ANALYSIS OF ADOPTION OF NEW COTTON VARIETIES AMONG FARMERS IN OSUN STATE, NIGERIA

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ABSTRACT

The study focused on the analysis of socio-economic factors that influence the adoption of improved cotton varieties among farmers in Osun Sate. Multistage sampling technique was used to select 100 cotton farmers as respondents. Data collected were analysed using descriptive statistics and Logit regression model. Results showed that majority of the respondents were aware of the improved cotton varieties, while eighty five percent of the respondents got their information from extension agents. The results of the logit regression analysis showed that age, farming experience, level of education, farm size, off farm income and household size were the factors that influence the adoption of improved cotton varieties. The major constraints identified were high cost of fertilizer and cost of labour, lack of capital, lack of contact with extension agents and lack of market for produce. It is recommended that cost of fertilizer should be subsidized and policies should target strengthening cotton farmers to have access to improved education and frequent extension service contact for aiding acceptance and dissemination of agricultural technology information which has the potential to increase the rate of adoption of improved cotton varieties.

Keywords: Improved cotton varieties, logit regression analysis, socio-economic factors, Nigeria

INTRODUCTION

The agricultural sector in Nigeria has been invaluable in supporting economic growth and development even before independence in 1960 (Kudi *et al.,* 2011). According to the Central Bank of Nigeria (CBN) (2011), the percent share in the GDP of the crop sub-sector between 1981 to 2010 had been fluctuating between 28.37% and 19.99% and did not register any significant increase. CBN (2011) in its annual report indicated the percent share in total of the contribution of the agricultural sector to the GDP at 1990 constant basic prices. From 2007 through 2012, the share has been declining from 42% of the total GDP to 40.2%. The place of the crop production sub-sector in the total GDP have shown similar trend with a decline from 37.5% to 32.5% between the same periods. Despite this decline, the demand for many agricultural products, especially cotton, outweighs the supply (Obeta and Nwagbo, 1991 and Adeniji *et al.,* 2011). It is with respect to this that cotton was chosen to form the basis of this study.

Cotton (*Gossypium hirsutum* L.) is one of the most important non-food crops in the Nigerian economy. It is grown by about 0.9million farmers in a total estimated area of 6500 – 8000 ha (Abdoulaye *et al.,* 2014). Cotton has made substantial contribution to government revenues through taxes and export; it provides employment to many farming households,

grinners and raw materials for textile industries (the largest employer of labour after the public sector) (Adeniji *et al.*, 2011). In addition, cotton seeds provide edible oil for human consumption while cotton seed cake is used as raw material for livestock feed due to its high protein content (Alam *et al.*, 2013).

Under the traditional production practices, unimproved seed varieties are planted and spacing are irregular (Babatunde *et al.* 2008). The old varieties so cultivated were bewildered by number of factors such as variety genetic depression, pest and diseases attack and the consequent poor ginning percentage. Hence, in order to redress these problems, the Institute for Agricultural Research (IAR), Samaru, developed and introduced a package of technologies, about a decade ago, to improve and increase cotton production in the zone. The main component of the package are improved varieties seed (Samcot 10 (short staple) and Samcot 11(long staple), time of planting, plant density, fertilizer recommendation, cultural practices and crop protection. IAR recommended that planting of these varieties begins as soon as the rain is established preferably May. For optimum yield, it is recommended that cotton seed should be dressed with a mixture of Bronocot and Apron plus at 2.5+5.0g for one kg of cotton seed (to control Alternaria leaf spot and Bacteria blight). The seed rate is 20-25 kg/ha, spacing 90 x 40 (early sowing) or 75 x 54 (late sowing) at 2-3 seeds per hole thus giving about 50,000 plants per ha (ICAC, 2015). These technologies have been tested in on-farm adaptive trials across locations in the derived savannah agro-ecological zone of the Southern cotton growing zone but very little is known about the level of farmers' awareness and adoption of these packages. It is based on this credence that this study attempt to identify the available new cotton varieties in the study area. The sources of information on new cotton varieties, determine the extent to which the farmers are aware of the improved cotton varieties, the influence of socio-economic characteristics of the farmers on adoption of improved cotton varieties and the problems confronting farmers' adoption of new cotton varieties.

Methodology

The study was carried out in Osun State. The State is located in the South-West geopolitical zone of Nigeria and occupies an area of land of about 14,875km^{2}with a total arable area of 596,256 hectares available for food and non-food crops farming. It is bounded by Ogun State to the South, Kwara State to the North, Oyo State to the West and Ondo and Ekiti State to the East. It has 30 Local Government Areas, three Agricultural zones (Iwo, Osogbo and Ife-Ijesha zone) and there are two distinct climatic seasons. These are the rainy season which is between the months of March and October, and the dry season between the months of November and early March. The State runs an agrarian economy with an estimated population of about 3.5 million (NPC, 2006). The vegetation of the State is characteristically that of rain forest and derived savannah. The mean annual rainfall varies between 980mm and 2800mm and temperature range is 27 - 32^{0}C.

A multistage sampling technique was employed in selecting the respondents. The first stage was the purposive selection of five Local Government Areas (Odo-Otin, Egbedore, Ede North, Ilesa East and

Oriade) because preliminary survey conducted showed high concentrations of cotton farmers in these areas. The second stage involves the random selection of five villages from each of the five LGAs while the third stage was the random selection of four cotton farmers from each of the villages. In all, a total of 100 cotton farmers were selected for interview.

Types of Data Collected

The data collected from the farmers include those on their socio-economic characteristics, awareness and adoption decision of improved technologies for cotton production and constraints to adoption of the technologies. Data were collected with the aid of well-structured Questionnaires and data analysis was done using descriptive statistics and logit regression analysis. Logit analysis shows the relationship between dependent and independent variables. The logit regression model was used to identify factors influencing the adoption of improved cotton varieties by farmers. The probability of a cotton farmer adopting improved cotton variety is determined by an underlying response variable that captures the true economic status of a farmer. The underlying response variable y* in the case of binary choice is defined by logit regression relation:

$y^* = \Sigma_{xi}\beta_j + \mu$ ..... (1)

Where: $\beta_j = \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}$

$X_i = X_{i1}, X_{i2}, X_{i3}, X_{i4}, X_{i5}, X_{i6}, X_{i7}, X_{i8}, X_{i9}, X_{i10}$ and μ = stochastic term

The relevant logistic expressions are given as:

$$\text{Prob } (y^* = 1) = 1 - F^*(\sum X_i\beta_j) = \frac{e^{\sum Xi\beta j}}{1 + e^{\sum Xi\beta j}} \quad ...(2)$$

$$\text{Prob}(y^*=0) = F^*(\sum X_i\beta_j) = \frac{e^{\sum Xi\beta j}}{1 + e^{\sum Xi\beta j}} \quad .....(3)$$

Where

F = the cumulative distribution function for μ_i

The explicit logit model is expressed as:

$Y = \beta o + \beta_1X_1+\beta_2X_2 + ..\beta_{10}X_{10} + \mu$.....(4)

Where:

Y = Adoption (1 = adoption of improved cotton variety, 0 = non adoption of improved cotton variety)

X_1= Age of household head (years)

X_2 =Marital status (Married = 1, Single = 0)

X_3= Farming experience (years)

X_4= Education (years of formal schooling)

X_5 = Household size (number)

X_6= Farm size (hectares)

X_7=Access to credit (1 if yes, 0 if no)

X_8= Membership of cooperative

X_9= Off-farm income (₦)

X_{10} = Extension contact (no of contacts)

$\beta_1 - \beta_{10}$ = The coefficients for the respective variables in the logit function

μ = Error terms.

Results and Discussion

Socio-economic characteristics that were investigated during the farm survey, as presented in Table 1, are those relevant to influencing the adoption of new cotton varieties in the study area. These socio-economic factors include; occupation, age of respondents, level of education, marital status, gender, experience in farming, access to credit, sources of information, extent of awareness, membership in association, farm size, income sources and frequency of extension contact. Awareness is the first stage of technology adoption (Adeniji *et al*. 2011; Kudi *et al.*, 2011 and Abdoulaye *et al.*, 2014). A farmer has to know about new innovation before adopting it. Descriptive statistics results showed that majority (94%) of the respondents were aware of the improved

cotton varieties while most of the farmers (85%) got their information on new cotton varieties from Extension agents, 10% through Radio and Television, 3% from other farmers and 2% got the information from friends. Also, 94% of the respondents had contact with extension agents. Hence, the extension agents are the key sources of information on the improved technologies and that the more the farmers have contact with extension agents, the more tendencies of adopting new technologies. The result is consistent with the earlier report by Obeta and Nwagbo (1991); Akinola *et al.*(2010) and Alam *et al.* (2013), where extension agents were identified as the major source of information to farmers on recommended practices and that frequent contact with extension agents is likely to minimize doubts among farmers and ensure timely purchase of inputs.

Agricultural credit facilities are essential in order to circumvent and overcome the problem of shortage of capital among cotton farmers. Table 1 revealed that seventy two percent (72%) of the respondents had access to credit from various statutory financial institutions while twenty eight percent (28%) had no access to formal credit. This implies that there is that tendency that farmers will adopt new innovations because majority of them had access to credit which would enable them to purchase inputs and pay for labour required in the adoption of new cotton varieties. Two main varieties of cotton were identified in the study area. Table 1 revealed that 93% of the farmers cultivate Samcot 11 while 7% cultivate Samcot 10. Hence the dominant cotton variety adopted in the study area is Samcot 11. Occupation is an important socio-economic attribute determining farmer's livelihood, level of income, wealth and ability to invest in agricultural production. Major occupation prevalent among the respondents was farming representing 92% of the respondents.

According to FAO (2005) and Alam *et al.* (2013), employment in non-farm activities is essential for diversification of the source of farm household's livelihood and adoption of new technology. Also, Age is a socio-economic attribute upon which farmer's abilities and physical disposition in planning, organizing, controlling resources, adopting new technology and accomplishing production activities and farm tasks are based (Alimi, 2003). From the sampled farmers, the mean age was 49.3±2.3 years. This depicts that most of the farmers are within the middle age. Hence, it suffices to conclude that the productive age group constitutes 78% of the respondents which depends largely on the mental and physical labour productivity of cotton farmers in the study area and the ease of adopting new technology since old people are known to be conservative and difficult to adopt new technologies. Table 1 also revealed that 82% of the respondents were married, 8% were single while 10% were widowed. Hence, most of the respondents (82%) are married having family responsibility. Family responsibility presupposes their willingness to adopt new technology and to get involved in productive activities to meet family demands. Membership of respondents in different farmers' association is assumed to have influence on adoption decision of farm households. It makes farmers to have more access to input, information and better interpretation of available information related to new technology. Majority (87%) of the farmers were members of one farmers association or the other, while (13%) were not. The mean

farm size of the respondents was 3.2±2.2 ha. This shows that farm size has a relationship with adoption of improved cotton varieties in the study area.

Also from Table 1, 98% of the respondents who cultivated cotton were males while the female respondents were just 2%. The result of this study agrees with Adesina and Seidi (1995) and Alam *et al.* (2013), that division of labour in rural agricultural activities is gender specific and that cotton production is labour intensive and thus predominantly dominated by men. Cotton farmers have various depths of experiences in their farming activities. Table 1 showed that majority (75%) of the sampled farmers had experience of above 15 years. The mean farming experience was 18.4±12.3 indicating that the study sample was composed of experienced farmers. This implies that the higher the level of experience, the more the tendency for a farmer to adopt new technologies. Also, farmers acquire more experience as the rate of adoption of new varieties increases. This agrees with the findings of Bamire *et al., (*2002); Akinola *et al.* (2010) and Abdoulaye *et al.* (2014), that year of farming experience increased rate of adoption and agricultural productivity. The level of education attained by an individual is a powerful determinant regarding the capacity to adopt new technologies and produce goods and services in the society Okeke-Agulu (2014). Table 1 showed that only 6% of the farmers had no formal education, 52% had secondary education while 30% had more than secondary education. The mean year of education was 12.2±1.7. Thus it can be concluded that most of the respondents are educated. This no doubt, accounts for the high level of adoption of the new cotton varieties in the study area. Indeed, formal education is a veritable attribute enhancing farmers to be able to innovate, adapt and adopt new technology and improved recommended cotton production practices. This agrees with the submission of Nweke and Akorha (1983); Lawal *et al.* (2004) and USAID (2011) that the level of education is highly important in influencing farmer's adoption of agricultural innovations and decisions on various aspects of farming. Some respondents had other sources of income besides farming which implied that they engage in off farm activities. Of the total respondents, (58%) got their income solely from farming. Others combined petty trading (25%), artisans (10%) and civil service (7%) with farming.

Table1. Socio-economic/Demographic Characteristics of cotton farmers

Variables	Frequency	Percentage (%)	Mean
Awareness			
Yes	94	94	
No	06	06	
Sources of information on cotton varieties			
Extension agents	85	85	
Other farmers	03	03	
Friends	02	02	
Radio /Television	10	10	
Extension contact			
Yes	94	94	
No	06	06	
Acess to credit			
Yes	72	72	
No	28	28	
Cotton varieties cultivated			
Samcot 10	07	07	
Samcot 11	93	93	
Occupation			
Farming	92	92	
Others (livestock rearing, hunting and fishing)	08	08	
Age range (Years)			
20 - 39	14	14	
40 - 59	78	78	49.3(2.3)
60 - 75	08	08	
Marital status			
Married	82	82	
Single	08	08	
Widowed	10	10	
Gender			
Male	98	98	
Female	02	02	
Years of experience			
1 – 5 years	04	04	
6 – 10 years	08	08	
11 – 15 years	17	17	18.4(12.3)
Above 15 Years	71	71	
Level of formal education			
No formal education	06	06	
Attended Primary School but did not complete	02	02	
Completed Primary School	10	10	12.2(1.7)
Had Secondary Education	52	52	
Above Secondary Education	30	30	
Farm size			
<1ha	07	07	
1 - <2ha	11	11	
2 - < 3ha	53	53	3.2(2.2)
3 - <4ha	29	29	
Income sources			
Farming only	58	58	
Farming/ petty trading	25	25	
Farming/artisan	10	10	
Farming/civil service	07	07	
Membership in Association			
Yes	87	87	
No	13	13	

ha = hectare, standard deviation in parenthesis Source: Field Survey, 2016

Table 2.Logit regression estimate of factors influencing the adoption of improved cotton varieties.

Variables	Coefficients	Std. error	T-value
C	0.2886	0.9301	0.310
Age	- 0.0701*	0.0155	-4.523
Marital status	0.0326	0.0213	1.531
Farming experience	-0.0704*	0.0162	-4.346
Education	0.1240*	0.0567	2.187
Household size	0.0949*	0.0233	4.073
Farm size	0.0788*	0.0236	3.339
Credit	0.0782*	0.0345	2.267
Cooperative society	0.0797	0.2629	0.303
Off-farm income	0.1482	0.2393	0.619
Extension contact	-0.0001	0.0015	-0.066
Log likelihood ratio test		38.0142	
Pseudo R-square		0.17	

Source: Field survey, 2016 * = 5% alpha level.

Factors influencing adoption of new cotton varieties

The result of the logit regression analysis in Table 2 revealed that six variables were found to be significant in relation to the adoption of the new cotton varieties. These variables include Age, farming experience, level of education, household size, farm size and access to credit. Age of the household's head was found to be a statistically significant variable at 5% level with a negative relationship. The negative relationship implies that the older the respondent, the lower the decision to adopt the technology. This finding agrees with previous studies on technology adoption such as Bamire *et al.,* (2002) and Akinola *et al.,* (2010). The coefficient of farming experience was negative and statistically significant at 5%. This implies that the older the farmer, the less likely he is to adopt new ideas as he gains more confidence in his accustomed ways and method because experience affects individual mental attitude to new ideas differently and influence adoption in several ways. This is in consonance with Bamire *et al.,* (2002).

The coefficient of the level of formal education of the household head was positive and statistically significant at 5% level. Education which is the ability of respondents to read and/or write increased adoption of improved cotton varieties in the study area. Educated farmers are more analytical and observe easily the obvious advantages of new technologies. The positive significant influence implies that the higher the level of formal education, the higher the probability of adoption of improved cotton varieties. This agrees with Adeniji *et al.,* (2011). Household size was statistically significant and positively related to the adoption of improved cotton varieties at 5%**.** The direct relationship implies that large household size predisposes adoption of improved cotton varieties. This may be due to the fact that large household size is assumed to be an indicator of labour availability and that such household would like to improve its food security. This is in agreement with

the studies conducted by Bamire *et al.*, (2002) and Abdoulaye *et al.,* (2014).

Total farm size of the respondents was positive and statistically significant at 5% level on the adoption of improved cotton varieties.Okeke-Agulu and Onogwu (2014) argues that larger farm owners have more flexibility in their decision making, greater access to discretionary resources, and more opportunities to use new practices on a trial basis with more ability to deal with risks. This could be explained by the fact that large farm size presupposes large farm assets. Thus farmers who had more assets had more dispositions to adopt new technologies than those who had less. A similar result was reported by Kudi *et al.*, (2011) and Idrisa *et al.,* (2012). Coefficient of credit was statistically significant positively in determining the adoption of improved cotton varieties at 5% level. This implies that the more the volume of credit, the more the hectares of land cultivated with improved cotton varieties. Hence, increase in accessibility to credit increases adoption of improved technologies since more money will be available to acquire more hectares of land, more seeds and associated inputs. The positive sign was in line with *a priori* expectation and agreed with Abdoulaye *et al.,* (2014).

With respect to other variables, none was statistically significant. Marital status, membership in association and off-farm income were positive as expected. However, frequency of extension services paradoxically had negative influence on adoption of improved cotton varieties in the study area.

Table 3. Distribution of respondents according to constraints preventing the adoption of new cotton varieties.

Problems encountered	Frequency	Percentage
Lack of capital	45	45
Lack of contact with extension agent	2	2
Lack of market for produce	28	28
High cost of fertilizer	10	10
High cost of labour	8	8
Land tenure system	7	7
No response	0	0

Source: Field survey, 2016

Problems confronting farmers in adoption of new cotton varieties

Problems faced by farmers in the adoption of the improved cotton varieties are represented in Table 3. The result in Table 3 showed that forty-five percent of the respondents lack capital, while twenty eight percent of the respondents reported lack of market for produce as constraint preventing them from using some of the improvedcotton varieties, while ten percent were of the view that high cost fertilizer was a major constraint that hinders them from adopting the improved cotton varieties. The analysis also revealed that eight percent of the respondents were of the view that high cost of labour hinders them from adopting the improved cotton varieties. Similarly two percent of the respondents admitted that they lack

extension contact and seven percent reported problem of land acquisitions as a factor preventing them from adopting the technology.

Conclusion and Recommendations

The study revealed that the level of awareness and adoption of improved cotton varieties were high in the study area. The study concluded that the adoption of improved cotton varieties was driven by a host of socio-economic factors such as age, Marital status, level of education, farm size, household size, off farm income and farming experience while insight into the key socio-economic factors affecting adoption of improved cotton varieties was provided which include; age, level of education, farming experience, farm size, household size and off farm income. Based on the findings of this study, the following recommendations are proffered:

1. Efforts should be made to make credit accessible to farmers, since lack of capital was the main obstacle to the adoption of the improved cotton varieties. Hence, pragmatic efforts should be made by policy makers to see that the Bank of Agriculture is strengthened to enable them finance farmers since it is only farmers who have access to finance that can have the tendency to adopt the new technology.
2. Cost of fertilizer should be subsidized, since high cost of fertilizer prevented farmers from using some of the improved cotton varieties.
3. Policies should target strengthening cotton farmers to have access to improved education and frequent extension service contact for aiding acceptance and dissemination of agricultural technology information which has the potential to increase the rate of adoption of improved cotton varieties.
4. Since inadequate market is identified as among the constraints for adoption of the improved cotton varieties, provisions should be made for proper marketing channels of cotton produce.

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