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Studies on the Preparation of Fish Silage
IV. Economics of Production

By

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Introduction

Previous papers in this series have reported on technicl aspects of producing liquid and dried silage products in Sri Lanka from silver belly (*Leiognathus splendens*). This paper deals with the economic aspects. Capital and operating costs for a plant capable of producing up to 450 tons of liquid fish silage or 290 tons of a dried fish silage/rice bran mixture per year are given and a discounted cash flow analysis presented for projects of 5 and 10 years duration.

Background Details

This evaluation of the cost of producing in Sri Lanka a dried silage product which is suitable for use in compound chicken feeds is based on a plant situated in Mannar or Jaffna which will process 5,000 lbs. of fish per day for 200 days per year. It is assumed that 2.5% w/w formic acid will be used to produce liquid silage from minced silver belly and grade I rice bran will be added in a ratio of 1 : 3 (rice bran to liquid silage). Previous work (Jayawardena *et al.*, 1980) has shown that an acceptable dried silage product can be produced from these ingredients and that the final dried product will contain 32.5% protein and the yield will be 65.3%. All weights and measures are given in imperial units.

The following is a list of estimated capital costs, operating costs and working capital requirements. The estimates were obtained in late 1978 and where possible the source is given.

Capital Costs :	*Rs.*	(Rs. 15 = $ 1.)
Land [1]. (5 acres at Rs. 2,000/acre)	10,000	
Buildings, fences, store, etc.	150,000	
BP Silage unit [2]. including freight and installation	200,000	
Electric generator	40,000	
Van	210,000	
Drying and miscellaneous	30,000	
	640,000	
Operating Costs :		
Raw materials [3].—Silver belly (0.30 Rs./lb.)	300,000	
Formic acid (2.5% w/w at Rs. 12,000/ton) ..	135,000	
Rice bran I (Ratio 1 : 3 at Rs. 800/ton) ..	124,000	
Electricity [4]	13,000	
Labour [5]	38,000	
Packing [6]	35,000	
Transport	10,000	
Maintenance (10% of buildings, equipment, etc.). . ..	64,000	
	719,000	

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Working Capital :	*Rs.*
Sufficient for 3 months production (i.e. operating costs × 3/12) ..	180,000
	180,000

Notes on data above

[1] Land	..	Estimated price in Mannar Island from Land Reform Commission (1978).
[2] Silage Unit	..	B. P. Nutrition, liquid fish protein plant (LFP) 500, capable of producing up to 500 tons of liquid silage per annum.
[3] Raw materials	..	Silver belly purchased from CFC or Cey-Nor. Formic acid 85 – 90% (w/v) imported by Sri Lanka State Trading Corporation and distributed in 35 kg. drums. Rice Bran I from Paddy Marketing Board.
[4] Electricity	..	3 kw. generator using 13 gallons diesel oil per day at Rs. 5/gallon
[5] Labour	..	One supervisor at Rs. 8,000/year and 10 labourers for 200 days at Rs. 15/day.
[6] Packing	..	4,353 × 150 lb. gunny bags at Rs. 8 each.

Discounted Cash Flow (DCF) Analysis

In order to carry out a DCF analysis to determine the economic viability of the project it is necessary to assess the revenue for the product. A least cost feed formula analysis for a poultry feed in Sri Lanka containing fisn silage and Rice Bran I together with other locally available materials has been carried out by Tropical Products Institute, London (Disney 1979). The results suggest that the dried fish silage/rice bran component of such a feed would have a value of approximately Rs. 5,0C0 ton. During a full year's operation of the silage plant 292 tons, i.e. ($5{,}000 \times 200 \times 0.653$) lbs, of dried silage will be produced. The yearly revenue accruing to the project would therefore be Rs. $292 \times 5{,}000 =$ Rs. 1,460,000. However, as fish silage is a new product it would normally be introduced at a price attractive to animal feed compounders, eg. Rs. 4,000 per ton. This would give a yearly revenue of Rs. 1,168,000. For comparison, the effect of revenue at Rs. 3,700/ton (i.e Rs. 1,080,400/year) has also been tested.

The DCF analysis is shown in Table 1. During the first year of operation it would not be possible to obtain full production and hence a revenue of only 75% has been assumed. The project is evaluated over a 5 and 10-year period and three sales prices are considered. For the project of 5 years duration it is assumed that everything is written off at the end of 5 years, ie. the end of the life of the silage unit. In the case of the 10-year project a capital input of Rs. 200,000 is assumed to allow for the replacement of the silage unit.

At the higher sales price of Rs. 5,000/ton the internal rate of return (IRR) is 77% for a 10-year project and 73% for a 5-year project. Even at the lower sales prices the IRR are 44% (10-year project) and 38% (5-year project) for Rs. 4,000/ton, and 34% (10-year project) and 26% (5-year project) for Rs. 3,700/ton. To interpret the IRR value it should be explained that the project would recover the principal (ie. the investment capital) even if the capital was borrowed at an interest of 34 to 77% for a 10-year project and 26 to 73% for a 5-year project. As the interest rate is in fact in the region of 16% the project would obviously represent a very profitable investment. It is necessary, however, to verify the economic feasibility in practice.

The Tropical Products Institute in London has made available to the Institute of Fish Technology (IFT) a BP silage unit of the type discussed in this report. IFT in collaboration with a commercial firm in Mannar and the Veterinary Research Institute in Peradeniya are shortly undertake trials to test the economic viability of the unit and the acceptability of the product in commercial practice. The results of these trials will be published in due course.

Conclusion

A discounted cash flow analysis for the production, in Sri Lanka, of a dried fish silage/rice bran product suitable for use in compounded poultry feeds shows that the internal rate of return for a 10 year project would be between 34% and 77% and for a 5-year project between 26% and 73%. This indicates that the project would be extremely profitable.

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TABLE I

DISCOUNTED CASH FLOW

Year	*Capital Cost*	*Working Capital*	*Operating Cost*	*Revenue Rs. 5,000/ton*	*Net Cash Flow*	*Revenue Rs. 4,000/ton*	*Net Cash Flow*	*Revenue Rs. 3,700/ton*	*Net Cash Flow*
0	640,000	—	—	—	−640,000	—	−640,000	—	−640,000
1	—	180,000	719,000	1,095,000	+196,000	876,000	−23,000	810,300	−88,7000
2	—	—	719,000	1,460,000	+741,000	1,168,000	+449,000	1,080,400	+361,400
3	—	—	719,000	1,460,000	+741,000	1,168,000	+449,000	1,080,400	+361,400
4	—	—	719,000	1,460,000	+741,000	1,168,000	+449,000	1,080,400	+361,400
5	—	—	719,000	1,460,000	+641,000	1,168,000	+449,000	1,080,400	+361,400
6	200,000	—	719,000	1,460,000	+541,000	1,168,000	+249,000	1,080,400	+161,400
7	—	—	719,000	1,460,000	+741,000	1,168,000	+449,000	1,080,400	+361,400
8	—	—	719,000	1,460,000	+741,000	1,168,000	+449,000	1,080,400	+361,400
9	—	—	719,000	1,460,000	+741,000	1,168,000	+449,000	1,080,400	+361,400
10	†10,000	†180,000	719,000	1,460,000	+931,000	1,168,000	+639,000	1,080,400	+551,400
Internal rate of return				10-year project 77.52 %		10-year project 44.49 %		10-year project 34.25 %	
				5-year project 73.71 %		5-year project 38.09 %		5-year project 26.81 %	