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Original Research Article

Gender differentials and fertilizer adoption among small holder farmers in cocoa based farming system of Southwestern, Nigeria

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This study examined gender differences in the adoption of fertilizer among smallholder farmers in cocoa based farming system of Southwestern Nigeria. Specifically, it described the socio-economic characteristics of the farmers by gender; determined the rate of adoption of fertilizer; and analysed the factors affecting the rate of adoption of fertilizer. A multistage sampling procedure was used to select 200 respondents, comprising 147 males and 53 females. Data were collected on socio-economic characteristics such as age, household size, years of schooling, farm size access to credit, and fertilizer use among others. Data were analyzed using descriptive statistics and probit regression model. Descriptive statistics revealed significant difference between male and female farmers for age, years of formal education, years of farming experience, and farm size. The adoption rate of fertilizer was low with a significant difference between male (37.4%) and female (28.3%) farmers. The determinants of adoption of fertilizer by both male and female farmers were years of formal education, while there were gender specific variations. The significant determinants of fertilizer adoption among male farmers are age, farm size and access to credit while membership of an association was significant for female famers. It was concluded that strategies aimed at improving male farmer's adoption of fertilizer m consider age, farm size and access to credit, female targeted programmes should take membership of association into consideration. In general, considering the years of formal education of both male and female farmers will enhance fertilizer adoption in cocoa based farming systems.

Key words: Gender, fertilizer, cocoa, adoption, Southwestern Nigeria.

INTRODUCTION

Cocoa (*Theobroma cacao* L.) has remained the most reliable source of foreign exchange earnings than export commodities in the Nigeria (Fadipe et al., 2012).However, cocoa production in the country witnessed a downward trend after 1971 season thereby relegating its position to fifth largest to date (Folayan et al., 2006; Nwachukwu et al. 2010). This declining production could be as a result of the low quantity of inputs application, pest and diseases infestation, inconsistent production pattern (Nkamleu et al., 2007).

Cocoa Research Institute of Nigeria (CRIN), an institution with the national mandate on cocoa research, implemented strategies to help cocoa farmers increase their yields. These include the introduction of high-yielding varieties, fertilizers, educating farmers on modern management practices among others. This led to increase in the annual cocoa production to about 500,000 metric tonnes (FAOSTAT, 2007). Despite the recent gains, low productivity on individual cocoa farms continually persisted. This had been traced to declining soil fertility in

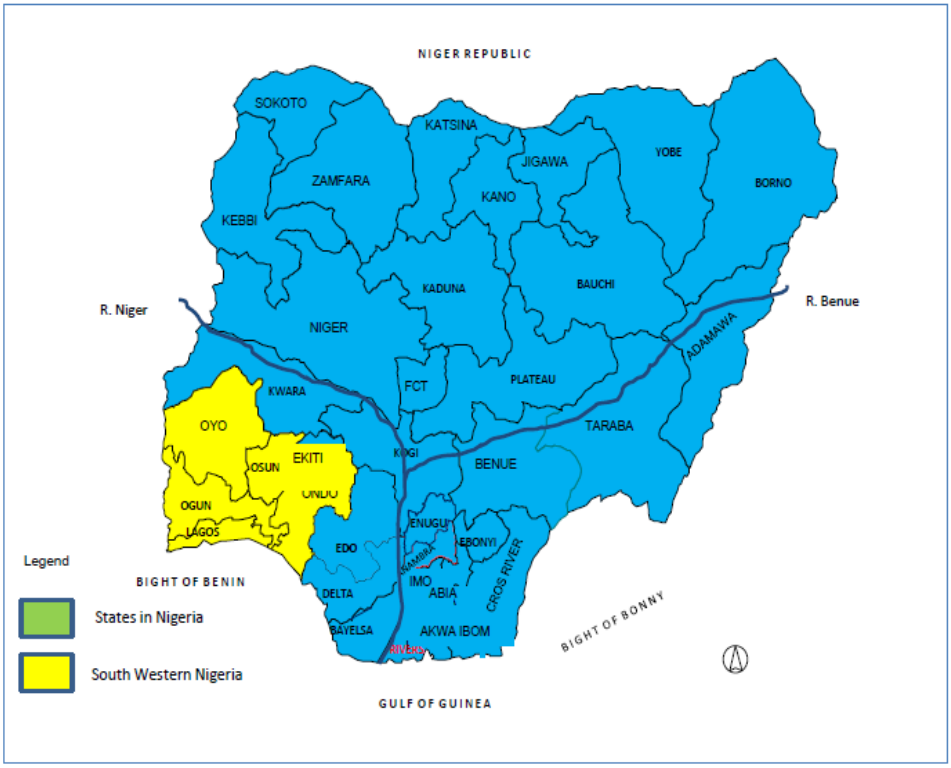

Figure 1: Map of Nigeria Showing the Study Area

cocoa farms (Ololade et al., 2010). This is sequel to the fact that soil nutrients in cocoa plantation are being eroded through harvest in every year (Ogunlade et al., 2010). Thus, phosphorus and other important nutrients are very low on cocoa farms due to the relatively low use ofinorganic fertilizers (Ogunlade and Aikpokpodion, 2006).Therefore, fertilizer is necessary toimprove productivity and product quality on cocoa farms (Opeyemi et al., 2005).

To support the dissemination of recommended packages, a humid tropics project was initiated under a collaborative effort of International Institute for Tropical Agriculture (IITA) and Obafemi Awolowo University Ile-Ife. It was aimed at disseminating the recommended technologies, fertilizer inclusive, to cocoa farmers for adoption in order to increase cocoa output and educating them on improved management practices. Despite the dissemination of the recommended technologies, the adoption levels of fertilizer in particular over the years by the cocoa farmers have been low (World Bank, 2008; Omoregbee and Ekpebu, 2012). Consequently, smallholder farmers obtain yields lower than potential yields.

Several scholars established that female farmers have much lower yields than male farmers (Larson et al., 2015; Cadzow, 2016). This could be trace to the fact that women have limited access to productive resources such as land, credit etc. (Doss, 2015). Also, they have limited access to information about improved technologies and extension services (Bravo-monroy et al 2016). Oseni et al. (2015) noted that women are more prone to be constrained in their access to productive inputs, resulting in lower levels of fertilizer application which are limited by cultural norms and values. In Nigeria, socio-cultural norms and practices forbid women to inherit this productive resource such as land, credit etc (Ololade and Olagunju, 2013). Consequently, this study investigated the gender differentials in the adoption of fertilizer among cocoa farmers in the southwestern Nigeria. Specifically, it describes the socio-economic characteristics of cocoa farmers in the area by gender; estimates their adoption rate of fertilizer by gender; and determines the factors that influence the rate of adoption of fertilizer by gender.

METHODOLOGY

Study area

Southwestern Nigeria was purposively selected based on cocoa growing zone of Nigeria and constitutes the study area of humidtropics project. The area lies between Longitude 2°31¹and 6°00¹East and Latitude 6°21¹and 8°37¹N (Agboola, 1979) (Figure 1). The locations are Akindele in Ido local government and Lagbedu in Ogo-oluwa local government located in Oyo State, while Iwara in Atakumosa East local government and Osunwoyin in Ayedire local government were located in Osun State. The

region is characterized by tropical humid climate with two major bimodal rainfall distribution pattern with major rainfall peaks in July and September. The favourable climate of the area encouraged about 70 percent of the inhabitants to engage in cocoa farming. They generally grow both permanent and food crops. Farmers in the area are predominantly small scale. The climate is ideal for the cultivation of food crops like maize, yam, cassava, millet, rice, plantain which are generally done in combination as mix or intercropping.

Cocoa production in Southwestern Nigeria is predominantly carried out by smallholder farmers in an integrated system involving the combination of different enterprises. To identify an optimum enterprise combination within the integrated cocoa farming system, this study adopted a two pronged approach. The first approach involved the formation of the innovation platforms (IPs) in the four action sites which brought all stakeholders in the cocoa based farming system together. The stakeholders involved representatives of farmer organizations, private sector (input dealers, agricultural products processors, agricultural product marketers, etc.), NGOs and civil society, governments, research institutes and universities. The Ips played two important roles in the research processes. First, it helped to bridge the gap among stakeholders within the cocoa based farming systems a situation that contributed to the challenges and constraints by RAISS. Secondly, it ensured stakeholder's participation in the research processes which has potential to facilitate farmer's up-take of research outputs. The second approach involved a survey of cocoa based farming households with a view to determining the biophysical and socioeconomic characteristics of the farmers as well as the identification of different enterprise combinations practiced among farmers in the field sites.

Sampling procedure and sample size

A multistage sampling procedure was used to obtain data for the study. The first stage was purposive selection of two states in Southwestern Nigeria (Osun and Oyo State) where cocoa is dominantly grown, the second stage involved purposive selection of two field sites per state to make four field sites i.e. four innovation platform of humid tropics. The third stage was random selection of fifty cocoa farmers from the enlisted members of the innovation platform located in each of the field site to give a total of 200 respondents, consisting of 147 male farmers and 53 female farmers. Data were collected on farmers' socio-economic characteristics such as age, education, gender, household and farm size, fertilizer adoption, among others.

Analytical techniques

Data collected were analysed with the use of Descriptive statistics and Probit regression model. Descriptive statistic was used to describe gender differences among study variables. Probit regression was used to determine the factors influencing the adoption of fertilizer by gender. Probit is a binary choice model that can only assume two values of 1 or zero and tries to explain the probability that a farmer will choose an improved variety over a traditional variety based on some factors (Akudugu et al., 2012). This decision is a function of a set of socio-economic factors that may likely affect the probability that male and female farmers will adopt fertilizer or not. The estimated Probit model is specified as follows:

$$Y_i = \beta_0 + \beta_1 AGEHHED + \beta_2 FFEDU + \beta_3 FAMSIZE + \beta_5 ACECRED + \beta_5 HHSIZE + \beta_6 COOP + e_i$$

Where,

Y_i is the dependent variable, the probability of adoption of fertilizer (Dummy: Adopt, 1; Non-adoption, 0)

The independent variables are:

AGEHHED is age of the farmers (years), FFEDU is years of schooling (years), FAMSIZE is farm size (ha), ACECRED is access to credit (1= Access, 0= Non access), HHSIZE is farm household size (#), COOP is membership of a cooperative (1= Yes, 0= No), and e_i is random error term.

RESULTS AND DISCUSSION

Socio-economic characteristics of cocoa farmers by gender

The socio-economic characteristics of farm households by gender are shown in Table 1. There was a significant difference ($p<0.05$) between the mean age of male (53.61±13.74years) and female (48.83 ±13.15 years) farmers. This suggests that male cocoa farmers were relatively older than their female counterparts. There was a significant difference ($p<0.01$) in the years of academic attainment between gender. The years of schooling by male farmers were longer than the female farmers (7.2 ±5.2and 4.7±2.2 years respectively). This could indicate that male farmers spent quality time in school than their female counterpart. There was also significant difference ($p<0.01$) between the years of experience of male farmers (30.45 ±15.11) years and female farmers (25.15±14.87). The result indicated that male farmers have several years of experience than the female farmers. This may be due to the involvement of the male child in farming activities during the early age. While some of them served as component of family labour and thus acquaint knowledge of farming from family. Unlike the female counterpart that were more in domestic activities. Similarly, there was a significant difference ($p<0.1$) between the farm size of male (9.30±8.3) ha and the female farmers (6.8±4.2) ha. This may further suggest that males have better control and access over resources, particularly land, and therefore likely to try new innovations. On the contrary, there was no significant difference between the household size of male farmers (10.71±5.31) and female farmers (8.35±5.88) persons. Also, there was no significant variation in access to credit between male farmers (5.4%) and the females (1.9%). Majority (73%) of male farmers were member of an

Table 1. Socio-economic characteristics of maize farmers by gender

Variable	Male(n=147)	Female (n=53)	t-test
Age (years)	53.61(13.74)	48.83(13.15)	2.199**
Household size(#)	10.17(5.31)	8.35(5.88)	0.885
Years of formal education	7.24(5.20)	4.30(2.17)	3.705***
Farm size (ha)	9.30(8.26)	6.79(4.19)	1.847*
Years of experience	30.45(15.11)	25.15(14.87)	2.205**
Access to credit (%)	5.4	1.9	
Membership of an association	72.8	54.7	

Note: Figures in parentheses are standard deviations; ***, **Significant at 1% and 5% respectively.
Source: Field survey, 2015

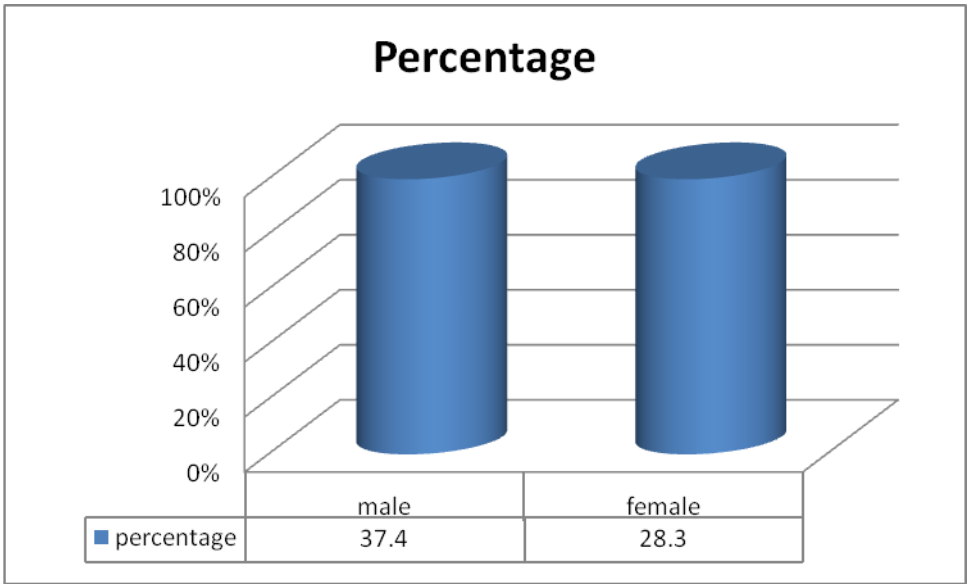

Figure 2: Adoption of fertilizer by gender
Source: Field survey, 2015

association though 55% of female farmers were also member.

Adoption of fertilizer by gender

The rate of adoption of fertilizer by gender is shown in Figure 2. The adoption rate was low, however, males had relatively higher proportion of adoption (37.4%) than females (28.3%) with a significant variation at 1 percent. This could be ascribed to access of male farmers to productive resources such as land and credit as compared to female farmers, which gives them advantage to adopt new technologies (Bamire et al., 2012).

Factors influencing the adoption of fertilizer by gender

From Table 2, gender analysis of the factors influencing the adoption of fertilizer showed some variations. For male farmers, the coefficients of age, years of schooling, farm size, access to credit significantly influenced the adoption of fertilizer at different levels of probability. The coefficients of years of schooling, farm size and access to credit had positive signs, implying that for every unit increase in any of these variables, the rate of adoption of fertilizers increased by the magnitude of their coefficients; 0.494, 0.572, and 2.896 units, respectively. Also, the negative coefficient of age implies that this variable reduces the rate of adoption by the magnitude of its coefficient (0.056) units.

On the other hand, years of schooling, and membership of an association significantly influenced the adoption of fertilizer among female farmers. The coefficients of all of the variables had positive signs. The positive signs suggest a positive influence on adoption of fertilizer. A unit increase in years of schooling and an effective contact with a member of an association increased the rate of adoption of fertilizer by 0.206 and 2.433 units, respectively. This suggests that strategies targeted at improving adoption of fertilizer among male farmers should consider age, years of schooling, farm size and access to credit, while focus on increasing female adoption of fertilizer, focus should be on

Table 2: Factors influencing the adoption of fertilizer by gender

Variables	Male (n=147)	Female (n=53)
Age	-0.056(-1.97)**	-0.008(0.30)
Household size	0.025(0.16)	-0.003(-0.07)
Years of education	0.494(2.20)**	0.206(2.25)**
Farm size	0.572(2.57)***	0.0431(0.90)
Access to credit	2.896(1.98)**	0.471(0.69)
Membership of an association	0.776(0.89)	2.433(3.48)***
Constant	6.142(2.02)**	1.196(2.09)**
Chi-square	176.22	133.75
Log likelihood	-97.685	-91.576
Prob>chi2	0.000	0.000

***, **, * implies Significant at 1%, 5%, and 10%. Figures in parentheses () are t-values.
Source: Field survey, 2015

membership of an association. However, years of formal education is a common factor influencing adoption of fertilizer for both male and female farmers.

Conclusion

Cocoa is grown by vast majority of farming households in Southwestern Nigeria with gender variations in the socio-economic characteristics of both male and female farmers and adoption of fertilizer. Male farmers were significantly older than their female counterparts. Male farmers had larger farms than the female farmers. Adoption of fertilizer by cocoa farmers in Southwestern was low, with males having a relatively larger proportion than the females. Year of formal education is a common factor that drives the adoption of fertilizer for both male and female farmers; age, farm size and access to credit were specific to male farmers, while only membership of an association was specific to females. It is recommended that promoting fertilizer adoption should be through intensive enlightenment programmes by effective and efficient extension services among members of agricultural related association and the need to be conscious of gender variations in the access to productive resources such as credit and land among cocoa farmers in southwestern Nigeria.

Conflict of interests

The authors declare that they have no conflicting interests

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