# ADOPTION OF IMPROVED RUBBER TECHNOLOGIES BY SMALLHOLDER RUBBER FARMERS IN EDO STATE OF NIGERIA AS AFFECTED BY THEIR SOCIO-ECONOMIC FACTORS

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## ABSTRACT

*The adoption of improved rubber technologies among small holder rubber farmers in Edo State as affected by their socio-economic factors was examined in this study. The demographic characteristics of the respondents, sources of information on rubber technologies, technologies adopted and constraints faced by smallholder rubber farmers were investigated. The study was carried out in three (3) local government Areas of Edo State namely Ovia Southwest, Ovia Northeast and Uhumwode. The study reveals that majority of the farmers were old and are males, have large family size, are experienced in rubber farming and they have low access to information source. Over 70% of farmers are small scale holders. They have low income, 54.7% have income of less than N20, 000 a month. The technologies the farmers were aware of are weeding, (100%), fire tracing (91.4%), pruning (48.2%), holing/dibbling (10.1%) and intercropping (0.7%). Age, farming experience and house hold sizes are critical factors of rubber technology adoption. The study identified small farm size, non availability of credit, scattered farm plot, long gestation period, high cost of labour, scarcity of trained tappers, incidence of disease (white root rot disease) as constraint to rubber technology adoption.*
*It is therefore recommended that there is urgent need for extension arms of Edo state Agricultural Development Programme and Rubber Research Institute of Nigeria to work together and disseminate information on rubber technologies to farmers. Regular extension visit to farmers should be encouraged.*

**Keywords:** Evaluation, Socio-economic factors, Adoption, Rubber technology, Smallholders.

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## INTRODUCTION

Nigeria is blessed with very good natural resources for agricultural development and production. The country has large expanse of land, water and forest resources. Its diverse climate and vibrant population has great agricultural potential. Natural Rubber (*Hevea brasillensis* Muel Arg) was introduced into Nigeria in 1895 from Brazil. In Nigeria, natural rubber grows well in the Deciduous Rain Forest region with temperature of 21- $25^0$C and well distributed annual rainfall of 200cm or more on well drained soil (Aigbekaen et al, 2000). Rubber is grown in Edo, Delta, Abia, Imo, Rivers, Akwa – Ibom, Cross River, Bayelsa, Anambra, Oyo,

Ondo, Taraba, Ogun, and marginally in areas like Ebonyi, Enugu, Osun, Ekiti and Southern Kaduna. Rubber (Hevea brasiliensis) in an economic tree crop that is grown for its latex which is milky exudates extracted from matured rubber tree during tapping. Rubber seeds have been found to be useful in production of animal feeds rubber seed oil, alkyd resins, paints, liquid soap, body cream, putty etc. Rubber wood is also used for furniture making (RRIN, 1995). Rubber is a major foreign exchange earner of Nigeria after oil palm and cocoa.

The activities of rubber industry in Nigeria have been on a decline due to the low world market price of rubber, this has made rubber farmers to abandoned rubber plantation and switched over to other profit making crops such as oil palm or cut down rubber trees to be sold as fire wood (Presidential committee on Rubber production and export, 2006). About 154,000 hectare of land are under rubber production in Nigeria, out of which 96,000 hectares are under small holding this accounted for over 70% of land under rubber production in Nigeria owned by small holders. Edo, Delta, Akwa-Ibom and Cross River states have the highest concentration of small holders in Nigeria. It is estimated that about 58,000 hectares of land in Nigeria is under Estate production. These Estates are between 20 and 52 years old and have outlived their economic life span, which is a decline in rubber production. The small holdings need to be checked if Nigeria must maintain her proper position in the world map of rubber exporters (Igbinosun, 2009).

Rubber Research Institute of Nigeria (RRIN) was established in 1961, mandated by the Federal Government of Nigeria to carry out research into rubber and other latex producing plants of economic importance. Over the years a lot of technologies have been developed to improve rubber production and improved farmers' standard of living in Nigeria. These include the development of improved planting material (NIG. 800 and 900 Series) that are high yielding and the yield potentials is as high as 3,200 - 3,500kg/ha/year, new methods of intercropping food crops under immature rubber plantation before canopy closure, improved rubber tapping systems and yield stimulation methods, development of integrated farming systems for small scale farmers under matured rubber plantation with integrated weed management practices and fabrication and design of small–scale rubber seed Oil extraction like putty manufacture and budded stumps lifting equipment among others (RRIN, 2008/2009).

Adoption is defined as the mental process an individual passes through from the first time he or she learns of the existence of an innovation to the time he finally decides to adopt or reject the innovation (Rogers, 1983). The acceptance of a new idea by farmers has been known to go through several steps reflected both in thought and action of individual. Acceptance of a new idea by farmers is not a simple decision. Thus the mental process which an individual passes through from time he/she hears the new idea and finally accepted by him or her is called adoption process and it consists of 5 stages -awareness, interest, evaluation, trial and adoption. (Williams et al., 1984)

However, the non-adoption of improved farm practices or innovations by farmers is one of the major reasons for low productivity in natural rubber production (Giroh, et al., 2007). Researches in rubber have generated improved technologies that may ameliorate the current decline in rubber production. Improved technologies generated by researchers may not be relevant except adopted by farmers

The study was therefore conducted to evaluate the socio-economic factors affecting the adoption of rubber technologies among smallholders in Edo State, Nigeria.

The specific objectives are to:

- determine the Socio-Economic characteristics of small holder farmers in the area,
- determine the level of awareness of available technologies,
- identify sources of information on rubber technologies,
- identify the technology adopted by smallholder and
- identify the constraints faced by smallholder rubber farmers in adopting rubber technologies.

## METHODOLOGY

The study area: Multi-stage purposive and random sampling procedures were adopted. Stage one was the purposive selection of Edo State. The choice of Edo State was because of her prominent role in rubber production in the rubber belt of Nigeria. The second stage was the selection of rubber growing local government areas in Edo state which are Uhunmwode, Ovia North East and Ovia South west. The third stage was a random sampling of 150 farmers herein refers to as respondents who are actively involved in rubber cultivation from six randomly selected villages. The respondents were served with questionnaires out of which 139 were returned and used for analysis (Field survey, 2006).

Data analysis: Data collected were analyzed using descriptive and inferential statistics. Descriptive statistics such as frequency counts, tables, percentage and means were used. Likert scale (Osuala, 1993) was used to measure the constraints faced by smallholder rubber farmers in adoption of rubber technologies. The Likert scale was adopted with score of the items of constraints as very serious (3), serious (2) and not serious (1). The mean score, which formed the bench mark on which the constraints were judged, was observed by the farmers.

$X = X/N$, where $x = 1, 2, 3$, X is the assigned constraints i.e. 3, very serious; 2, serious and 1, not serious. N= number of occurrence.

The benchmark on which the significance is computed is by summing up assigned values and dividing by the number of occurrence, $3 + 2 + 1 = 6$ and divided by $3 = 2$(i.e. $6/3 = 2$). The decision score = 2 was considered a significant constraint.

Chi square ($\chi^2$) statistics was used for the analysis of farmers' socio-economic variables and adoption, at 5% level of significance.

## RESULTS AND DISCUSSION

The socio- economic characteristics of respondents (i.e. farmers) is as shown in Table 1 below. The result implies that rubber production is still dominated by older farmers as 77.0% of the respondents were above 41 years of age particularly the age group greater than 60 years that accounted for 40.3% which constitute the majority. This finding is in line with the findings of Abolagba *et al*., (2003) which indicated that aged farmers formed major sources of labour in natural rubber business. This trend need to be reversed as young and energetic men are much needed to face the rigours of natural rubber production. However the studies of Onomolease *et al*., (2001), Okwoche *et al*., (1998) and Akinola (1983) have shown that there is no association between age and adoption behavior of farmers.

All respondents (100%) were males meaning that rubber production in the study area is exclusively left for males. A plausible reason for this is that rubber productions require large expanses of land and traditional practice in the study area is biased against land

allocation to females. Aghimien, (1997), also reported that rubber production in Edo State is dominated by males. Majority of rubber farmers in the study area are married (98.6%) and this shows that married people are more engaged in rubber production than singles.

Majority of rubber farmers (82%) have at least primary education, this shows that famers are literate (Table 1). With this high level of education of the respondents, it is expected that the level of adoption of innovation or technologies in rubber production will be high. This is in line with the studies of Onomolease et al., (2001) who found out that education is positively correlated with the adoption of improved technologies. Majority of the respondents (65.5%) has house hold size greater than nine (9) which include children.

Majority (71.9%) of the respondent, have farm size of between 1.5 and 2.5 hectares which implies that most rubber farmers sampled are small holders. The result also indicated that 61.1% of the rubber farmers have farming experience greater than 31 years. The longer the rubber farming experience of the farmers, the more they acquired skills and knowledge and experience about rubber farming which enable them adopt improved rubber farming practices. This study is in line with the studies of Atala and Abdullahi (1988) that farming experiences influences farmers response to the adoption of improved practices.

**Table 1: Socio- Economic Characteristics of Respondents (Farmers)**

| Socio-economic variable | Category | Frequency | Percentage |
|---|---|---|---|
| Age (Years) | 21-30 | 5 | 3.6 |
| | 31 – 40 | 27 | 19.4 |
| | 41 – 50 | 24 | 7.3 |
| | 51 – 60 | 27 | 19.4 |
| | >60 | 56 | 40.3 |
| Gender or Sex | Male | 139 | 100 |
| | Female | 0 | 0 |
| Marital Status | Married | 137 | 98.6 |
| | Single | 2 | 1.4 |
| Educational Level | No formal Education | 25 | 18.0 |
| | Primary Education | 35 | 25.2 |
| | Modern III/Secondary Education | 72 | 51.8 |
| | Tertiary Education | 7 | 5.0 |
| Household/Family Size | 1 – 4 | 2 | 1-4 |
| | 5 – 8 | 46 | 33.1 |
| | 9 – 12 | 62 | 44.6 |
| | 13 – 16 | 20 | 14.4 |
| | >16 | 9 | 6.5 |
| Farm size (Ha) | 1.5 and below | 26 | 18.7 |
| | 1.6 – 2.5 | 74 | 53.2 |
| | >2.5 | 39 | 28.1 |
| Farming experience | Below 20 years | 32 | 23.0 |
| | 21 – 30 years | 22 | 15.8 |
| | 31 – 40 years | 27 | 19.4 |
| | >40 years | 58 | 41.7 |

Source: Field survey, (2006).

The income distribution of respondents or farmers is as shown in Table 2 below. About 54.7% of the farmers have a monthly income of less than ₦20, 000. This is low considering the socio-economic realities of farmers' environment. Farmers' income has been found to be a critical factor in agricultural production. The higher the farmers income the more they are able to adopt new farming practices. This view agreed with Ogunfiditimi (1981) who stated that the economic status of farmers which shows positive and significant relationship with adoption portrays the fact that the more the farmers are economically viable in terms of their ability to purchase necessary input such as insecticides, fertilizers, labour etc., the more they are prone to adoption of new practices.

**Table 2: Income Distribution of respondents**

| Income Category(₦) | Frequency | Percentage |
|---|---|---|
| Less than ₦10,000 | 21 | 15.1 |
| ₦(10,000 - 20,000) | 55 | 39.6 |
| Greater than ₦20,000 | 63 | 45.3 |

Source: Field survey, (2006).

The distribution of respondents based on information sources is as shown in Table 3. The information sources available to the farmers in the study area are from private rubber estates (17.3%), Co-operative societies (3.6%) and RRIN organized workshop/seminar (0.7%). Private rubber Estates appears to impact more on the respondents than government agencies such as Agricultural Development Programmes (ADP) /Ministry of Agriculture and RRIN.

**Table 3: Distribution of respondents based on information sources**

| | Aware | | Not Aware | |
|---|---|---|---|---|
| **Information sources** | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Private rubber estates | 24 | 17.3 | 115 | 82.7 |
| Co-operative societies | 5 | 3.6 | 134 | 96.4 |
| RRIN organized workshop/seminar | 1 | 0.7 | 138 | 99.3 |

Source: Field survey, (2006).

The technologies awareness and adoption by respondents is presented in Table 4. The rubber technologies adopted by farmers in the area are weeding (100%), fire tracing (91.4%), pruning (48.2%), holing/dibbling (10.1%) and intercropping (0.7%). Regular weeding of rubber plantation reduces the risk of fire hazards in rubber plantations. The poor adoption of intercropping technology by the farmers in the study area underscore the importance of intercropping rubber with arable crops at the immaturity stage of the rubber trees. Intercropping rubber with arable crops increases farmers' revenue from the arable crops intercropped with rubber. It also ensures an efficient utilization of both land under rubber and farm labour throughout the year. The performance of rubber can be monitored and/or compared when planted alone or when intercropped with arable crops.

**Table 4: Technologies awareness and adoption by respondents**

| | Aware | | Not Aware | |
|---|---|---|---|---|
| **Technology** | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Weeding | 139 | 100 | 0.00 | 0.00 |
| Fire trace | 130 | 93.5 | 9 | 6.50 |
| Pruning | 72 | 51.8 | 67 | 48.20 |
| Holing/dibbling | 15 | 10.8 | 124 | 89.20 |
| Intercropping | 3 | 2.2 | 136 | 97.80 |

Source: Field survey, (2006).

The distribution of respondent based on adoption constraints is as shown in Table 5. The following constraints to rubber adoption was analyzed which include small farm size, non availability of credit, long gestation period, high cost of labour, high cost of chemicals, scattered farm plots, disease incidence (white root rot) and scarcity of trained tappers. Most of the constraints have a mean value greater than 2.00 which shows that the constraints identified by farmers are serious (Table 5).

**Table 5 Distribution of respondent based on adoption constraints**

| | **R E S P O N S E S** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Very Serious** | | **Serious** | | **Not Serious** | | |
| **Constraints** | **No** | **%** | **No** | **%** | **No** | **%** | **Mean** |
| Small farm size | 139 | 100 | - | - | - | 0.00 | 3.00 |
| Non availability of credit | 139 | 100 | - | - | - | 0.00 | 3.00 |
| Long gestation period | 139 | 100 | - | - | - | 0.00 | 3.00 |
| High cost of labour | 139 | 100 | - | - | - | 0.00 | 3.00 |
| High cost of chemicals | 139 | 100 | - | - | - | 0.00 | 3.00 |
| Scattered farm plots | 111 | 79.86 | 28 | 20.14 | - | 0.00 | 2.79 |
| Disease incidence (white root rot) | 57 | 41.01 | 82 | 58.99 | - | 0.00 | 2.41 |
| Scarcity of tappers | 42 | 30.22 | 97 | 69.78 | - | 0.00 | 2.30 |

* Mean >2.00 = Serious constraint.
Source: Field survey (2006).

The relationship between farmers' socio-economic variables and adoption is as shown in Table 6. To analyze the socio-economic variables and adoption, chi-square statistics was used. Age, education, income, household, size, farming experience and extension visit was analyzed. It was found that, household size, and farming experience were significant at 5% probability level while education, income and extension visit were found to be insignificant ($p>0.05$).

With regards to age and adoption behavior of farmers, the study revealed a significant relationship between age and adoption. Giroh *et al*., (2007); Onomolease (2001) and Okwoche *et al*., (1998) however reported in their respective studies that there is no association between age and adoption behaviors of farmers.

A significant ($p <0.05$) relationship was found to exist between the household size and farmers' adoption of rubber technology. Household size imposes the necessity to adopt as more family size puts pressure on the household heads to devise a means of sustenance of livelihoods by engaging in productive ventures.

Extension visit was not significant with adoption behavior of farmers. This is more so because farmers in the study

area have not been regularly visited by the extension agents. Frequent visits would enhance adoption of innovation. Theoretical plausibility for this result may be inadequacy of change agents as ratio of extension agents to farmers in Africa is relatively large and their inability to visit all farm families (Giroh *et al.,* 2007). This result also implies that a greater majority of the farmers do not have access to extension agents and therefore, farmers are not aware of improved rubber farming practices. It is an established fact that extension agents are a major source of awareness of improved agricultural information. Therefore, lack of extension visit to farmers may lead to lack of awareness and hence low adoption of rubber farming innovation. This view is supported by Osuntogun *et al*., (1984) that technology adoption is facilitated through contact agricultural extension workers and it contributes positively to economic returns of farmers.

**Table 6: Relationship between farmers' socio-economic variables and adoption**

| Variable | df | $\chi^2$ calculated | $\chi^2$ tabulated |
|---|---|---|---|
| Age | 4 | 18.30* | 9.49 |
| Education | 3 | 7.50 | 7.82 |
| Income | 2 | 0.78 | 5.99 |
| House-hold size | 4 | 9.75* | 9.49 |
| Farming experience | 3 | 1 5.62* | 7.82 |
| Extension visit | 1 | 3.21 | 3.84 |

*= ($p < 0.05$); df = degree of freedom.
Source: Field survey (2006).

## CONCLUSIONS

- Majority of the farmers are males, have large family size, experienced in rubber production and characterized by small size holdings, low-income earnings and are older farmers.
- Farmers have low access to information sources on improved rubber technology.
- Age, farming experience and household size are critical factors of rubber technology adoption among farmers and farmers do not adopt most improved rubber technologies.
- Farmers are bedeviled with production constraints such as small farm plots, long gestation period of rubber tree, high cost of labour, scarcity of trained tappers, low extension visit and disease incidence especially white root rot disease.

## RECOMMENDATIONS

- There is an urgent need for the extension arms of both Edo state ADP and RRIN to work together to disseminate improved rubber production technologies to farmers through organized training workshops on plantation establishment, nursery practices and tapping.
- Rubber farmers should be encouraged to form co-operatives to enable them have access to production credit from Agriculture Bank and other commercial banks to enable them purchase farm inputs such as chemicals, fertilizers, improved planting materials etc.
- Intercropping of immature rubber plantations should be encouraged for effective land utilization.
- Government should encourage rubber production through regular funding, timely release of fund and allocation of hectares of land for the cultivation of natural rubber.

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