GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 18, NO. 1&2, 2012: 15-18

 ISSN 1118-0579
www.globaljournalseries.com, Email: info@globaljournalseries.com

ECONOMIC ANALYSIS OF INTERCROPPING RUBBER (*HEVEA BRASILIENSIS*) IN THE RUBBER GROWING AREAS OF EDO AND DELTA STATES, NIGERIA

DENGLE YUNIYUS GIROH, YUSTUS SUNDAY FRANCIS AND EPHRAIM IBRAHIM JEN

(Received 15, August 2011; Revision Accepted 18, October 2011)

ABSTRACT

This study was carried out in 2007/2008 planting season to evaluate the economics of intercropping rubber among smallholder rubber farmers of Edo and Delta States, through a survey of 54 rubber farmers in a multi stage, purposive and simple random sampling techniques. Data collected were analyzed using budgetary technique and production function analysis. Empirical result of the production function analysis indicated that selective herbicides and farm size had the expected positive sign and were statistically significant at ($p>0.05$) and ($p>0.01$). The return to scale (RTS) of 0.5267 indicated decreasing return to yield with respect to variable inputs. This shows that production is in stage II (rational zone). The production function analysis also showed that the coefficient of determination (R^2) was high and indicated that a percentage of 91.30% are explained by inputs used for the regression. Budgetary analysis reveals an average variable cost/ hectare was ₦3,725.40($25.69) with ₦11,522.86($79.47) as profit and ₦7,797.462($53.78) is left as gross margin. Similarly, the per farmer analysis also revealed average revenue of ₦42, 288.89($291.65) with a gross margin of ₦28, 616.67($197.36). Rubber based intercrop is a profitable venture if well managed.

KEY WORDS: Intercrop, Hevea, Smallholder, Farmers, Production Function, Budgetary Technique

INTRODUCTION

Natural rubber takes long gestation period (5 - 7 years) to mature for tapping. Rubber plantations usually have a spacing of 6.7 x 3.34 m or 6 x 3 m which is wide enough for intercropping with other crops for at least the first three years of growth. Intercrops serve a double function in that it gives farmers additional income and increasing land and labour productivity as well as cover crops which can reduce soil erosion. Both food and horticultural crops can be intercropped during immature rubber period and had no negative effect on rubber growth (Esekhade *et al.,* 1996). Girth increase is faster in rubber intercrops than in monoculture or sole (International Rubber Research and Development Board, IRRDB, 2007). Monoculture has been found to be a disincentive to farmers who want to adopt rubber and its allied technologies. Effective utilization of avenues in immature rubber plantations have been advocated for the planting of other crops as an intercrop with rubber for maximum benefits. Esekhade *et al.,*(1996) observed that the intercropping in the vast inter row of young rubber plantation holds key to attracting small holders to rubber farming. Integrated farming (apiculture, rearing of snails, use of shade tolerant crops such as coco yam and edible mushroom) can be introduced at maturity phase of rubber plantation. Empirical evidence suggests wider adoption of rubber-based intercrops in many rubber-producing countries of the world. Rodrigo *et al.,*(2001a) conducted a study on priorities and objectives of smallholder rubber growers and the contribution of intercropping to livelihood strategies in Sri- Lanka and found that over two- thirds of annual household income derived from on farm activities with 70% of this from intercropping of immature rubber land. Intercropping during the early growing stage of rubber provides one means of addressing the gaps in income suffered by smallholders after replanting or new planting of rubber. The combination of rubber with banana resulted to a profit margin above 350% (Rodrigo *et al.,* 2001b). The planting of rubber with food crops has also been reported in Indonesia and Brazil (Dove, 1993; Gouyon *et al*., 1993; Schroth *et al.*, 2004). Esekhade *et al*., (1996) conducted a study on the suitability and economic viability of intercropping in rubber on acid sandy soils of southern Nigeria. The studies found both agronomic compatibility and economic viability of intercropping.

A study of this nature becomes necessary to examine the economics of rubber-based intercrops among smallholder rubber farmers. The objectives are to examine cost and return to rubber intercropping and to evaluate the influence of herbicides, hectares of land and labour on the output of crops in the intercrop combination.

METHODOLOGY

The study area: Multi- stage, purposive and random sampling procedures were adopted. Stage one was the

Dengle Yuniyus Giroh, Research Outreach Department, Rubber Research Institute of Nigeria, P.M.B 1049, Benin City, Nigeria
Yustus Sunday Francis, Rubber Research Institute of Nigeria, Gum Arabic Sub-Station, Gashua, Yobe State, Nigeria
Ephraim Ibrahim Jen, College of Agriculture, P.M.B 1025, Jalingo, Nigeria

purposive selection of Edo and Delta States. Edo State lies between latitudes 5^o 44´´ and 7^o 34´´ N of the equator and between longitudes 5^o 04´´ and 6^o 43´´ E of the Greenwich Meridian while Delta State lies between latitude 5^0 00´´ and 6^0 30´´ N of the equator and longitude 5^0 00´´ and 6^0 45´´E of the Greenwich Meridian (Emokaro and Erhabor, 2006; Ike, 2010).The choice of the two States was because of their prominent role in rubber production in the rubber belt of Nigeria. The second stage was the selection of rubber growing Local Government Areas of the States (Uhunmwode, Ovia North East and Ovia South West L.G.As Edo State and Ika North East L.G.A, Delta State). The third stage was a random sampling of 100 farmers involved in rubber cultivation from the twelve villages randomly selected from the local government areas. 100 respondents were served with interview schedule out of which 54 were returned and used for analysis. The survey was conducted in 2008 in which data was collected on rubber-based intercrop for 2007 / 2008 planting season.

Data analysis: Data collected were analyzed using descriptive statistics, budgetary technique and the production function analysis. Four functional forms (linear, semi-log, exponential and power function) were fitted to the data. Exponential function gave the best fit and is represented by the equation (Folefack, 2008):

$$Y_t = e^{bo+biX1+b2X2+b3X3+e} \quad (1)$$

By logarithmic transformation, a linear relationship was obtained

$$\ln y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \quad (2)$$

Where: Y_i = Yield (kg of rubber based intercrop combination) X_1 = selective herbicide used in litres, X_2 = farm size in hectares and X_3 = labour (SMD) and μ_1 = the error term (was assumed to have zero mean and constant variance).

β_0 = A constant, β_1, β_2 …. B_3 are regression coefficients to be estimated while other variables are as previously defined above.

The budgetary technique used for cost and return analysis is the gross margin. The gross margin per hectare, which is the difference between total revenue per hectare and total variable costs per hectare, is expressed by:

$$GM = \sum Q_y P_y - \sum X_i P x_i \quad (3)$$

Where Q_y = output (kg/ha); P_y = unit price of the output (N), $Q_y P_y$ = total revenue derived per hectare, X_i = quantity of the ith input/ ha, Px_i = price per unit of the ith input/ ha, $X_i Px_i$ = total cost associated with ith input /ha and $\sum$= summation sign.

Thus,

$$GM = GR - TVC \quad (4)$$

Where: GR = gross return (N/ha), TVC = total variable cost (N/ha), according to Giroh and Adebayo (2007).

RESULTS AND DISCUSSION

Cost and returns to intercropping: Intercropping of immature rubber plantation with other crops such as plantain, banana, cassava, and maize may not only be for the purpose of satisfying the household food need or subsistence but may also be a source of revenue for the farmer. Thus the farmers' like any other entrepreneur would be interested in the profitability of the intercrop enterprise. For this reason, efforts were made to determine the cost associated with rubber based intercrop and also revenue that accrues to the farmer. Only the variable cost of production was considered while profitability was measured as the gross margin. Table 1 shows that the average variable cost per hectare was ₦3,725.40 ($25.69) with ₦11,522.86($79.47) as profit and ₦7,797.462($53.78) as gross margin. Similarly, the per farmer analysis also revealed an average revenue of ₦42, 288.89 ($291.65) with a gross margin of ₦28,616.67 ($197.36). The rate of return (ROR) is the ratio of total revenue to total cost of production. This indicates that for ₦1 used in rubber based intercrop, revenue of three naira nine kobo (₦3.09) will be realized indicating that intercropping can give good returns to the farmers. The result of this study agrees with others (Esekhade *et al.*, 1996; Rodrigo et *al.*, 2001a; IRRBD, 2007).

Estimated production function: Exponential function gave the best line of fit for rubber intercropping and is computed using ordinary least square (OLS) method. Pearson correlation coefficient was used for all independent variables to detect the presence of multicollinearity, and was found to be insignificant (Folefack, 2008).

It is stated:

$$\ln y_t = 10.86^{***} + 0.0304X_1^{**} + 0.1610X_2^{***} + 0.3353X_3$$

(.269) (.011) (.053) (.256)

$F = 5.23^{***}$ $R^2 = 0.932$ R^2 adjusted = 0.913

Standard errors of the estimate = 0.06560.

Figures in parentheses are standard errors of the coefficients.

***, ** indicate significance at 1 &5 % probability levels.

The estimated regression shows that the entire coefficients carried the expected positive sign, which indicated that an increase in these variables would lead to increase in output of rubber farmers. The coefficient for selective herbicide (X_1) is statistically significant ($p>0.05$). This shows that a 10% increase in herbicide use would be associated with an increase in yield of intercrop by 0.304%. The coefficient for hectares ((X_2) is statistically significant ($p>0.01$) implying that a 10% increase in hectares would be associated with an increase in yield of intercrop by 1.61 %.

Labour measured in standard days was not significant. The efficacy of the use of herbicide is a substitute for manual labour. Return to scale (RTS) of 0.5267 indicated decreasing return to scale of the yield with respect to variable inputs. This shows that production is in stage II (rational zone). This indicates that a 10% increase in all the variable factors which would lead to an increase in intercrop yield of 5.267%. Result of the production function analysis indicated that the coefficient of determination (R^2) was high and showed that 91.30% of the variation in output was explained by inputs used for the regression. The F–value of the R^2 is also significant at the 1%, implying that the data pertaining to the selected variables fit the regression line.

Table 1: Cost and return analysis per hectare and per farmer in a rubber based intercropping

Variables	Value
Per hectare analysis	
Total revenue (TR)	₦11,522.86(79.47)*
Total variable cost (TVC)	₦3,725.40(25.69)
GM (TR - TVC)	₦7,797.46(53.78)
ROR (rate of return)	309%
Per farmer analysis	
TR/ farmer	₦42, 288.89(291.65)
TVC/ farmer	₦ 13,672.22(94.29)
GM/ farmer (TR – TVC)	₦28, 616.67(197.36)

Source: Field survey, 2008. * Figures in parenthesis are US dollars equivalent at the exchange rate of ₦145.00 to 1 US dollar as at the time of the study.

CONCLUSION

The study revealed that intercropping of rubber was profitable. Production function analysis shows that herbicides and hectares of land were statistically significant at ($p>0.05$) and ($p>0.01$), the entire production was in stage II (rational zone) with RTS of 0.5267 indicating decreasing return to yield with respect to inputs. It is also found to be a source of revenue to the farmer, capable of improving his socio-economic wellbeing.

REFERENCES

Dove, M. R., 1993. Smallholder rubber and Swidden agriculture in Barnea; a sustainable adaptation to the ecology and economy of the tropical forest. Economic Botany 47: 136 – 147.

Emokaro, C. O and Erhabor, P. O., 2006. A comparative Analysis of Input use and Profitability among Cassava farmers in the three Agro ecological Zones of Edo State, Nigeria. Journal of Sustainable Tropical Agricultural Research 19: 15 - 22.

Esekhade, T. U., Ugwa, I. K and Aigbekaen, E. O., 1996. Suitability and Economic viability of intercropping in rubber on acid sandy soils of southern Nigeria. India Journal of Natural Rubber Research 9: 36 – 39.

Folefack, A. J. J., 2008. The influence of Compost Use on the Production of Lettuce(*Lactuca sativa*) in the Urban and peri- Urban Areas of Yaounde (Cameroon). *Tropicultura* 26, (4): 246 – 253.

Giroh, D. Y and Adebayo, E. F., 2007. Analysis of the technical efficiency of rubber tapping in Nigeria. Journal of Agriculture and Social Sciences 3, (4): 140 – 142.

Gouyon, A., de Foresta, H and Levang, P., 1993. Does simple rubber deserve its name? An Analysis of Rubber agro forestry systems in Southern Sumatra. Agro forest systems 22: 181 –206.

Ike, P. C., 2010. Access and Loan Repayment in the Delta State Agricultural Loan Scheme. Farming Management Association of Nigeria (FAMAN) Journal 11, (1): 53 – 61.

International Rubber Research and Development Board, 2007. Rubber based farming systems development for increasing smallholders'incomeinIndonesia.http: //www.irrdb.com/IRRDB/Seminars/smallholdersIncome.htm. Retrieved 24/8/2007.

Rodrigo, V. H. L., Thenakoon, S and Stirling, C. M., 2001a. Priorities and objectives of smallholder growers and the contribution of intercropping to livelihood strategies: a case study from Sri - Lanka. Outlook on Agriculture 30, (4): 261 – 266.

Rodrigo, V. H. L., Stirling, C. M., Naranpanawa, R. M. A. K. B and Herath, P. H. M. U., 2001b. Intercropping of immature rubber in Sri- Lanka: present status and financial analysis of intercrops planted at three densities of banana. Agro forestry Systems 51, (1): 35 – 48.

Schroth, G., Moraes, V. H. F and da Mota, M. S. S., 2004. Increasing the profitability of traditional, planted rubber agro forest at the Tapajo's river, Brazilian Amazon. Journal Agriculture, Ecosystems and Environment 102: 319 –339.