JOURNAL OF AGRICULTURE & SOCIAL SCIENCES
ISSN Print: 1813–2235; ISSN Online: 1814–960X
07–261/AKA/2008/04–4–180–182
http://www.fspublishers.org

Full Length Article

Resource-Use Efficiency among Rubber Smallholders in Edo and Delta States of Nigeria: Implications on Output and Environmental Degradation

C.S. MESIKE[1] AND S.E. UBANI
Rubber Research Institute of Nigeria, P.M.B 1049 Benin City, Edo State, Nigeria
[1]Corresponding author's e-mail: sammesike@yahoo.ca

ABSTRACT

Data collected from 120 randomly selected rubber smallholders in Edo and Delta state of Nigeria were used to study the efficiency of resource use and its implication on output and environmental degradation. Results revealed that land, hired labour, family labour, capital and planting materials were significant factors influencing the output of rubber. All the inputs of production were found to be under-utilized and farmers were more interested in the innovations that would increase income even if it was damaging to the environment. Hence, they seemed to be more concerned about the short-term, rather than the long-term benefits of production.

Key Words: Efficiency; Resource-use; Rubber; Nigeria; Environment

INTRODUCTION

Agricultural economy of Nigeria is dominated by small farmers with more than 90% of total agricultural production coming from these small land holdings (Olayemi, 1980). It is estimated that rubber (*Hevea brasiliencis*) is produced on 154,000 hectares of the agricultural land in Nigeria with smallholders having 96000 hectares (Udofia, 2006). Increased and sustained production of rubber should therefore take cognizance of smallholders. One major characteristic of these small farmers is that they operate at low level of production with highly labour intensive production technology. Apart from that, drudgery of labor can be worth considering. This coupled with fragmentation of holdings and the long trekked distances between home and farms considerably reduce the man-hours utilized in any specific man-day farm. Hired labour costs represent over 60% of total costs of production.

The major source of farm labour is the family constituting about 75% of supply of farm labour requirement. The sector is further characterized by low fixed capital investment. This is due to dependence on simple tools and equipments, while low operating capital is attributed to the use of few purchased inputs with low level of average use; the practitioners are also characterized by low level of literacy (Anthonio, 1967; Olayemi, 1980). Falusi and Olayide (1980) and CBN/NISER (1992) indicated that Nigeria farmers own an average of two hectares of land on scattered holdings.

Rubber plantation is environment friendly as it helps protecting the soil from erosion. Amara *et al*. (1999) reported that the pressures from environmentalist and the ecologist about agricultural activities that damage the environment warrants the farmers to produce maximal output from a given level of inputs or use the minimum level of inputs for a given level of output, while conserving the environment. These policy changes have important implications for farmers, as they directly affect their welfare. How the farm sector adapts to these changes and how farmers ensure their survival, as producing units are ultimately dependent on the efficiency of production resources on the farm as well as the adoption of friendly attitudes towards the environment. Also, the differences in farming households' crop production status have implications for the environment and resource-use efficiency of farms. This paper estimates the resource-use efficiency among rubber smallholders in Edo and Delta states of Nigeria revealing the implication for the environment.

MATERIALS AND METHODS

The population of the study comprised settlers in the farm settlement centers in southwest Nigeria located in Edo and Delta states. The farm settlements were Iguoriakhi in Edo state, Utagbo-Uno and Mbiri in Delta State of Nigeria. These farms were chosen for their large number of rubber farmers. The farm settlements were established by the government to promote production of tree crops such as rubber and oil palm. The Mbiri, Utagbo-Uno and Iguoriakhi farm settlements comprised 182, 162 and 52 farm families, respectively (Begho *et al.*, 2002). Survey approach to collect information gathering was adopted for this study. Multistage random sampling technique was adopted for the selection of

To cite this paper: Mesike, C.S. and S.E. Ubani, 2008. Resource-use efficiency among rubber smallholders in Edo and Delta states of Nigeria: implications on output and environmental degradation. *J. Agri. Soc. Sci.*, 04: 180–82

120 rubber farmers on whom well-structured personal interview schedules were administered. The respondents were selected proportionately by chosen 30% of farm families in each of the farm settlements. Simple random sampling technique was then used to select 55, 49 and 16 farmers from Mbiri, Utagbo-Uno and Iguoriakhi farm settlements, respectively.

The data were analyzed using descriptive statistics and ordinary least square (OLS) regression technique. The descriptive statistics that was used is the percentage and table, while the model for the regression analysis was $q = f(x_1, x_2, \ldots\ldots x_5)$, where q is the value of the rubber-based farm's output in Naira per year, x_1 is the amount of land used by the i^{th} rubber-based farm in hectares, x_2 is the amount of hired labour employed on the farm in man-days, x_3 is the amount of family labour used on the farm in man-days, x_4 is the amount of capital used on the farm in Naira and x_5 is the quantity of fertilizer in kg.

Hired labor in the study area is paid based on task and not per man-days. In order to convert amount to man days, the total amount paid by each farmer to hired labor were divided by 8 h, (which make one man-day). The choice of a functional form is critical to an empirical study like this. Griffin *et al.* (1987) stated that the functional form can significantly affect the results. A flexible functional form is generally preferred since it does neither impose prior restrictions on the parameters nor on the technical relationship among inputs. The two flexible functional relationships commonly used are the transcendental and transcendental logarithmic (translog). These are stated below:

$$\text{Ln } q = a_o + \sum a_i x_i + \sum b_i \ln x_i \quad \text{Transcendental}$$

$$\text{Ln } q = c_o + \sum c_i \ln x_i + \tfrac{1}{2} \sum\sum d_{ij} (\ln x_i)(\ln x_j) \quad \text{Translog.}$$

Where q and x_i are previously defined and a_o, a_i, b_i, c_o, c_i and d_{ij} are parameter estimated from above equations. Note, that the Cobb-Douglas production function is nested within both the transcendental and translog forms. If all a_i's become zero, the transcendental form reduces to Cobb-Douglas function, while this is the case for translog form when all d_{ij}'s become zero. In this study, however, only the transcendental production function was used, because of ease of computation and handling. The translog functional form is likely to have more variables that are likely to be multicollinear. Special statistical tests (Nested hypothesis F test & condition indexes test) were performed to verify whether or not the Cobb-Douglas function would be an appropriate functional form for the production function estimated in this study.

The efficiency of resource use was obtained from the estimated equation by comparing the Marginal Value Product (MVP) of a particular input with the Marginal Factor Cost (MFC) of that input. The MVP of an input was obtained by:

$$MVP_{xi} = MPP_{xi} * P$$

Where MPP_{xi} is the Marginal Physical Product of x_i and P is the unit price of the output (q). The MFC For an input is defined as:

$$MFC_{xi} = MPP_{xi} * r_{xi}$$

Where r_{xi} is the unit price of input x_i.

The regression coefficients, which are equal to the elasticity coefficients in Cobb-Douglas production function, were used to measure the return-to-scale in rubber production. When $b_1 + b_2 +$ ------ $+ b_5$ equal one, there is constant return to scale, above one indicate increasing, while less than one indicate decreasing return to scale.

As regards the resource use efficiency, whenever $MVP_{xi} > MFC_{xi}$ there is under utilization of resource x_i, $MVP_{xi} < MFC_{xi}$ there is over utilization of resource x_i and $MVP_{xi} = MFC_{xi}$ there is optimum utilization of resource x_i.

RESULTS AND DISCUSSION

The estimated transcendental production function for rubber smallholders in Edo and Delta state of Nigeria (Table I) revealed that only 3 out of the 11 parameters were significant in the production of rubber in the states. The regressors included in the model accounts for about 64% of the variability in the value of rubber output. Few explanatory variables were significant with a high value of coefficient of multiple determination. This revealed that there is likelihood of the presence of multicollinearity. According to Belsley *et al.* (1980), a condition index higher than 30 (that is, the square root of the ratio of the largest to the smallest characteristic roots) revealed a strong linear dependencies among the independent variables. Hence, the result suggests strong multicollinearity among the variables in the transcendental functional form.

A nested hypothesis test was performed to determine whether the Cobb-Douglas production function could be appropriate for the study. This was based on the fact that the Cobb-Douglas functional form is nested within the transcendental function. An F value of 1.46 ($p > 0.01$) was obtained. Hence the hypothesis of Cobb-Douglas cannot be rejected when compared with the transcendental form. Therefore, the Cobb-Douglas function was used for this study.

From data in Table II, 89% of the variability in rubber output was explained by the variables in the model. The F-ratio revealed that the model has a good fit to the data. All the five inputs were significant. A 100% increase in land, hired labour, family labour, capital and planting material will, respectively increase the output of rubber by 42.1, 6.5, 13.4, 80.9 and 7.4%. Hence, the degree of responsiveness of rubber output to an increase in each of the input is inelastic.

The scale coefficient was 1.503 and was significantly different ($p < 0.05$). This has implications for rubber output, because rubber production in the study area is within the domain of increasing return – to – scale. That is, if all inputs can be increased by 100%, the output of rubber will rise by 150.3%. However, the above result of the scale coefficient masked the resource use efficiency of each input in the

Table I. Transcendental Production Function for Rubber Smallholders in Edo and Delta State

Variable	Coefficients	t-ratios
Intercept	0.985	1.75***
Land (x_1)	0.206	1.89***
Hired labour (x_2)	0.007	0.72
Family labour (x_3)	0.008	0.63
Capital (x_4)	0.019	1.41
Planting material (x_5)	0.034	1.02
ln Land (x_6)	0.512	2.64*
ln Hired labour (x_7)	0.068	1.42
ln Family labour (x_8)	0.001	1.48
ln Capital (x_9)	0.274	1.02
Ln Planting material (x_{10})	0.286	1.44
R2 = 0.64, Adj R2 = 0.62, F = 9.62, Condition indexes$^+$ =31.38; Cobb-Douglas nested hypothesis test F = 1.46 (p value = 0.17)		

* Coefficients of variable is significant at 1%, *** = 10%; $^+$ condition index higher than 30 reveals strong linear dependencies. Belsely *et el.* (1980)

Table II. Estimated Cobb-Douglas Production Function for Rubber Smallholders in Edo and Delta state of Nigeria

Variable	Coefficients	t-ratios
Intercept	1.217	2.82*
ln Land (x_1)	0.421	4.52*
ln Hired labour (x_2)	0.065	1.72***
ln Family labour (x_3)	0.134	2.18**
ln Capital (x_4)	0.809	2.42*
Ln Planting material (x_5)	0.074	1.69***

R^2 = 0.89, Adj. R^2 =0.88, F =12.14, Condition indexes = 4.32, * Coefficients of variable is significant at 1%, ** at 5% and *** at 10%

Table III. Marginal value product (MVP) and marginal factor cost (MFC) of production inputs in rubber production in Edo and Delta region of Nigeria

Input	MVP	MFC	MVP/MFC
Land	173.25	145.60	1.19
Hired labour	56.30	27.20	2.07
Family labour	41.27	18.40	2.24
Capital	184.16	150.70	1.22
Planting material	26.40	8.80	3.00

Table IV. Farmers attitudes toward conservation practices that affects the level of soil erosion and farm income

Item	A	B
Agree	42.6	18.2
Disagree	52.2	68.5
Neither Agree nor Disagree	5.2	13.3

A–I would pay more for any innovation that could reduce soil damage even if it does not increase my income; B–I would not adopt any innovation that could cause soil damage even if it could increase my income

production of rubber in the study area. Table III, shows the MVP and MFC of the individual input used.

Data revealed that all the production inputs were under-utilized, as the MVP was higher than the MFC (Table III). This implied that increased use of this inputs will lead to further increase in output. Specifically for every amount spent on land, hired labour, family labour, capital and planting material, the returns from rubber will increase by ₦1, ₦2, ₦2, ₦1 and ₦3, respectively. Land in the study area is underutilized either because of the restrictive land tenure system operating in the study area or probably, because some of the rubber farmers do not intercrop with food crop. Labour (family & hired) is very scarce in the area probably, because people now prefer to train their children in school or on trade that will eventually pull them away from agriculture. As for capital, most of the rubber smallholders do not have enough capital to expand their production.

About 43% of the farmers agreed to pay more for any innovation that would reduce soil damage even if did not increase income as against 52% who were not willing to pay more for an innovation that would only reduce soil damage without a rise in income (Table IV). A large proportion (69%) of the farmers would adopt any innovation that could cause soil damage as long as it would increase income, while about 18% of the farmers were not willing to adopt any innovation that could cause soil damage even if it would raise the level of income. The results revealed that farmers would adopts an innovation that would increase soil damage as long as it increase the level of income rather than to pay more for an innovation that would reduce soil damage without an increase in income. The results also showed that farmers are not always cautious about the damage done to the environment and seem to be more concerned about their income and short-term benefits.

Based on the findings of the study, it is recommended that rubber production should be based on any technique that will use more of the production inputs examined in the study area. Also, efforts should be made to alleviate the poverty level of the people, so that they can invest in yield increasing and soil conservation technologies that will ensure increased supply of agricultural output in addition to conserving the environment.

REFERENCES

Anthonio, Q.B.O., 1967. The stagnant sector in Nigerian economy. *Bull. Rural Econ. Sociol.*, 2: 27–39

Amara, N., N. Traore, R. Landry and R. Romain, 1999. Technical efficiency and farmers attitudes towards technological innovation: the case of the potato farmers in Quebec. *Canadian J. Agric. Econ.*, 47: 31–43

Begho, E., R.M. Abubakar and E.O. Akpaja, 2002. Farmers perception of the mistletoe problem on rubber trees in southern Nigeria. *J. Agric. For. Fisheries,* 3 and 4: 5–9

Belsley, D., E. Kuh and R. Welsh, 1980. *Regression Diagonostics*: *Identifying Influential Data and Sources of Collinearity*. John Wiley and Sons, New York

CBN/NISER, 1992. *The Impact of SAP on Nigerian Agriculture and Rural Life*, Vol. 1. The national report, A CBN/NISER National Study

Falusi, A.O. and S.O. Olayide, 1980. Agricultural Inputs and small farmers in Nigeria. *In*: Olayide, S.O., J.A. Eweka and V.E. Bello-Osagie (eds.), *The Nigeria Small Farmers*. Centre of Agricultural and Rural Development, University of Ibadan, Nigeria

Griffin, R.C., J.M. Montgomery and M.E. Rister, 1987. Selecting functional forms in production function analysis. *West J. Agric. Econ*., 12: 216–7

Olayemi, J.K., 1980. Food crop production by small farmers in Nigeria. *In*: Olayide, S.O., J.A. Eweka and V.E. Bello-Osagie (eds.), *The Nigeria Small Farmers*. Centre of Agricultural and Rural Development, University of Ibadan, Nigeria

Udofia, K.J.W., 2006. *Report of the Presidential Initiatives on Rubber Production, Utilization, Marketing and Export.* Held in the office of deputy governor, Akwa Ibom state, 17th January, 2006

(Received 07 August 2007; Accepted 25 June 2008)