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

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ABSTRACT

The study analyzed the level of adoption of 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. 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 adoption was low, but higher in Delta than Edo State. Reasons for low level of adoption 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: Technologies, adoption, small scale farmers

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 (Aigbekaen *et al*., 2000, Abolagba *et al.,* 2003). Omorusi et al, (2015) pointed out that the rubber industry is perceived to be one of the major contributors to the national economy and a source of pride for those directly involved in the industry, particularly, the smallholders and rubber planters. Smallholder rubber farmers have significant role in the natural rubber industry as they are the primary producers and processors. The smallholder rubber farmers hold about 70% of rubber farms and the remainder is held by large plantation owners (International Rubber Research Development Board, 2006). Although, Esekhade et al (2017) affirmed that training borne out of the need for the government to create awareness and improve the technical know – how of rubber farmers has increased. 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 level of adoption 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 rubber technologies in the two States
(iii) determine the level of adoption of rubber echnologies in the two States.
(iv) identify the barriers responsible for low adoption of these technologies.

The null hypotheses tested in this study is: Ho_1: There is no significant difference in the level of

technology adoption 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,).

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 heavy in July. It has a high temperature, ranging between 29^{0}C and 44^{0}C with average of 30^{0}C. Agriculture is the predominant occupation of the people in both states and the soil isfavourable for the production of natural rubber (Aigbekaen *et al.*, 2000, Abolagba *et al.,* 2003).

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 of the 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).

Data Collection and Analysis

The data collected were analyzed using descriptive and inferential statistics such as frequency, percentage and Z- test.

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. This confirms with the finding of Umar (2014) who reported that most young people are impatient to do farm works. 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 improved 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. According to Kuwormu et al.,(2011), an experienced farmer is more likely to have knowledge and skills which minimizes negative effect on his or her farming practices. 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 . Land size is one of the indicators of the level of economic resources available to farmers. According to Etwire (2013), farm size has positive relationship with farmers' involvement in certain agricultural projects. The

average farm size of 2.3 ha suggests that the respondents were small scale rubber farmers. The implication is that scale of production is a limiting factor to the levelof output for the farmers as well as the extent to which they may want to adopt improved rubber technologies. Ajayi and Okunola (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.

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Rubber Technologies Awareness by Respondents.

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 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.

Respondents' sources of information on rubber technologies

The table shows the sources of information on improved rubber technologies for the respondents. The finding reveals that Michelin (27.9%), the Ministry of Agriculture and Natural Resources (23.8%), ADP extension agents (22.9%) and Rubber Research Institute of Nigeria (21.7%) were the main information sources on improved rubber production technologies. Family/friends (14.6%) and radio/TV (12.5%) media constituted less important sources of information. An examination of Delta and Edo state results shows that while Michelin constitute a major source of technology information to farmers in Delta state (39.8%), MANR was the major source for farmers in Edo state (39.4%).

Rubber technologies adoption by the 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.

Table 1: Distribution of Farmers by Socio-Economic Characteristics

Socio-economic characteristics	Edo State freq	% (n=113)	Delta State freq	% (n=127)	Pooled freq	% (n=240)	Mean X
Age (years)							
21- 30	1	.9	1	8	2	.8	56 years
31- 40	0	0	8	6.3	8	3.3	
41- 50	0	0	12	9.4	12	5.0	
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			
Marital status							
Married	108	95.6	106	33.5	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	48.0	136	56.7	
9-12	15	13.3	29	22.8	44	18.3	
>	5	4.4	9	7.1	14	5.8	
Educational Level							
No formal education	16	14.2	19	15.0	35	14.6	
Completed pry sch	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,BS.C etc	15	13.2	21	16.5	36	15	
Farming experience							
< 10 years	38	33.6	34	26.8	70	30	17 years
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 (hectares)							
< 2 hectares	31	27.4	75	59.1	106	44.2	2.3 hectares
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 2020

Table 2: Rubber technologies aware of 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 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)

Table 3 : Respondents' sources of information on rubber technologies

Sources	Delta		Edo		Total	
	Freq	%	Freq	%	Freq	%
Michelin	45	39.8	22	17.3	67	27.9
MANR	7	6.2	50	39.4	57	23.8
Extension agents	16	14.2	14	11.0	55	22.9
RRIN	32	28.3	20	15.7	52	21.7
Family/friends	23	20.4	12	9.4	35	14.6
Radio/TV	17	15.0	13	10.2	30	12.5
TCU			5	3.9	5	2.1

Source: Field Study, 2020

Level of Technology Adoption between the Farmers in Edo and Delta States

Hypothesis Test of difference in adoption of rubber technologies between farmers in Edo and Delta States (Z-test) Ho: There is no significant difference in adoption of rubber technologies between farmers in Delta and Edo States. Z –test statistic was used to test the difference in adoption between Edo and Delta states rubber farmers. The results, shown in Table 4 reveal that the average adoption between both groups was 3 for Edo state respondents and 4 for Delta state respondents. The z-test result (t = 2.00) was significant at the 5% level since the estimated z value (2.00) is more than the tabulated z value (1.96) at the 5% level. The finding suggests there is a significant difference in adoption between rubber farmers in both States with farmers in Delta state responding more significantly to adoption of rubber technologies than those in Edo state. This suggests that location plays a significant role in the adoption of rubber technologies. The null hypothesis is therefore rejected in favour of the alternative hypothesis.

Reasons for low rubber technology adoption among respondents

The pooled result shows some of the major factors responsible for low technology adoption 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 Okunola (2013), who asserted that inadequate capital hinders adoption of some cocoa rehabilitation techniques

Table 4 : Rubber technologies adoption by the respondents

	Edo				Delta	Pooled
	Adopted Freq*	%	Adopted Freq*	%	Adopted Freq*	%
Intercropping	79	69.9	87	68.5	166	69.2
Pests/disease control techniques	49	43.4	45	35.4	94	39.2
Tapping techniques	40	35.4	54	42.5	94	39.2
Rubber quality improvement practices	46	40.7	41	32.3	87	36.3
Improved rubber clones (Nig 800)	36	31.9	50	39.4	86	35.8
Integrated farming (mini-livestock) under matured rubber plantation	29	25.7	55	43.3	84	35.0
Recommended spacing (3.34 x 6.7m)	29	25.7	50	39.4	79	32.9
Use of fertilizers	29	25.7	47	37.0	76	31.7
Fire tracing technique	29	25.7	50	39.4	79	32.9

**Multiple response* Source: Field Survey, 2020

Table 5: Test of difference in adoption of rubber technologies between farmers in Edo and Delta States (z-test)

State	N	Adoption (mean)	Z value	Remark
Edo	113	3	2.00*	Significant
Delta	127	4		

**Significant at 5% (z tab = 1.96)* Source: Field Survey, 2020

Table 6: Reasons for Low rubber technologies adoption 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 contact	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, 2020

CONCLUSION

Government should support rubber farmers through subsidies and these subsidies should be targeted to farmers' who need them and should be on time so as to enhance their agricultural productivity. Subsidies can help poor rubber farmers overcome inability to obtain credit or take risks. The Farmers should also be encouraged to organize themselves into cooperative groups. This formation can 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 and also discourage discontinuance.

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