PROFITABILITY OF BEE-KEEPING UNDER MATURE RUBBER PLANTATION IN EDO STATE, NIGERIA

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ABSTRACT

This study examines the profitability of bee-keeping under matured rubber plantation at the Rubber Research Institute of Nigeria, Iyanomo near Benin City. One hectare each of a GT I rubber clone (rubber clone developed at the Gondang Tapan Estate in Indonesia) plantation planted in 1995 and opened for tapping in 2002 was used for the study. Eight Kenyan Top-Bar bee hives were arranged peripherally in between the last four rubber trees in the plantation leaving the rides free for tappers and supervisors, thereby reducing distraction of the bees and risk of attacks on workers. The rubber tapping system was the Half Spiral Alternate Day no Stimulation (S/2 d/2 Nil stim). The rubber yield was evaluated for sales on kg DRC (Dry Rubber Content), while the honey from bee keeping was processed using the local method and yield determine on per litres based on two export grades (1 and 2). Results show that the total revenue per hectare for sole rubber and rubber + honey bee production was ₦ 742, 823.00 and ₦ 1, 169, 323.00 respectively. The gross margin and net income that accrued to the sole rubber and rubber + honey bee production were found to be ₦287, 573.00 and ₦689, 573.00; and ₦ 228, 215.47 and ₦615, 595.72 respectively, indicating that there were certain levels of returns or profit derivable from the two enterprises, but introduction of honey bee into the plantation increased the profitability of the enterprise by ₦387, 380.25 in three years. The rates of return on the two investments were found to be 31% and 53% for the sole rubber and rubber + honey bee production with an operating ratio 0.61 and 0.41 respectively.

Keywords: Profitability, Rubber plantation, Bee-keeping, Mixed cropping, Revenue, Profit.

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INTRODUCTION

Rubber plantation enterprise has remained unattractive especially to small-scale farmers in Nigeria because it requires a large expanse of land and almost 70% of the vast inter-row spaces are underutilized. This is compounded by the long gestation period of rubber (5 – 7 years) and the fluctuating prices of rubber in the local and international market. Hence, a timely adoption of appropriate plantation management practices that is capable of utilizing the under-utilized land resources and increases the revenue base of the enterprises is important to the attainment of the drive to increase rubber production in Nigeria.

Recently, intercropping of rubber with arable crops has been found to be beneficial to the growth of rubber and capable of improving the economy of rubber enterprise thereby reducing the need for subsidies and credit to rubber

farmers (Esekhade *et al.,* 2003; Thelma, 2002; Zainol *et al.,* 1993).

After canopy closure, planting of shade tolerant crops and mini-livestock rearing has been developed under mature rubber plantation and are currently being popularized among rubber farmers in Nigeria. These systems have been found to be compatible with rubber and capable of improving the economy of the systems. Thelma (2002) reported increased economic benefits from mixed farming where crops and animals interact together. Devendra (2010) in a study of oil palm and goat integrated systems reported that integrating goat and oil palm has numerous economic benefits such as sustainability, environmental integrity, enhanced productivity and food security. In Rubber Research Institute of Nigeria, apiculture (Bee-keeping) is one of the integrated farming systems developed under matured rubber plantation and being disseminated to rubber farmers in Nigeria. Bee-keeping is the applied science of rearing honey bees for human benefits (FEBKAN, 2003). Some of the benefits of bee-keeping include; pollination of economic trees, production of pollen grains, honey, bee wax, and royal jelly. However, adoption of technologies developed by RRIN among rubber farmers has been slow (Aigbekhaen, *et al.*, 2000), because farmers want to be sure of the agronomic and economic viability of new technologies before adoption.

Therefore, this study looks at the financial benefits of bee-keeping under mature rubber plantation in Nigeria.

MATERIALS AND METHODS

The experiment was conducted at the Rubber Research Institute of Nigeria (RRIN), Iyanomo near Benin City. The area is located on latitude 6^{o}00' and 7^{o}00' North and longitude 5^{o}00' and 6^{o}00' East, with a hot humid climate. The mean temperatures ranges in 2008 and 2009 were 25.52^{o}C – 28.1^{o}C and 25.73^{o}C – 28.38^{o}C respectively. While rainfall figures for 2008 and 2009 were 2012 mm and 1582.7 mm respectively.

One hectare each of an existing rubber plantation planted to GT I clone in 1995 and opened for tapping in 2002 was adopted for the study. The plantation was divided into sole rubber and rubber + bee keeping farming systems. The method of latex exploitation was the half spiral alternate day no latex stimulation system (S/2 d/2 Nil Stim). Data for latex and cup lump were collected during the period of the study. While the honey yield were collected for each year.

Eight Kenyan Top-Bar bee hives were placed peripherally at the extreme end of the rubber plantation leaving the rubber rides free for rubber tappers and supervisors thereby reducing human distraction of bees and attack of bees on workers. The hives were baited with 170 ml pure honey, 50 ml pineapple jam and down town perfume. The four stands of each hives were treated with condemned engine oil to prevent the bee colony from ants' invasion.

Rubber latex yield were collected and sold on the basis of kilogram Dry Rubber Content (DRC) basis, while the honey was harvested and processed using local methods and sold on litre basis. The economic implications of the mixed farming systems were determined after the sales of the products. The local prices of rubber and honey at the time of harvest were used in the computation of the economic viability of the farming systems and they are as follows; Honey export grade 1, ₦1200 per litre; honey export grade II, ₦700 per litre and rubber latex, ₦250 per kg DRC and cup lump, ₦140 per kg DRC.

The budgetary analysis technique emphasized the cost and returns to sole rubber and rubber + honey bee production enterprise. The cost of establishing one hectare rubber plantation including all costs associated

with land acquisition, latex tapping kits and containers and the cost of bee hives and containers for harvesting honey form part of the fixed items. Depreciation on this equipment was calculated using the straight line method with assumed salvage value of zero. The profit level and profitability ratios were calculated using gross margin and return to management (Kay, 1981).

The formula used in this study is as follows:

- GM = TR-TVC
- NI = GM-TFC
- Profitability Index or Return on sale =NI/TR
- The ratio of return on investment **(%RRI) = NI/TR X100**
- Rate of return on variable cost **(%RRVC) = TR-TFC x 100**
  TVC
- Operating Ratio = TVC/TR

Where GM = Gross Margin; TR = Total Revenue; TVC =Total Variable Cost; NI = Net Income; PI =Profitability Index; TFC = Total Fixed Cost and TC = Total Cost.

RESULTS

The yield of rubber during the three years of the study is as presented in Table 1. The result showed that a total of 5045.8, 4536.5 and 4727.8 kg DRC of rubber latex were generated in year 1, 2 and 3 respectively while 2697.5, 2814.0, and 2724.0 kg DRC of coagula were generated from the cup lump in year 1, 2, and 3 respectively. The honey bee intercrop generated a total of 90, 100 and 120 litres of export grade I and 18, 21 and 26 litres of export grade honey in year 1, 2, and 3 respectively. A total of 14,310.10 kg DRC of rubber latex, 8, 235.50 kg DRC cup lump of rubber produced in the first, second and third years. While the total honey produced the three years were 310 litres and 65 litres of Export Grade I and Export Grade II honey respectively.

Table 1: Yields from rubber-beekeeping mixed farming system in Edo State, Nigeria.

Parameters	Year 1	Year 2	Year 3	Mean yield
Rubber yield (kgDRC)				
Rubber latex	5045.80	4536.50	4727.80	4770.03
Cup lump	2607.50	2814.00	2724.00	2745.17
Total rubber production	7743.30	7350.50	7451.80	7515.20
Honey yield(Litres)				
Honey (Export Grade I)	90.00	100.00	120.00	103.33
Honey (Export Grade II)	18.00	21.00	26.00	21.67
Total honey yield (litres)	108.00	121.00	146.00	125.00

The gross income and net incomes are presented in Table 2. Results showed that, the total revenue per hectare for sole rubber and rubber + honey bee production was ₦742, ₦823.00 and ₦1,169,323.00 for sole rubber and rubber + honey bee production respectively, accrued from sale of rubber latex, cup lump, pure grade 1 and grade 2 honey syrup for the three years of the enterprise. Workers wages accounted for 84.51% and 81.73% of the total variable costs for sole rubber and rubber + honey bee enterprise respectively. Variable costs for the sole rubber and rubber + honey bee production constituted 88.47% and 86.42% of the total cost, while fixed cost for the sole rubber and rubber + honey bee production accounted for only about 0.12% and 13.58% respectively of the total cost incurred per month. The gross margin and net income that accrued to the sole rubber and rubber + honey bee

production were found to be ₦287, ₦573.00 and ₦689, ₦573.00 respectively, indicating that there were certain levels of returns or profit derivable from the two enterprises.

The rates of return on the two investments were found to be 31% and 53% for the sole rubber and rubber + honey bee production. The operating ratios for the two enterprises (sole rubber and rubber + honey bee production) were 0.61 and 0.41 respectively (Table 3).

Table 2: Average Costs and Returns (₦) on Rubber and Bee keeping enterprise for a 3- year's period at Iyanomo, Edo state, Nigeria

Items	Revenue Generated Sole Rubber	Rubber + Bee Hive
Sales from Latex	630,000.00	630,000.00
Sales of Cup Lump	112,823.00	112,823.00
Sales from Grade 1 Honey	-	372,000.00
Sales from Grade 2 Honey	-	45,500.00
Total Revenue (TR)	**742,823.00**	**1,160,323.00**
Variable Cost (₦)		
Weeding	63000	63000
Fertilizer	7500	7500
Tappers wages	168,750	168,750
Supervisors	216000	216000
Baiting	-	5000
Labour for Baiting Hives	-	750
Labour for Harvesting Honey	-	2250
Labour for Processing Honey	-	7500
Total Variable Costs (TVC)	**455,250.00**	**470,750.00**
Fixed Costs		
1 ha rubber plantation + cost of Land	49,063.00	49,063.00
Tapping Knife	342.30	342.30
Cup Hanger	2852.50	2852.50
Cup	1782.81	1782.81
Spout	213.94	213.94
Sharping Stone	71.31	71.31
File	142.63	142.63
Bucket	342.30	342.30
Rain Boot	453.40	453.40
Rain Coat	456.40	456.40
Plastic Bowl	-	142.63
Shunks	3423.00	3423.00
Dip Stick	213.94	213.94
Bee Hives	-	9698.50
Harvesting kits	-	4064.81
Containers	-	713.81
Total Fixed Cost (TFC)	**59,357.53**	**73,977.28**
Total Cost (TC)	**514, 607.53**	**544,727.28**
Gross Margin (GM)	**287,573.00**	**689,573.00**
Net Income (NI)	**228,215.47**	**615,595.72**

Table 3: Profitability Analysis of rubber and honey production

Parameter	Sole Rubber	Rubber + Bee Hive
Profitability Index or Return on sale	0.31	0.53
Rate of Return on Investment (%RRI)	31%	53%
Rate of Return on Variable Cost (%RRVC)	150%	231%
Operating Ratio	0.61	0.41

DISCUSION

The average yield of honey from the beehives placed under rubber trees which was 18, 21 and 26 litres per hive in the first, second and third year respectively (Table 1) were comparable with the average yield of 16 - 23.57 litres of honey yield per Kenyan top bar hive reported by FAO, (2012), Perm-apiculture, (2012), The Organic farmer, (2007) and Gamzel et al., (2004).

Revenue and profit margin generated from sole rubber in the first, second and third year were lower compared with those generated from the rubber + honey bee farming system. The profitability analysis indicated a return to scale of 0.31 and 0.53, the rate of return on investment of the sole rubber was 31 % compared with 53% obtainable from the rubber + honey bee production. This implies that after deducting the cost of performing marketing functions of the two enterprises (sole rubber and rubber + honey bee production), the farmer earned an average of about 31 kobo and 53 kobo for every Naira of the final price paid by the consumers of the products respectively. This indicated that rubber farmers in Nigeria will earn additional income of up to 22 kobo per every N1.00 invested by addition of honey bee to the plantation enterprise. This result was similar to the submission of Odekina *et al.,* (2012); Onuoha and Ohaka (2006) in a study of women participation in economic enterprises in Nigeria.

This finding is in line with those of Davendra, (2010) and Thelma, (2002) who reported an increase in economic benefits from mixed farming systems where crops and animals interact together in the farm. Also, Esekhade *et al., (*2003) and Zainol *et al.,* (1993) reported that intercropping of rubber with arable crops has been found to be beneficial to the growth of rubber plants and improve the economy of the rubber enterprise. Esekhade *et al., (*1996) in an experiment demonstrated that intercropping of rubber with arable crops before rubber canopy closure help reduces the cost of rubber plantation establishment by generating income to farmers during the period of rubber establishment thereby reducing the need for subsidies and credit to rubber farmers.

CONCLUSIONS

- Introduction of Honey bee hives into rubber plantation lead to increase in the revenue and profit margin of the farmer compared with when matured rubber plantation are left as sole rubber plantation.
- Rubber farmers in Nigeria can earn additional income of up to 22 kobo per every N1.00 invested on rubber plantation enterprise by the addition of bee hives to produce honey. This result is relevant to the quest for increased rubber production to enhance farmer's income and standard of living in Nigeria.

Plates 1: Export grade honey produced from rubber-based apiary.

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