

EXPERIENCES WITH A 10,000 TONNE COCONUT OIL MILL IN SOLOMON ISLANDS

By

D. Friend*

Summary

The rationale behind building a 10,000 tonne (copra throughput) oil mill in Solomon Islands is discussed. Brief descriptions of the construction, installation of machinery, and the machinery and its operations are presented. Problems encountered include minor breakdowns, high copra moisture and infrequent shipping of oil which gave rise to storage deficiencies.

Advantages of milling copra in situ on the Estate include - flexibility in copra disposal, control of oil quality, prospects for further processing and added value of oil and cake, and the provision of an industrial raw material base for local industries.

Introduction.

Lever Solomons Limited (LSL) is the current name for a Plantation Company which has been operating in Solomon Islands since the early 1900's. The Company operates two estates, one in Russel Islands and one in Guadalcanal. Emphasis on the former is on coconut-cattle culture (5,000 hectares undergrazed with 2,000 head of cattle) while on the latter, coconut intercropping (1,000 hectares intercropped with cocoa).

Production of copra is currently around 7,000 tonnes with a potential, as recent plantings mature, of 15,000-18,000 tonnes per year. Until 1989, all copra produced was sold through the Commodities Export

Marketing Authority. The raw material base (the coconut) consists therefore of some 35 million nuts with a potential of over 70 million nuts. Solomon Islands' copra production (excluding that of LSL) is around 32,000 tonnes, all of which is exported to Europe and Asia. It has been considered for many years, that Solomon Islands, should in some way process its own coconut to add value. Generally, however, visiting consultants have felt that there was either insufficient copra or the international logistics of centralising coconut collection would make the construction of oilmills and other factories a marginally economic proposition.

LSL decided, however, that it could be profitable to mill copra on site near its Yandina port, if a suitable size mill could be found. A mill was designed with a throughput of 10,000 tonnes copra per annum or 33 tonnes copra per day for 300 days on three 8-hour shifts. It was planned that copra would be purchased initially to make up for the 3,000 tonne shortfall in production and when LSL's production exceeds 10,000 tonnes, to either expand the mill, or process the excess into other products (i.e. cream).

* Managing Director, Lever Solomons Ltd., Solomon Islands.

It was felt that there were the following advantages in favour of milling our own copra, viz:

- (i) The mill could be built on the copra factory doorstep and oil stored near the overseas wharf;
- (ii) With control of copra quality, good quality oil could be produced taking advantage of any premium;
- (iii) Milling would give two by-products, oil and cake, which could be further processed to support local industries;
- (iv) If the original cost of the mill was low enough and only a few skilled workers are needed to run it, the company could switch to milling or copra production, depending on the crushing margin; and
- (v) The final product attracts a cheaper freight rate than bulk copra.

LSL, thus, decided to go ahead with the mill construction.

CONSTRUCTING THE MILL

Building

The building is basically a very simple design, being a clear span portal frame construction. The main building measures 12 x 18 metres, with lean to type annexes added to house copra reception, cake handling, a small office, and a workshop.

The company building section handled the foundations, roofing, cladding and annexes, but the main frame was constructed and erected by a local contractor.

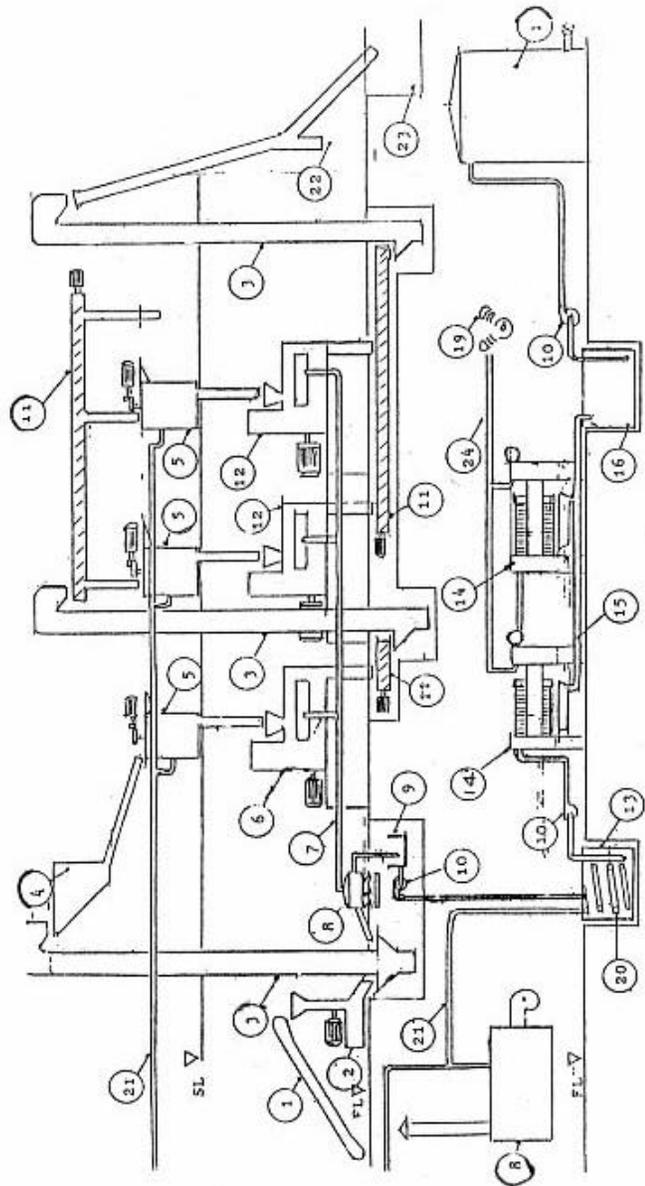
Machinery

All the actual milling machinery was constructed or purchased in Taiwan by Lupton Engineering. Installation and testing was carried out by that company.

The basic layout of the machinery is illustrated in the attached diagram.

The materials flow is as follows:

Copra	To shredder	(2)
Shredded Copra	To first kettle	(5)
Conditioned Shredded Copra	To first press	(6)
First press expeller (FW)	To second kettles	(5)
Conditioned FPE	To second presses	(12)
Final Expeller	To cake storage	(23)
Oil - all presses	To vibrating screen	(8)
Oil from vibrating screen	To holding tank	(13)
Oil (Unfiltered)	To filter press	(14)
Oil (filtered)	To holding tank	(16)
Oil (filtered)	To day tank - storage	(19)



LEGEND

- 1. CONVEYOR
- 2. SHREDDER
- 3. ELEVATOR
- 4. SURGE BIN
- 5. COOKER
- 6. SCREW PRESS 1ST STAGE
- 7. CNO PIPE (DIRTY)
- 8. VIBRO SEPARATOR
- 9. SURGE TANK
- 10. PUMP
- 11. SCREW CONVEYOR
- 12. SCREW PRESS 2ND STAGE
- 13. HOLDING TANK (DIRTY)
- 14. FILTER PRESS
- 15. CNO PIPE (CLEAN)
- 16. HOLDING TANK (CLEAN)
- 17. STORAGE TANK
- 18. SCREW PRESS END STAGE
- 19. AIR COMPRESSOR
- 20. STEAM COIL
- 21. STEAM PIPE
- 22. CAKE BAG FILLING
- 23. CAKE STORAGE
- 24. AIR LINE

LEYER SOLOMONS LTD, DIAGRAMMATIC LAYOUT OF THE YANDINA COCONUT OIL MILL

All steam is provided from a diesel fired boiler rated at one tonne steam per hour at 150 psi (10 bar). The boiler is diesel fuelled. The overall electricity requirement for the mill is 100 kwhr and is provided by a 150 kwhr caterpillar generator with a link to the main power as standby. The screw presses are one 6" (15.2 cm) and 2 x 4" (10.2 cm).

Storage

Initial storage capacity was for 530 tonnes. The steel tank was constructed some 60 metres from the overseas wharf and 60 meters from the factory. The tank was fabricated by a local contractor. This is now considered insufficient as shipping frequencies have declined and a second tank is planned. Oil is pumped to ship at a rate of 100 tonnes per hour on full tank declining to 80 at low tank.

Mill Capacity/Output

The original specification for the mill were to process 10,000 tonnes copra in 300 days giving an oil extraction from 6% m.c. copra of 60% and expeller, 357c. Thus in three shifts, the rated throughput per hour is 1.4 tonnes per hour and an output of 0.83 tonne oil/hour and 0.49 tonne cake/hour.

Construction time

The ground was broken for mill construction in June 1989. The mill was commissioned and officially opened on December 16th 1989. Operations (run up year) commenced in January 1990, viz:

Operation	6/89	7/89	8/89	9/89	10/89	11/89	12/89	1/90
Building	_____							
Annexes	_____							
Machinery	_____							
Storage	_____							
Commissioning							*	
Operation								*

Note the capital cost of the mill at current exchange rate was about \$US 560 K.

THE RUN UP YEAR 1990

As with any new venture, teething troubles occurred and staff and workers had to learn the ropes.

The first problem encountered were minor but time consuming faults in the machinery. The basic units were sound, but faulty bearings and weak elevator chains caused numerous breakdowns and loss of production time. Experience had to be gained in rapid detection and repair of such small faults.

Probably the single most important discovery was that the copra was not being sufficiently prepared for milling. Generally, the moisture content at 7.8% was too high to ensure good extraction.

The quality of the oil was excellent in terms of FFA (0.8-1.2%) and cleanliness. However, oil colour was darker than expected (2.5-3 red (lovibond)).

Because of the high moisture content in the copra and the numerous small breakdowns, output fell well below target. The best achieved on a clear run day was 17.5 tonnes of oil. Higher than expected downtime, however, reduced the average output to 12 tonnes per day.

Oil content of the copra was lower than expected (a function of moisture and extraction) and fell to 55%. This resulted in a higher than expected cake extraction (40%) and the cake oil percentage was as high as 8-10% v. a spec of 7%. Occasional samples were over 10%. The high cake oil resulted from the high proportion of unpressed copra particles escaping through the system.

Other downtime during this run up year was caused by shipping delays, i.e., when the storage was full, we had to stop production.

To cap the year off, we saw the rapid decline in prices which negated crushing margins and the mill was closed at the end of October.

THE SECOND YEAR 1991

With most of the problems diagnosed in the run-up year and with oil production held pending price changes, we were able to set in motion a major overhaul of the mill and turn our attention to improved copra drying.

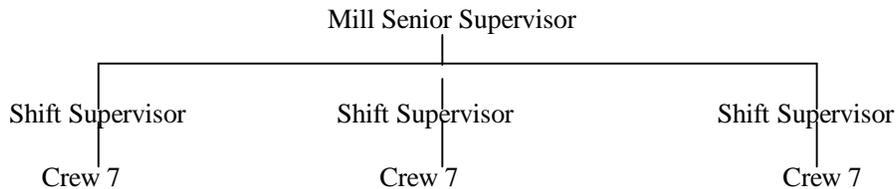
All minor faults in machinery design and materials have been corrected. We are planning at time of writing to increase the capacity of the first kettle and upgrade the power of the shredder. Already, extra drier capacity has been built to precondition copra to the required 5.6% moisture. A second storage tank has been ordered for construction by year end.

Up until April, we continued to sell copra and only milled for local oil requirements. General workers were deployed elsewhere in the company and a skeleton crew of skilled workers kept to operate for the local oil and for maintenance. The mill began operating from April to meet some forward contract requirements and to enable further improvements to be tested. The decision to continue full time oil production will of course be price led.

RUNNING THE MILL

One of the constraints to development of factory industries in small Pacific countries is the scarcity of qualified and experienced engineering personnel at all levels. In our case, we were perhaps more fortunate than most in that LSL had a basic engineering structure from which to draw its key personnel in the mill. It also has the support of engineering workshops on site.

The basic organogram for the mill is shown below.



Ancillary work on copra transport and cake transfer to storage is carried out by a front end loader (part time). With the exception of the Supervisors and 3 key operators per shift, the remaining men can be easily trained quickly in their tasks. This can be said to be the result of having simple appropriate technology in the mill. In close down periods, all skilled personnel can be concentrated into a single shift for maintenance and occasional running to produce oil for the local market and the others re-deployed elsewhere in the Estate.

A second constraint to the establishment of such a factory in our Islands is the shortage of contractors capable of carrying out major repairs such as press screw rebuilds. Added to this is the need to maintain a large inventory of spares than would be necessary in larger Asian coconut oil producing countries. Again,

the former can be overcome by training existing staff in such repairs, but there seems no immediate answer to the inventory problem. We are, however, reducing requirements by changing inferior bearings, etc., by standard bearings, and upgrading materials in parts with heavy wear and tear.

Another problem we all face in the Pacific is escalating fuel costs. The mill requires some 41.8 litres of diesel fuel per hour. The long term solution, albeit a capital expensive one, is to install steam generators fuelled by coconut waste to provide power and steam.

Running costs can be divided as follows:

		Factor/tonne oil	
Wages and Salaries	21%	Supervision	0.2 man days
		Labour	1.05 man days
Fuel	50%	Diesel	42 litres
Repairs; & Maintenance	9%		
Other Inc. Dep'n	20%		

Overall costs of milling are about US\$ 68 per tonne oil.

THE FUTURE

The first priority for the future will be to save costs by increasing throughput and making cake and copra handling semi-automatic. In the longer term, further savings can be effected through steam generation using husk and shell. When full efficiency/ cost savings have been effected, we can look for further ways of adding value to our products to give a better return.

Premium can be obtained for very low FFA oil of good colour. This can be to a certain extent tailor-made to the customer's requirement, thus, opening up the possibility of less volatile niche markets. Cake can also be further processed even to the simple extent of hammer milling and bagging.

At present, only relatively small quantities of oil are consumed locally for soap making. With further attention to quality and perhaps even some relatively small scale refining bleaching and deodorising, further local uses may be found. Note that there is small scale RBD processing in Ponape at present. Cake also is only supplied in small quantities to an animal feeds mill in Solomon Islands. There is great potential for expansion of both compound feeds and the use of cake for direct feed in animal production here.

Above all, the relatively low cost mill has given the company some flexibility in what it does with its copra.