2021 Journal of Agricultural Production and Technology ISSN: 2360-9364

ANALYSIS OF THE LEVEL OF DISCONTINUANCE OF ADOPTED RUBBER TECHNOLOGIES AMONG SMALL- SCALE RUBBER FARMERS IN EDO AND DELTA STATES, NIGERIA

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ABSTRACT

The study analyzed the level of discontinuance of adopted rubber technologies among small-scale rubber farmers in Edo and Delta States, Nigeria. Data were collected from two hundred and forty small scale farmers by the use of well-structured questionnaire. Data were analyzed using descriptive and inferential statistics, and Sigma scoring method was used to compare the level of technologies discontinuance in the two states. The study revealed that rubber production in the study area is dominated by men with mean age of 56 years and farming experience of 17 years. However, their level of discontinuance was also high, but higher in Edo than Delta State. Reasons for discontinuance included inadequate capital to continue with the technology (94.4%), unavailability of improved planting materials (90%), high labour cost (88.9%) and poor extension contact (85.6%). The study recommends among others the need for government to support rubber farmers through subsidizing of farm inputs. Subsidies can help poor farmers overcome the inability to obtain credit or take risks.

Keywords: Rubber technologies, Discontinuance, Adoption, Small-scale farmers.

J. Agric. Prod. & Tech. 2021; 10:1-9

INTRODUCTION

Natural rubber is major agricultural export crop. It is an economic tree crop grown for its latex which is a milky exudate extracted from a matured rubber tree during tapping. It was found to be the best source of rubber because of its singular ability to renew its bark and thus ensure sustained harvest. The rubber belt of Nigeria covers a large expanse of land measuring about 7.6 million hectares, occurring in coastal areas of Nigeria, such as Edo, Delta, Ondo, Ogun, Abia, Anambra, Akwa-Ibom, Ebonyi, Cross-River, Imo, Rivers, Bayelsa and recently in other areas like Enugu, Kaduna and Taraba States, It is pertinent to add that while Edo and Delta States have the largest area of smallholder rubber farms, Cross-River State has the largest size of rubber estates (Abolagba *et al.,* 2003; Aigbekaen *et al*., 2000). However, yield and productivity of natural rubber has constantly declined in alarming rate. Natural rubber production dropped from 254,000 metric tonnes in 2002 to 48,000 metric tonnes in 2009 (Umar *et al.,* 2011).

The study thus examined the factors responsible for discontinuance of improved rubber production technologies among farmers in Edo and Delta State, Nigeria with the aim to:

(i) ascertain the socio-economic

characteristics of small-scale rubber farmers in Edo and Delta States.

(ii) compare farmers' level of awareness of rubber technologies in the two States

(iii) determine the level of discontinuance of adopted technologies in the two States.

(iv) identify the barriers responsible for discontinuance of these technologies.

The null hypotheses tested in this study is:

Ho_1: There is no significant difference in the level of technology discontinuance between Edo and Delta States rubber producers.

MATERIALS AND METHODS

Study Area: The study was carried out in Edo and Delta States of Nigeria. Edo State has a population of 3,218,332 which approximates to 2.4% of the total population of the country (National Population Commission, 2006) and with a land area of 17,802km^2. The region lies within the rainforest zone and has a temperature range of 21 – 30^{0}C with a well distributed rainfall of 2000 mm annually (Aigbekaen *et al.*, 2000). It has ultisol soil with a pH range of 4.5 – 5.5 which is favourable for the production of natural rubber (Abolagba *et al.,* 2003; Aigbekaen *et al.*, 2000). Agriculture is the predominant occupation of the people in this state. The major economic trees produced are rubber and oil palm. In addition, the state produces such crops as yams, cassava, rice, plantain, guinea-corn, assorted types of fruits and vegetables.

Delta State has a population of 4,098,391 (NPC, 2006) and with a land area of 17,698 km^2 and a tropical climate marked by two distinct seasons, the dry and rainy seasons. The average annual rainfall is about 266.7 cm in the coastal areas and 190.5cm in the extreme north. Rainfall is heaviest in July. It has a high temperature, ranging between 29^{0}C and 44^{0}C with average of 30^{0}C. It has ultisol soil with pH range of 4.5 – 5.5 favourable for the production of natural rubber (Abolagba *et al.,* 2003; Aigbekaen *et al.*, 2000). Economic trees, which abound in the state, include Sapele wood, Iroko, Mahogany, Raffia palms, rubber and palm trees.

Population and Sample Size Selection:

The population of this study comprised all small-scale rubber farmers in Edo and Delta State. A sampling proportion of 50% of the population of rubber farmers were selected for the study. Due to the enormity of this population (480), a sample size of 240 respondents were selected using multistage, purposive and simple random sampling techniques.

In the first stage of sampling, six Local Government Areas each in Edo and Delta State were selected purposively based on their high involvement in rubber production. In the second stage of sampling, six major rubber producing communities from each Local Government areas were selected. The final stage was the use of simple random sampling techniques in selecting farmers from each selected communities in proportion to the population. The list of rubber farmers was obtained from Research outreach and training services division of Rubber Research Institute of Nigeria (RRIN), the Tree Crop Unit in Edo State Ministry of Agriculture and Natural Resources.

Data collection and analysis

Data collected were analyzed using descriptive and inferential statistics such as frequency, percentage, mean and sigma scoring method.

To compare the level of technologies discontinuance in the two states, the sigma scoring method was used. The following steps were used.

First, the percentage of farmers who adopted the technology (A%) was first obtained.

$$\frac{\text{Numbers of Farmers who adopted the technology}}{\text{Total Number of Respondents}} \times \frac{100}{1} = A\%$$

This is followed by dividing the percentage (A%) by two and minus the answer from 100; i.e. 100-(A%/2) = B%

Check B% on the statistical table of normal deviates to get the sigma distance (x). Next, increase the value of the sigma distance using a constant figure of 2 and multiplying the result by the same constant.

$(x+2) \times 2 = y$

Since sigma method assign weight in reverse direction in a ten (10) point scale, the actual sigma score would be 10 minus the answer (y).

$10 - y = Z$

Decision rule: any mean score (z) less than 5 are considered as low level of adoption. The same method also applies when determining the level of discontinuance of adopted technologies.

RESULTS AND DISCUSSION

Table 1 shows distribution of farmers by socio – economic characteristics. The result revealed that most respondents (72.50%) fell between 51 and 60 years of age. About 14% were 61 - 70 years while 5% were 41-50 years old. The result suggests that rubber farmers in the study area were fairly old probably because of the long gestation period associated with rubber production. Comparatively, the results of the study showed that older individuals were involved in rubber production in Delta State than in Edo State and suggest that the youths showed little interest in taking up rubber farming. Thus, farm innovations might not be easily adopted because the old farmers are very conservative and more resistant to change. Also, all the respondents were males suggesting that rubber production is largely a male activity in the study area. It is possible that the tedious activities associated with the cultivation of the crop may be responsible for the dominance of males in the rubber enterprise. Table 1 also showed that most (89.2%) respondents were married while 5.8%, 3.3%, and 1.7% were single, widowed and divorced respectively. The findings indicated that rubber cultivation is dominated by the married. The need to cater for their families may explain the prevalence of married individuals in rubber production.

The educational qualifications showed that 43.3% of them completed primary education, 27.1% had GCE/WASC/Technical education, 15% had tertiary education, while close to 15% had no formal education. From the findings, majority of the farmers (58.1%) had primary education. These findings suggest that the rubber farmers in the study had a fairly low educational level. The role of education has always been recognized as positive in the adoption of improved technologies by farmers (Sheikh *et al.,* 2006). Farmers' level of education according to Etuk *et al.,* (2018) influences the kind of opportunities available to improve livelihood strategies, enhanced food security and reduction in the level of poverty.

Based on the rubber farming experience of the respondents, 30% of them went into rubber production in the last 10 years, 25.8% had an experience of 11-15 years, 12.5% had an experience of 16-20, while 12.1% had an experience of 31-35 years. The average experience was 17 years which suggests that the respondents were quite experienced in rubber cultivation and

may have come to appreciate the need for adopting improved technologies in their production activities. Also, 44.2% had a farm size of 2 ha and below, 46.7% had 2.1-4.0 ha while 9.2% had over 4ha respectively. Land size is one of the indicators of the level of economic resources available to farmers (Ajibefun, 2006). The average farm size of 2.3hectares suggests that the respondents were small scale rubber farmers. The implication is that scale of production is a limiting factor to the level of output for farmers as well as the extent to which they may want to adopt improved rubber technologies. Ajayi and Okunlola (2006) asserted that farmers with larger farm holdings are more likely to invest in their farm enterprise than those with smaller holdings as the former feels they have more to gain. .

Table 1: Distribution of respondents (farmers) by socio-economic characteristics

Socio-economic Characteristics	Category	Edo State		Delta State		Pooled		Mean
		Freq. (n=113)	%	Freq. (n=127)	%	Freq. (n=240)	%	X
Age (years)	21-30	1	9	1	0.8	2	0.8	56yrs
	31-40	0	0	8	6.3	8	3.3	
	41-50	0	0	12	9.4	12	5	
	51-60	107	94.7	62	52.8	174	72.5	
	61-70	2	1.8	31	24.4	33	13.8	
	>70	3	2.7	8	6.3	27	11	
Sex	Male	113	100	127	100	240	100	
	Female	0	0	0	0	0	0	
Marital status	Married	108	95.6	106	83.5	214	89.2	
	Single	5	4.4	9	7.1	14	5.8	
	Widowed	0	0	8	6.3	8	3.3	
	Divorced	0	0	4	3.1	4	1.7	
Household size	1-4	18	15.9	28	22	46	19.2	
	5-8	75	66.4	61	48	136	56.7	
	9-12	15	13.3	29	22.8	44	18.3	
	>12	5	4.4	9	7.1	14	5.8	
Educational qualifications	No formal education	16	14.2	19	15.0	35	14.6	
	Completed pry school	39	34.5	65	51.2	104	43.3	
	Completed technical/ vocational/WASC	43	38.1	22	17.3	65	22.7	
	Tertiary Edu (OND, NCE, HND, B.Sc. etc.	15	13.2	21	16.5	36	15	
Farming experience (years)	< 10 years	38	33.6	34	26.8	70	30	17yrs
	11- 20	49	43.4	43	33.9	92	38.3	
	21-30	11	9.7	22	17.3	33	13.8	
	31-40	10	8.3	23	18.1	33	13.8	
	> 40	5	4.4	5	3.9	10	4.2	
Farm size (ha)	< 2 hectares	31	27.4	75	59.1	106	44.2	2.3ha
	2.1- 4.0	72	63.7	40	31.5	112	46.7	
	>4.0	10	8.8	12	9.4	22	9.2	

Source: Field study 2016.

Awareness of Rubber Technologies

Table 2 shows respondents' level of awareness of rubber production technologies. The pooled result revealed that majority of the respondents were aware of intercropping rubber with arable crops

(91.7%), pest/disease control techniques (88.3%), tapping techniques (86.7%), and integrated farming under matured rubber plantation (83.3%), including recommended spacing of 3.34 x 6.7m (82.5%), and improved rubber clones (73.8%). Slightly above half the respondents were aware of rubber quality improvement practices like cleaning of latex cups and coagula pan before tapping (59.6%), use of fertilizer (57.5%) and use of fire tracing (46.3%). The general results suggest that the farmers' level of awareness of rubber production technologies was high suggesting an effective information dissemination of the technologies in the study area. The mean awareness for Edo State was (6) while Delta State was (7). Awareness of new technologies creates interest in adoption leading to other adoption processes (Okunola, 2010).

High level of awareness of improved rubber management practices may be due to the existence of strong co-operative societies and all the respondents belong to such societies and all the respondents belong to such societies in the study areas. Co-operative membership, according to Mustapha *et al*., (2012), enhances access to information for members and many other inputs of the technologies. .

Table 2: Rubber technologies awareness by respondents

Technologies	Delta		Edo		Pooled	
	Freq.	%	Freq.	%	Freq.	%
Intercropping rubber with arable crops	119	93.7	101	89.4	220	91.7
Pests/disease control techniques	113	89.0	99	87.6	212	88.3
Tapping techniques (Improved)	110	86.6	98	86.7	208	86.7
Integrated farming (mini-livestock) under matured rubber plantation	111	87.4	89	78.8	200	83.3
Recommended spacing (3.34 x 6.7m)	112	88.2	86	76.1	198	82.5
Improved rubber clones	85	66.9	92	81.4	177	73.8
Cleaning of latex cups and coagula pan before tapping	85	66.9	58	51.3	143	59.6
Use of fertilizers	78	61.4	60	53.1	138	57.5
Use of fire tracing technique	60	47.2	51	45.1	111	463

Mean awareness: Edo state (6), Delta state (7): pooled (7)

Adoption and Discontinuance of Rubber Technologies by Respondents

The pooled results show that intercropping (69.2%) was the most adopted rubber technology by respondents. Pest/disease control techniques (39.2%), tapping techniques (39.2%), rubber quality improvement practices such as cleaning of

latex cups and coagula pan before tapping (36.3%), improved rubber clones (35.8%) and use of integrated farming (mini-livestock) with matured rubber plantation (35%) were adopted by respondents to a lesser degree. The least adopted technology was use of fire tracing technique (16. 3%). The general result suggests that respondents' level of adoption of rubber technologies was low relative to their awareness level which the study found to be high. The result for technology discontinuance showed that the most discontinued technology by respondents were fire tracing technique (71.9%), recommended spacing (67.5%), integrated farming under matured rubber (65.5%). The finding suggests that the level of technology discontinuance was very high relative to the adoption. The result agrees with that of Nnadi and Akwiwu (2007) who said that 63% discontinued the use of yam mini-set technology in Imo State.

Table 3: Rubber Technologies Adoption and Discontinuance by the Respondents

Rubber Improvement Technologies	Edo State				Delta State				Pooled			
	Adopted		Discontinued		Adopted		Discontinued		Adopted		Discontinued	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Intercropping	79	69.9	34	30.1	87	68.5	40	31.5	166	69.2	74	30.8
Pests/disease control techniq	49	43.4	64	56.6	45	35.4	82	64.5	94	39.2	146	61
Tapping techniques	40	35.4	73	72.9	54	42.5	83	57.4	94	39.2	146	59.5
Rubber quality improvement practices	46	40.7	67	66.2	41	32.3	86	67.8	87	36.3	155	63.5
Improved rubber clones (Nig 800)	36	31.9	77	68.1	50	39.4	77	60.6	86	35.8	154	64.3
Integrated farming (mini-livestock) under matured rubber plantation	29	25.7	84	74.3	55	43.3	72	56.7	84	35.0	156	65.5
Recommended spacing (3.34 x 6.7m)	29	25.7	84	74.3	50	39.4	77	60.7	79	32.9	161	67.5
Use of fertilizers	29	25.7	84	72.4	47	37.0	80	63	76	31.7	164	67.5
Fire tracing technique	29	25.7	94	83.1	50	39.4	77	60.7	79	32.9	171	71.9

**Multiple responses.*
Source: Field Survey, 2012.

Level of Technology Discontinuance among Farmers in Edo and Delta States

The result indicated that the level of discontinuance was low for agroforestry with sigma score of 3.93 for Edo State and 3.99 for Delta States respectively. Rubber technologies such as tapping techniques (5.08), improved clone of rubber (5.17), recommended spacing for rubber (5.33) fire tracing techniques (5.57), had high level of discontinuance in Edo State. However, there were variations in the level of discontinuance of rubber technologies in Delta State. These include pest and diseases (5.10), rubber quality improvement practices (5.17) and use of fertilizer (5.04) respectively. However, in comparing Edo and Delta States, both states have high level

of discontinuance. Comparatively, the level of discontinuance was higher in Edo State. Low level of discontinuance in Delta State could be due to high level of awareness of rubber technologies in Delta state (7) and (6) for Edo state. Awareness of new technologies can create interest in adoption leading to other adoption processes. High level of awareness of Delta State rubber farmers is because of the existence of co-operative societies and all respondents belong to such societies. Thus, there is need for follow-up instructions on how to continue the use of the technology and this could be done through the use of printed materials and organizing workshops.

Table 4 : Level of technology discontinuance between farmers in Edo and Delta states

S/N	Technologies	% of Discontinued Technologies (Edo State)	Sigma Score	% of Discontinued Technologies (Delta State)	Sigma Score
1.	Agroforestry	30.1	3.93	31.5	3.99
2.	Pest and Disease control	55.6	4.82	64.5	5.10
3.	Tapping techniques	64.6	5.08	57.4	4.88
4.	Rubber quality improvement Practices	59.3	4.93	67.8	5.17
5.	Improved clones of rubber	68.1	5.17	60.6	4.97
6.	Integrated farming under matured rubber	74.3	5.34	56.7	4.85
7.	Recommended spacing for rubber	74.3	5.34	60.7	4.97
8.	Use of fertilizer	74.3	5.33	63	5.04
9.	Fire tracing technique	74.3	5.57	60.7	4.79

Source: Computed from field survey, 2016.

Reasons for Rubber Technologies Discontinuance among Respondents

The pooled result shows some of the major factors responsible for technology discontinuance to include inadequate capital to continue with the technology (94.4%), unavailability of improved planting materials (90%), high labour cost (88.9%) and poor extension contact (85.6%). Credit which would have helped to explain issues that may have arisen from initial adoption of the technologies is actually needed to access several of the recommended technologies such as purchase of planting materials, chemicals and the hiring of labour to implement other practices. However, farmers have found it increasingly difficult to get credit from official sources partly because of defaulting problems. This result agrees with the findings of Adebiyi and Okunlola (2013), who asserted that inadequate capital hinders adoption of some cocoa rehabilitation techniques. .

Table 5.: Reasons for Rubber Technologies Discontinuance among Respondents (n = 90)

Constraints	Edo		Delta		Pooled	
	Freq*	%	Freq*	%	Freq*	%
Inadequate credit	38	88.4	47	100.0	85	94.4
Unavailability of planting materials	35	81.4	46	97.9	81	90.0
High labour cost	38	88.4	42	89.4	80	88.9
Inadequate extension contacts	42	97.7	35	74.5	77	85.6
Marketing problems	1	2.3	14	29.8	15	16.7
Risk	0	0	14	29.8	14	15.6
High cost of chemicals	10	23.3	3	6.4	13	14.4
Inadequate information	4	9.3	5	10.6	9	10.0
Inconsistent government policy	6	14.0	2	4.3	8	8.9
Labour scarcity	0	0	6	12.8	6	6.7
Distance from technology source	0	0	6	12.8	6	6.7
Pest/disease	4	9.3	0	0	4	4.4
Poor prices	1	2.3	2	4.3	3	3.3
Low yield	0	0	3	6.4	3	3.3

**Multiple responses.* Source: Field Survey Data, 2016

CONCLUSIONS AND RECOMMENDATIONS

- Rubber production in Edo and Delta states was dominated by men with mean age of 56 years and farming experience of 17 years.
- The level of discontinuance of adopted rubber technologies was high, higher in Edo than Delta State.
- Reasons for discontinuance of adopted technologies includes inadequate capital to continue with the technology, unavailability of improved planting materials, high labour cost and poor extension contact.
- It was recommended that government should support rubber farmers through subsidizing of farm inputs. Subsidies can help poor farmers overcome the inability to obtain credit or take risks.
- The Farmers should also be encouraged to organize themselves into cooperative groups to enhance their access to credit facilities which they can use to acquire inputs required to enhance adoption of new technologies such as planting materials and hiring of farm labour to discourage discontinuance of adopted rubber technologies.

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