | 3,294,086 | 0.082 | 560,405 |

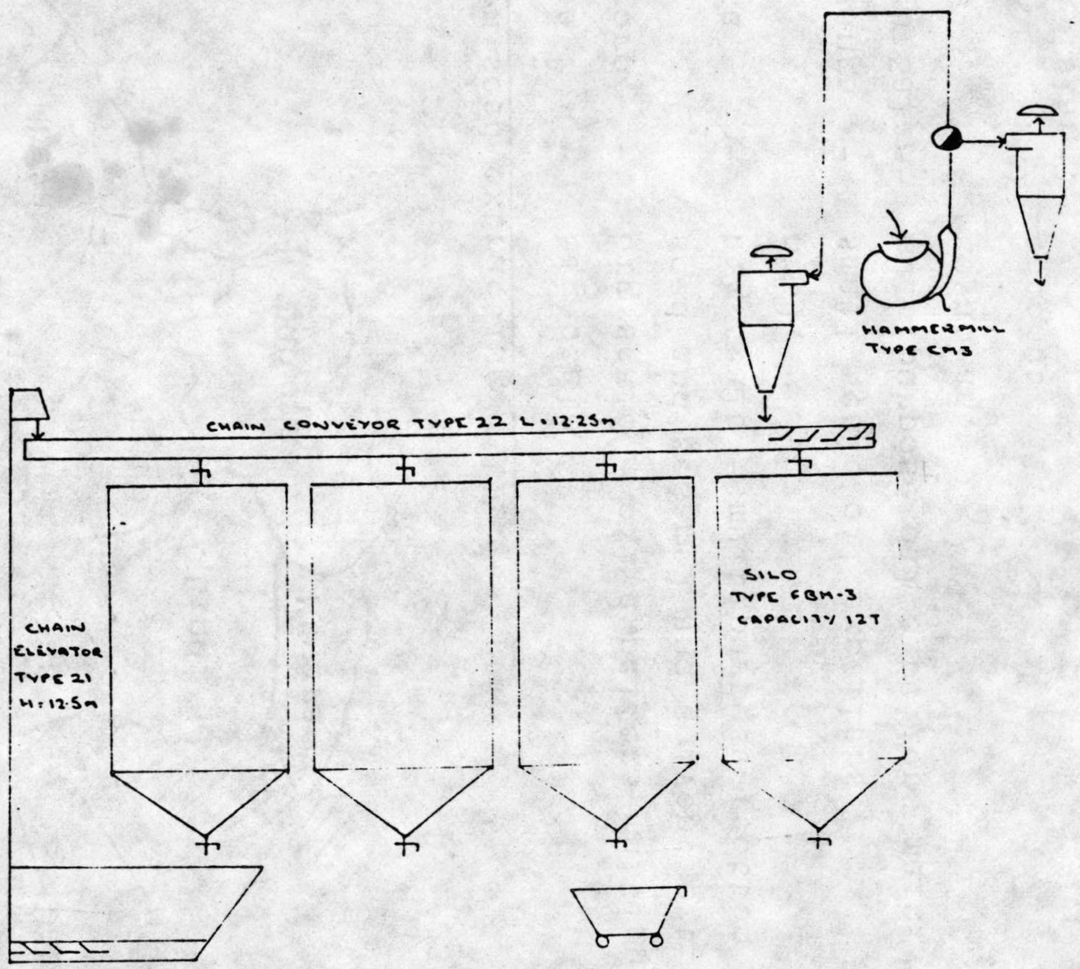
$$IRR = 11 + \frac{4,491,240\ (43 - 11)}{4,491,240 - 755,708} = 49.5\%$$

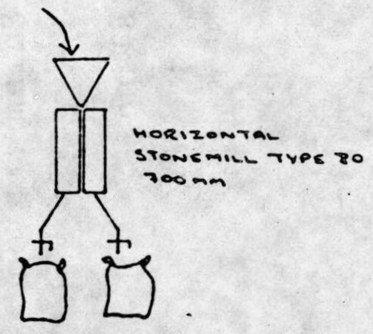
4,491,240 755,708

APPEXDIX 1

Layout Plan of the Multi-Purpose Feed Mill at Masimbu



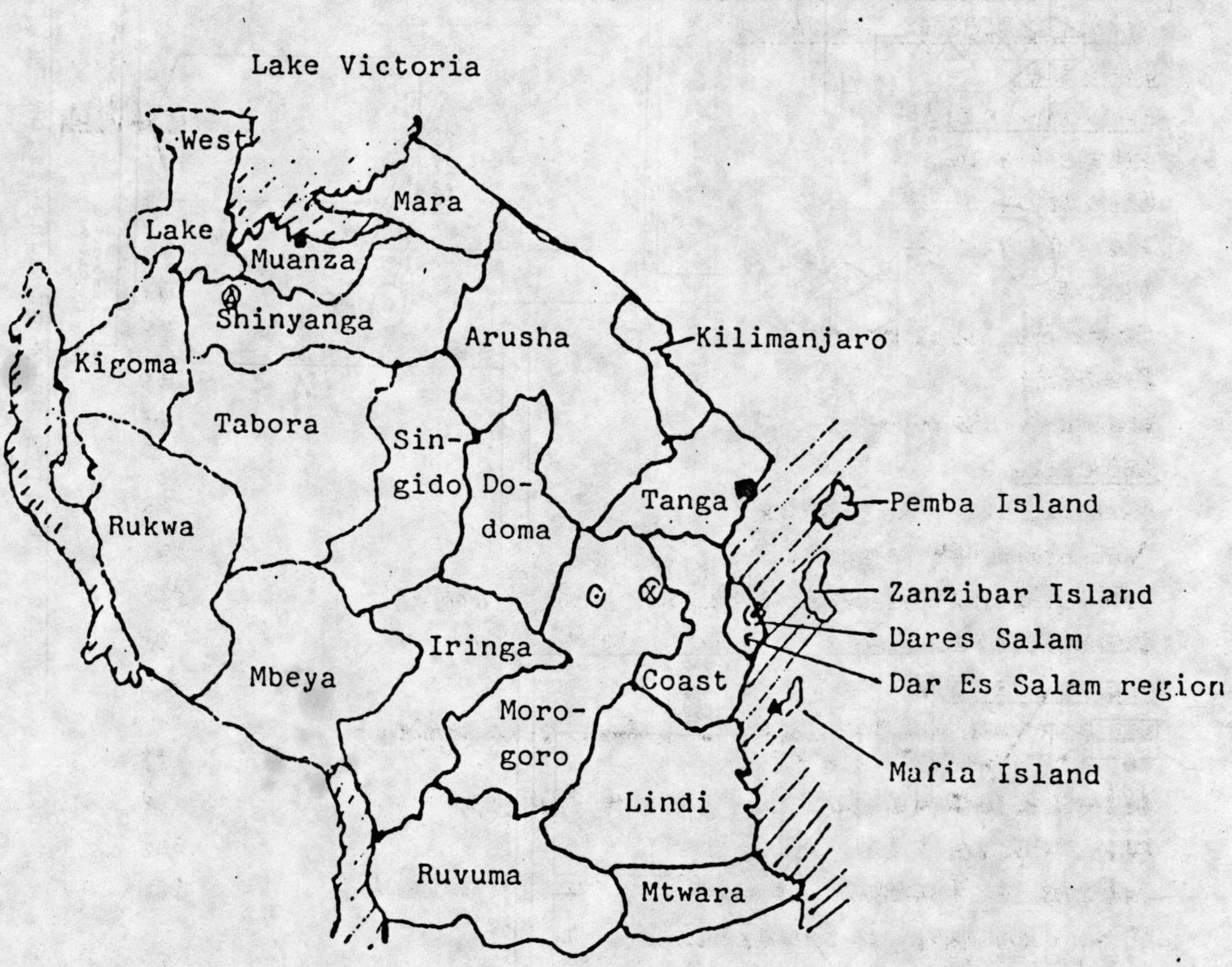




(SUPPLIER: SAEBY JERNSTØBERI • MASKINFABRIK)

APPEXDIX 2

Existing vegétable oil mills in Tanzania (regional):




Cotton seed extracting mills.

| | | | |
|---|---|---|---|
| I | ⊙ | Kilosa | - big scale |
| II | ⊗ | Morogoro | - big scale - oil expellers multipurpose (cotton seed and sesame) and solvent extraction system. |
| III | ● | Muanza | - big scale - multipurpose (cotton seed and ground nut). |
| IV | ⓐ | Shinyanga | - small scale oil expellers. |
| 2. | ⁘ | Dar es Salam | - multipurpose oil expellers mainly dealing with soyabean. |
| 3. | ■ | Tanga | coconut oil. |
| | ▲ | Mafia Island | |

APPENDIX 3

SUNFLOWER LARGE SCALE MECHANISED PRODUCTION

PRODUCTION COSTS AND RETURNS SHs/ha PRODUCTION YEAR 81/82, MARKETING YEAR 82/83

| Operation | Costs Shs/ha |
|---|---|
| **Machinery Cost:** | |
| Chisel Plough | 229 |
| Cultivator | 170 |
| Plant Fertiliser | 155 |
| Sprayer | 48 |
| Inter Row Cultivation | 71 |
| Thrasher | 85 |
| Harvest & Transport | 29 |
| **Materials :** | |
| Seed 5kg/ha @ Sh 7.55/kg | 38 |
| Fertiliser TSP 100kg/ha @ Sh 2.12/kg | 212 |
| Pre Emergence Herbicide 2.0kg/ha @ Sh 125.00/kg | 250 |
| Insecticide Didimac 5 10kg/ha @ Sh 8.01/kg | 80 |
| **Casual Labour :** | |
| Filling Seed and Fertiliser Hoppers, Spray Tanks, 1.3 days/ha @ Sh 17.70/day | 23 |
| Insecticide Dusting, 1 day/ha @ Sh 17.70/day | 18 |
| Hand Weeding, 8 days/ha @ Sh 17.70/day | 142 |
| Cutting and Stacking, 14 days/ha @ Sh 17.70/day | 248 |
| Threshing, Bagging, Transportation, 2.2 day/ha @ Sh 17.70/day | 39 |
| TOTAL COST Shs | 1,836 |
| Sales : 1,200kg @ Sh 2.90/kg | 3,480 |
| Return : Sh | 1,644 |

Note : Excluding depreciation

Source : MBD based on 'report of the Tanzania Oilseeds Identification Mission'. FAO Investment Centre 1977.

APPENDIX 3.2

SOYA BEAN LARGE SCALE MECHANISED PRODUCTION

PRODUCTION COSTS AND RETURNS Sha/ha

PRODUCTION YEAR 1981/82, MARKETING YEAR 1982/83

| Operation | Costs Sh/ha |
|---|---|
| **Machinery Cost** | |
| Chisel Plough | 229 |
| Cultivator | 170 |
| Plant Fertilise | 155 |
| Spayer | 48 |
| Inter Row Cultivation | 71 |
| Thresher | 85 |
| Harvester & Transport | 29 |
| **Materials :** | |
| Seed, 50kg/ha @ Sh 9.80/kg | 490 |
| Fertiliser TSP 100kg/ha @ Sh 2.12/kg | 212 |
| Pre Emergence Herbicide 2.5kg/ha @ Sh 117.00/kg | 293 |
| Insecticide Thiodan 35 6kg/ha @ Sh 74.35 | 446 |
| **Casual Labour :** | |
| Filling Seed and Fertiliser Hoppers, Spray Tanks, 1.5 days/ha @ Sh 17.70/day | 27 |
| Insecticide Dusting, 1 day/ha @ 17.70/day | 18 |
| Hand Weeding 8 days/ha @ Sh 17.70/day | 142 |
| Pulling and Stacking, 18 days/hr @ Sh 17.70/day | 319 |
| Threshing, Bagging, Trahsportation, 202 days/ha @ Sh 17.70/day | 39 |
| TOTAL COST Shs | 2,771 |
| Sales : 800kg @ Sh 3.00/kg | 2,400 |
| Return: Sh | -371 |

Note : Excluding depreciation

Source: MDB based on FAO Investment Centre 1977 report.

APPENDIX 4

FEED FORMULATIONS

| Ingredient *1 | Breeder | Chick | Grower | Layer | Starter | Broiler | Calf Weaner | Calf Rearer | Dairy | Pig Weaner | Pig Finisher |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maize | 52.7 | 42.8 | 51.3 | 46.1 | 41.6 | 47.2 | 47.8 | 41.8 | 20.7 | 50.9 | 48.8 |
| Maize bran | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 8.7 |
| Wheat bran | 2.8 | 15.0 | 25.0 | 3.3 | 3.5 | 5.4 | 10.1 | 20.0 | 40.0 | 10.0 | 30.0 |
| Cottonseed cake | 5.0 | 5.0 | 1.2 | 5.0 | 5.0 | 10.0 | 20.0 | 9.8 | 25.7 | 7.5 | - |
| Sunflower cąke | 8.6 | 5.5 | - | 9.6 | 5.2 | 7.5 | 10.0 | 15.0 | - | 8.9 | - |
| Soyabean cake | 12.1 | 17.1 | 8.3 | 15.1 | 26.2 | 14.7 | 6.0 | - | - | 9.6 | 9.0 |
| Sesame cake | - | - | - | - | 5.0 | 4.7 | - | - | - | - | - |
| Limestone | 6.4 | 1.7 | 2.4 | 9.1 | 1.3 | 1.5 | 1.8 | 2.1 | 1.9 | 1.7 | 1.0 |
| Salt | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.6 | 0.6 | 1.6 | 0.5 | 015 |
| Dicalcium Phosphate | 1.1 | 1.2 | 1.1 | 0.5 | 1.0 | 0.7 | 1.1 | 0.6 | - | 0.7 | 1.5 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.5 | 0.5 | 0.1 | 0.1 | 0.1 | 0.25 | 0.25 |
| Lysine | - | 0.003 | - | - | - | - | - | - | - | - | 0.196 |
| Oil (added) 2 | 0.7 | 0.6 | 0.1 | 0.7 | 0.4 | - | - | - | - | - | - |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source : Tropical Development and Research Institute.

Note : *1 These formulations are for guidance purposes only, exact formulae will depend on the availability and pricing of the ingredients and each animal needs.

*2 With cold press oil cake at 12-15% oil, added oil is not required.

APPENDIX 5

PRICES OF CONTAINERS 1982/83

| | | Shs |
|---|---|---|
| 1. | Ply unprinted cartons 4 x 4 kg | 8.00 |
| 2. | Ply unprinted cartons 1 x 12 kg | 9.75 |
| 3. | 20 litres plastic pails lids | 36.65 |
| 4. | 4 litres plastic jelly cans | 8.20 |
| 5. | 4 litres plastic pails and lids | 11.40 |
| 6. | 20 litres tins - $1\frac{3}{4}$ diameter 18 kg | 21.21 |
| 7. | 4 kg round tins $1\frac{3}{4}$ diameter | 8.75 |
| 8. | 1 litre plastic container | 3.60 |
| 9. | 1 kg container - round tins $1\frac{3}{4}$ | 3.05 |
| 10. | 5 litres cartons 14 x 14 x $7\frac{3}{4}$ | 8.00 |
| 11. | Palm oil labels 1 kg | 0.25 |
| 12. | Palm oil labels 1 litres | 0.25 |
| 13. | Kapok seed oil labels 18 kg | 0170 |
| 14. | Kapok seed oil labels 4 kg | 0.25 |
| 15. | Henkel glue 1 pail 5 kg | 1050.00 |
| 16. | Ponal glue 1 kg | 200.00 |

By courtesy of MOPROCO and Metal Box (Dar es Salaam).

APPENDIX 6

ABBREVIATIONS

1. SOMAFCO - Solomon Mahlangu Freedom College
2. MOPROCO - Morogoro Oil Processing Company
3. GAPEX - - General Agricultural Products Export Corporation
4. ISDC - Industrial Studies and Development Centre
5. TISCO - Tanzania Industrial Studies and Consulting Organisation
6. MDB - Marketing Development Bureau
7. NMC - National Milling Corporation
8. CATA - Cashew Nut Authority Tanzania
9. TSC - Tanzania Cotton Authority
10. TFNC - Tanzamia Food Nutrition Centre
11. SIDO - - Small Industries Development Organisation
12. TCA - Tanzania Cotton Authority
13. RTC - Regional Trading Company
14. TRDI - Tropical Development and Research Institute
15. CCM - Chama Cha Mapinduzi
16. NBC - National Bank of Commerce

APPENDIX 7

ORGANISATION AND INDIVIDUALS CONSULTED

1. FAO; Via delle Terme di Carcalla, 00100 Rome, Italy (Food Industries Officer).
2. GAPEX; Ministry of Agriculture, Pamba House, Dar es Salaam (Director).
3. Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres; Laboratorie de Technologie des cereales, 9 Place Piere Viala, 24060 Montpellier Cedax, France (Director).
4. LIFE: 915 Fifteenth Street, N.W., Rm 915 Washington D.C. 20005 USA.
5. MOPROCO; Box 1053, Morogoro(Production and General Manager).
6. SIDO; Mfaume Road, Box 2476, Dar es Salaam (Manager of Technical Services and Branch Manager at Morogoro).
7. SOMAFCO; P.C. Box Mazimbu, Morogoro.
8. TDRI; Culham, Abingdom, Oxfordxhire OX14 3DA, England (oilseed and Edible Nut Section).
9. TFNC; Ocean Road 22, Box 977, Dar es Salaam.
10. TISCO; IPS, Independant Avenue, Box 2650, Dar es Salaam.
11. TSC; Box 1036 Morogoro (Branch Manager).
12. UNICEF; Box 4076, UWT St, Dar es Salaam (Couhtry Representative).
13. UNIDO; Vienna International Centre, Box 300, A1400, Vienna, Austria.
14. University of Dar es Salaam; Faculty of Agriculture, Chuo Kikuu, Morogoro, (Oilseed Specialists).
15. VITA; 3706 Rhode Island Avenue, Mt Rainier, Maryland 20822, USA.

APPENDIX 8

LIST OF EQUIPMENT AND PACKAGING SUPPLIERS

1. Alvan Blanch Dev. Co. Ltd; Chelworth, Malmesbury, Wiltshire, SN16 9SG. England.
2. Ambono Plastics; Tanga.
3. Avery Ltd; Smethwick, Warley, West Midlands, England B66 2LP
4. CeCoCo; P.O. Box 8, Ibaraki City, Osaka 567, Japan.
5. IBG Monforts and Reiners GMBH & Co.; Postfach 514, D-4050, Monchengladbach 2. W. Germany.
6. Metal Box Tanzania; Pugu Road, Box 618, Dar es Salaam.
7. Saeby Jernstoberi & Maskinfabrik; P.O. Box 143, DK9300, Saeby, Denmark.
8. Simon "osedowns Ltd; Cannon Street, Hull, England HU2 OAD.
9. Tanganyika Tegry Plastics; Box 2219, Dar es Salaam.
10. Tanzania Seed Company; Box 1036, Morogoro.