

Economic evaluation of a locally fabricated extraction machine for a cottage cashew juice factory.

O. O. Oduwole, T. O. Akinwale and O. Olubamiwa,
Cocoa Research Institute of Nigeria (CRIN),
P. M. B. 5244, Ibadan, Nigeria.

Abstract

The need for local utilisation of agricultural procedure cannot be over-emphasised. Agricultural commodities are shifting from exploitation in their primary to processed forms. Cashew apple, a product of the fruit of cashew tree and a by-product of cashew nut harvest, is presently under-utilised in Nigeria. There is so much wastage of this fresh apple on farms since a negligible portion is consumed by the harvesters. Work has been on for some time now at CRIN to harness this wastage into commercially viable human foods or food ingredients. Much progress has been made to-date on the production of juice from the apple. This study assesses the cottage utilisation of the apple using a locally fabricated extraction machine. The economic analysis of the investment indicated that it is highly profitable with a profitability of 66.19% and a net present value of N453,283.21 (US\$4533) over three years, even under a short cashew harvesting period of three months. From these results, it was recommended that cashew farmer groups and co-operatives should be supported through credit facilities under the small-scale enterprise scheme to adopt this technology.

Introduction.

Cashew is an economic crop in Nigeria and it has long been grown in small plantations in Anambra, Imo, Kwara, Oyo, Edo and Lagos states, and to a lesser extent in Ogun, Osun, Delta, Ondo, Niger and other states. In 1994, cashew nut accounted for N156.1 million of non-oil export earnings in Nigeria which increased to N743 million (US\$ 7.43M) in 1995 (CBN Annual Report, 1997). There is no doubt that with considerable increase in planted areas and further increase in world demand for cashew kernels, the cashew industry will continue to expand. However, despite the increase in production, it is only the cashew nut that is mostly utilised in the processing industry. There is so much wastage of the fresh cashew apple due to its perishable nature. The cashew apple is five times the weight of the nut and contains about 85% juice with 10% sugar (Ohler, 1979). The present consumption of this apple is about 10% of production. To reduce this waste, it was thought worthwhile to assess the utilisation of this material for human consumption in local cottage industries. The studies at CRIN have established the possibility of utilising the apple to produce juice, wine, vinegar, jam, etc.

Recent findings at CRIN indicate that the use of locally fabricated extraction machine for cottage cashew juice industry is feasible and likely to be commercially viable. There is therefore, the need to examine the profitability or otherwise of production from this extraction machine. This was the main objective of the present study.

Materials and Methods

Ripe and matured cashew apples were harvested from Kosoni-Ola Farms, Oro, with about 327 ha in Kwara State, a major cashew growing area of Nigeria. The manually operated equipment includes extractor, mixer, pasteurizer, stainless steel and bottling machine.

The harvested apples were sorted and weighed. Known weights of the fresh apples were fed into the machine and the juice extracted was sieved using clean muslin cloth. A quantity of sodium benzoate (350ppm) was added as a preservative and thoroughly mixed. The juice obtained was filled into 35cl bottles, corked and pasteurised at 80°C for 10 minutes. The bottles were then allowed to cool down.

Qualitative and quantitative determination were carried out on the juice using AOAC (1980) methods.

Results and Discussions

Quality Characteristics of Juice

Quality Characteristics of juice extracted from the fresh and steamed cashew apples, in terms of colour, specific gravity,

pH, total acidity, % soluble solids (TSS) and vitamin C content (mg/100ml of juice) are presented in Table 1. Sensory evaluation of the fresh juice and that extracted from stem-treated apple juice was determined. The evaluation was in terms of taste, mouth feel, odour and overall acceptability. This indicated a significant difference at 5% for the mouth feel. Heat treatment of the apples for 10 minutes has been found to improve the acceptability of the cashew juice (Akinwale and Aladesua, 1999).

Economic Evaluation of the Extractor Machine

The economic analysis discussed is related to the locally fabricated small scale equipment processing 31.82kg apples per hour with a yield of 67.88% at 87.20% efficiency. This is equivalent to 172.8 litres of juice or 493 bottles (35cl) per day under an 8-hour working operation.

Capital Cost Estimate

The equipment required include extractor, mixer, pasteurizer, stainless steel and bottling machine. The initial capital outlay is estimated at N471,600 but when

Table 1. Some Physico-chemical characteristics of the Cashew Juice

Juice Type	Appearance	Colour	Specific gravity at 20°C	pH	Titrateable acidity %w/w acid	% Soluble solid at 20°C	Vit C content mg/100 ml of juice
Fresh Cashew juice	Unstable with lumps when mixed	Yellow	1.050a	4.20a	0.66a	12.00a	293.50a
Juice from steamed cashew apples	Cloudy and mixed evenly	Yellow	1.045b	4.10a	0.55a,b	12.00a	152.40b

A, b, means of values followed by different letters in each column are significantly differently at 5% level (Duncan's Multiple Range Test)

Table 2. Capital cost Estimate

Items	Price/ Unit (N)	Quantity	Use Life	Cost Allocation
Building	400,000	1	10	40,000
Extractor	18,000	1	5	3,600
Pasteurizer	25,000	1	5	5,000
Mixer	12,000	1	5	2,400
Bottling Machine	15,000	1	5	3,000
Plastic Bowls	500	Lot	1	500
Weighing scale	600	1	1	200
Miscellaneous	600	Lot	1	500
TOTAL	N 471,600			N55,200

Table 3. Operating Expenses/Cost per year

Operating Expenses	Cost per year (N)
1. Collection of cashew apples 254.26kg/day at N 1/kg	15,270.00
2. Payment for cashew apples 15, 24 tons/ 1month @ N5/kg	76,365.00
3. Preservatives 60 gim/day at No. 3/kg (18)	1,080.00
4. Water n1, 500/month	4,500.00
5. Energy N 1,000/month	3,000.00
6. Labour 2 unskilled @ N2,000/month 1 supervisor @ N4,000/month	12,000.00 12,000.00
7. Equipment maintenance 20% capital cost	5,520.00
8. Packaging	
(1) Cartons N20/carton	49,300.00
(2) Labels N5/label	147,900.00
(3) Corks N0.5/work	1,479.00
	328,414.00
9. Contingency 5%	16,420.07
Total Cost	344,834.07

Table 4. Cost, Returns and Probability of the juice Extraction Factory

Item	Year 1	Year 2	Year 3
A. COST			
1. Capital Cost (N)	55,200.00	55,200.00	55,200.00
2. Operating Cost (N)	344,834.00	344,834.00	344,834.00
3. Total Cost (N)	400,034.00	400,034.00	400,034.00
B. PRODUCTION: 493 BOTTLES/DAY			
Production cost/bottle/day (N)	13.52	13.52	13.52
C: EXPECTED SELLING PRICE			
	40.00	40.00	40.00
D: CONTRIBUTION PER UNIT OF BOTTLE			
	26.48	26.48	26.48
E: TOTAL PROFIT PER YEAR			
	783,278.40	783,278.40	783,278.40
F: PROFITABILITY			
	66.19	66.19	66.19
G. BENEFIT COST RATIO			
	01:01 96	01:01 96	01:01 96
H. NET PRESENT VALUE (NPV)			
20% Discount factor			
N.P.V.	N652,705.89	543,908.52	453,283.21

allocated yearly based on use life of each equipment, it is estimated at N55,200.00 p. a.

Operating Cost Estimate

The operating cost of the cashew juice production include materials, labour, maintenance and other overhead costs. The cashew apple constitutes over 80% of the total operating cost. The total operating cost was estimated at N344,834.7 per year (Table 3). However, it

should be noted that cashew harvesting period is between January and April with peak between February and March. The machine can only be used for the three months period in a village setting. This was taken into consideration in estimating the total production capacity and operating expenses. Alternative use for this equipment should be sought after the cashew fruiting season in order to put the equipment into full use. Research is also underway to have cashew varieties

of bigger apple size, low astringency, higher yield, prolonged fruiting and ability to yield fruit all year round.

Profitability of Investment

From the capital and operating cost estimates, the total cost of the juice production units is N400,034.7 per year. Given that 483 bottles will be produced per day, a total of 29,580 bottles of 35cl is expected within the 3 months operating period. The average cost of production is N13.52 per bottle. Presently, the exhibition price of the juice is N50.00 in urban locations. The price adopted for this exercise was N40 in order to effectively capture the rural market.

Based on this cost-price assessment, the contribution per bottle produced is estimated at N26.48, giving a total profit of N783,278.4 per year. This represents a benefit-cost ratio of 1 to 1.96 and a profitability of 66.19%.

Conclusion

The study has shown that the production of cashew from the juice extractor is a profitable venture. Cashew juice provides vitamin C, a necessary constituent of human diets. Vitamin C deficiency causes, scurvy and delays the healing of wounds. Its use will increase the nutritional health of the rural communities. It is important to note that the vitamin C content of cashew juice is higher than that of orange juice. In Brazil, the apple juice is given some slight processing before being bottled and sold (Lopez *et al.* 1985). It is, therefore, important to encourage extraction of the juice from the cashew apple utilizing the locally fabricated equipment. Support should be given to farmers and other local entrepreneurs under the small scale enterprise scheme.

Agricultural commodities are shifting from exportation in their primary form to process form. This is aimed at increasing value-adding to primary forms of commodities thus ensuring improved nutrition as well as creating job opportunities in rural areas. In order to spread the take-off of this cottage industries in most cashew producing areas, small-scale farmers groups or co-operatives, comprising not less than 20 members can be assisted with credit facilities under the small-scale enterprise scheme.

References

- Akinwale, T.O and Aladesua, O. C. (1991). Comparative study of the physico-chemical properties and the effect of different techniques on the quality of cashew juice from Brazilian and local varieties. *Nigerian Journal of Tree Crop Research* Vol. 3 No. 1 1999.
- A.O.A.C (1980). Official methods of Analysis, Association of official analytical Chemistry, Washington DC., USA.
- CBN (1997). Central Bank of Nigeria Annual Report and Statement of Account, 31st December, 1997.
- Ohler, (1979)./ Cashew Royal Tropical Institute Amsterdam, The Netherlands.
- Lopez, A., H. S., Ferreira, A. Liamoiias, A. P. Romeo (1985). Present status of cocoa by-product utilization in Brazil, proceedings, 9th International Cocoa Research Conference, Lome, Togo 1984: pp. 425-435.