A TECHNICAL REPORT ON

THE EDIBLE OIL PROCESSING PLANT PROPOSAL

FOR

THE COOPERATIVE UNION IN LIRA, UGANDA

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Scope of Work

To assess and evaluate the equipment content and economic viability of the proposal presented by "Magric" U Ltd of Kampala. To the CAAS project of the Cooperative alliance. The economic viability assessment is to be done by Mr Greg Kruse, Economist.

After initial discussions were had with Dr Vic Amman C.O.P. of the CAAS project on the possible outcome of the evaluation, the scope of work was enlarged to assess the possibility of smaller scale processing units being an alternative to one relatively large scale operation.

Evaluation

The initial discussions with all parties concerned in the project proposal produced a consensus of opinion that the proposal to erect a 25 ton per day edible oil processing plant at the Lira cooperative union location was not a viable consideration.

The technical reasoning for arriving at this conclusion is that;

1. The main components of this processing plant are the Expellers, which extract the oil from the oil seeds. The intention of the supplier was to recondition and install 5 Rosedown U.K. "Maxoil" expellers which were used extensively by the edible oil industry prior to 1972. The capacity of each machine is rated at 5 tons per 24hr day but in most installations this is only achieved by a pre-press operation which allows the expeller to final press the material being processed and this was not included in the proposal, consequently, this would effectively reduce the capacity to approx, 2.5 tons per day per machine.

2. The cost of these expellers after rehabilitation, is estimated as per the proposal, U.S. $207,300. A new U.S. made Anderson Duo 55 is less than this figure and it has double the capacity.

3. The total amount of the proposal is U.S.$2.8m this is extremely high for an effective process rate of 12.5 tons per day. The Makwhano edible oil process which was installed recently here in Kampala has a rated capacity of 85 tons per day and it's total cost was U.S.$2.1m.

4. The proposed primary raw material for this process is quoted as being Cotton seed and Sun flower seed. The Cotton seed supply is declining in the Lira area and ginning capacity is not available because of one badly worn 30 year old gin and a non functioning new one which requires a great deal of money to make it functional.

If the Sun flower seed is to be obtained from local farmers, the capital required to do this for the proposed capacity of 25 tons per day 25, would be approx, 500,000,000/- every 6 months to cover the 2 growing seasons in the year. When the total cost of the installation, raw material, transport and operational costs are considered at prevailing interest rates, the proposal in it's present form is not feasible or viable.

Alternatives

There is a range of smaller scale edible oil processing equipment available which have a processing capability from 40Kg to 100Kg per hr, which would probably be more suitable to commence the revitalization of the edible oil industry in Uganda. One of the major constraints associated with this equipment is that it is all imported and in terms of obtaining spare parts to maintain this equipment it is very expensive. Probably, the main advantage of this alternative is it's simplicity of operation, relatively low unit cost, low financial risk and in the event of default in the repayment of any loans, because of it's potential portability it can be relocated.

Some of the small scale expellers which are available are;

a. Hander, Japanese manufacture, approx, 100Kg/hr

b. Mini 40, Rosedown U.K. manufacture, approx, 40Kg/hr

c. Komet, Austrian/German manufacture, approx, 40Kg/hr

d. Tiny oil mill, Indian manufacture, approx, 75Kg/hr

Decorticators, Winnowers, Filter presses and pumps which are required to support and facilitate the efficient operation of the above expellers are also available from the same manufacturers and a European manufacturer of hand operated equipment, they can be used in any combination to achieve what is considered the best performance.

Recommendation

The Indian manufactured expeller, Filter press and oil pump would be selected, the Decorticator and Winnower which is manufactured by the European manufacturer and can be motorized, would be selected to comprise the basic process. All the transfer of materials within the process area would be done manually, the storage of oil would be in 20 litre containers and the cake from the expeller in hessian bags of the 50Kg size.

An addition to the basic process equipment, which is an optional item, would be the Indian manufactured steam boiler as per the illustration attached, applying heat to the prepared material to be processed does improve the extraction of the oil from the pressed seed, it provides a hot water source for cleaning, improves the efficiency of the process as a whole and the hulls of the Sun flower seed can be used as it's fuel.

The main consideration for selecting this equipment, is that because of it's basic simplicity of design it should be possible to manufacture the component and wear parts locally. This possibility is very important for the sustainability of the concept.

Training

The training of the personnel associated with this type of process and business venture is essential and the fields they will need training in is Management, Accounting, Marketing, Process methodology and Plant maintenance. The observations we have made during our tour of the various cooperative and private ventures, very forcibly confirms this fact to such an extent that it is reasonable to assume that the small scale oil processing operations we saw will probably fail because of the lack of training in the above mentioned fields.

The field of Plant maintenance needs to be gone into in a little more detail because we are really talking about Technical assistance in the form of consultant who is familiar with oil seed processing as a whole, plant maintenance, parts manufacture and repair. Particularly with regard to the wear parts of this equipment. The technology required to do this repair work is not available in Uganda as far as we can tell, it requires the knowledge of hard facing techniques, heat treatment of carbon steels and possibly chilled cast iron casting.

The technical assistance is very much an integral part of this project concept because the introduction of commercially viable small scale edible oil processing ventures into the rural environment, cannot survive without it.

Processing Oil Seeds

The method of processing oil seeds has a large bearing on what type of plant and equipment is selected to determine the size and complexity of the process. The most commonly used oil seeds that are processed for edible oil are Sun flower seed, Ground nuts, Sesame seed (Simsim), Soybeans and Cotton seed. The first three types are probably the easiest to process and they also have the highest oil content. Sun flower seed can vary in oil content the most of all the seeds and is caused by planting time, ground moisture at time of planting, length of growing and maturing time before harvest and exposure to the sun, the oil content of the kernel reaches it's maximum in the last days of growth. Analysis of all types of seed from open pollinated varieties to hybrids, have revealed oil content of the whole seed from 22% to 43% it can be seen that the quality of the seed in terms of oil content determine whether any given process is economically viable or not.

To illustrate this point, if the same material preparation is applied to the varying quality of Sun flower seed before expelling, the residual oil content of the expelled cake remains the same. Therefore, the higher the oil content of the seed the higher the yield of oil from the process.

The quality of Sun flower seed in terms of oil content is almost directly proportional to the thickness of the seed shell or hull. e.g. A seed with approx, 43% oil has a hull content of about 25% A seed with only 25% oil has a hull content of about 41% The reason why quality of seed is so important to a process, is that the hull is extremely abrasive and this is the prime cause of the wear parts of the expeller failing when a process does not include a decorticating stage in the preparation of the seed as is the case in most of the small scale plants.

The main advantage to decorticating Sun flower seed, apart from reducing the wear on the expeller, is that by removing approx, 50% of the hull it increases the material processing capacity of the expeller which increases the productivity of the process.

Ground nuts are the easiest of the oil seeds to process and the least abrasive because very often the shelling procedure is done external of the process by the producer. One reason for this is a bulk problem when vehicular transport costs have to be considered although if it is done as part of the process it is not a problem.

The ground nuts can be introduced straight into the expeller or some times a partial reduction in size and heating can improve extraction of the oil. Very often, because of the high oil content of the nut, double pressing is required to get the maximum oil yield.

In a case where the cake may be used for human consumption, if the value of the cake justifies it, a single pressing will suffice. The oil content of ground nuts varies from 35% under drought conditions to 55% under normal conditions.

Sesame seed (Simsim) requires pre-cleaning before processing because the method of harvesting is by threshing the plant after stacking and opening of the pods. This is very often done on a tamped dirt surface and the seeds being quite small results in dirt and sand particles being picked up with the seed, which, if it is fed into the expeller will have the same effect as the hulls of the Sun flower seed. In some plants, flaking or crushing the seed before moisturizing and heating takes place is carried out, this also assists the extraction of the oil but it is not essential to the process.

This seed also, can require a second pressing. The oil content of this seed can vary from 40% to 60%

Soybeans are relatively low in oil content, approx, 20% This is not a product to be processed in a small scale oil seed processing plant. When the extraction of it's oil is required to produce a high protein meal, it is done in large commercial operations. The main reason for processing soybeans is for it's high protein cake which is used in feed stock and increasingly as a human food supplement such as the World food program "HEPS" which when water is added produces a nutritious porridge. The processing of soybeans requires that the trypsin inhibitor which is a growth retarding characteristic of soybeans is removed by thoroughly heating the beans to a temperature of not less than 145 degrees F for a period of 1/2 hr.

In the larger scale processing plants this is done by either cooking in a flame rotary drier, steam jacketed cooker, an extruder or other heating devices and the expelling stage follows to extract the oil. The oil yield from soybeans is in the range of 10% to 14% on average and very often the oil has to be refined to remove gums, color and flavor.

Cotton seed is also not a seed to be processed in small scale oil seed processing plants. It requires different types of cleaning, decorticating and crushing equipment from the other seeds.

It has a low oil content of approx, 19% and the oil after extraction has to be refined before it can be considered for human consumption. The oil from the expellers is almost black in color, has an unpleasant odor and taste and very often in Uganda the Free Fatty Acid level is high because of being in storage waiting to be ginned. In comparison to the small cost of filtration, which is all that is required of the oil from Sun flower seed, Sesame and Ground nuts. The refining process of Cotton seed oil is expensive and the chemicals such as caustic soda and bleaching clay which are required to do the refining, have to be imported.

The oil yield from processing Cotton seed because of refining losses, is very often below 10% of the raw material weight.

Conclusion

If the following criteria can be achieved, there is a better than even chance that the introduction of small scale oil seed processing operations can be feasible and economically viable.

a. A method of financing the purchase of the small scale processing plant such as lease option to buy can be worked out.

b. Training and Technical assistance is provided as an integral component of the concept.

c. The oil seeds to be processed are restricted to Sun flower seed, Sesame seed and Ground nuts.

d. That locally manufactured parts can be initiated and produced and repair technology be introduced and sustained.

One of the major constraints to be aware of is the competitive price of imported edible oil, which is primarily from Kenya.