Journal of Applied Biosciences 20: 1166 - 1171
ISSN 1997–5902

Food security and socioeconomic characteristics of cocoa farming households in Nigeria: support through agricultural biotechnology

*Lawal Justina and Anna Muyiwa

Cocoa Research Institute of Nigeria, PMB 5244, Ibadan, Nigeria.

*Corresponding author e-mail: yemisilawal2003@yahoo.com

Published at www.biosciences.elewa.org on 7 August 2009

ABSTRACT

Objective: This study examined the socio-economic characteristics, adoption rate and effects of agricultural biotechnology methods on the food security status of cocoa farming households.

Methodology and results: The profile of food security among cocoa farming households in Osun and Ondo States of Nigeria was analyzed in relation to the cocoa production and socioeconomic characteristics. The status of adoption of agricultural biotechnology among the cocoa farming households in the country was examined against the needs of research on cocoa to ensure food security, household welfare and increased productivity to meet market demands. The level of research result adoption was empirically assessed in relation to increased productivity. Only 22% of the cocoa-farming households in the study area are food secure. This is attributed to low adoption (14%) of available technology (results from advanced tissue culture, marker assisted breeding), low level of education, lack of resources (capital), poor basic rural infrastructure, age of the farmer and their large household size. Structural barriers of non-participatory approach to research were also cited as a hindrance to technology adoption.

Conclusion and application of findings: The interface between food security and socioeconomic development requires policy intervention to be focused on participatory research in agricultural biotechnology for cocoa production to alleviate poverty among the cocoa-producing households. Access to production credit based on social collateral, and provision of research funds to accommodate participatory approaches is recommended.

Key words: cocoa, biotechnology, food security, adoption, participatory research

INTRODUCTION

There have been tremendous challenges to the capacity of agriculture to support the rapidly increasing human population. In Nigeria, population growth has outstripped agricultural output growth thus the issue of food security is of high importance to the nation (Olayemi, 1996). This food deficit problem is caused by declining productivity, a gap that can be addressed through agricultural biotechnology.

In several parts of Nigeria, the productivity improvements required to ensure food security and ensure socioeconomic development are severally restricted by a rapidly declining scientific knowledge resource base, increasing urbanization, poor infrastructure, limited relevant research, and poor adoption of new technologies and research results (Lawal, 2008). Also, unfavorable government policies,

poor funding of research, poor access to credit and inadequate agricultural support services, adequate information, intellectual capital required for improved productivity leading to poverty alleviation and sustainable development is lacking.

In the West African sub region, the average food production per person has been declining for many years and most of the countries suffer food insecurity (Asiedu, 2008). A large proportion of the continents' inhabitants are subsistent farmers, characterized by low yields, leading to low economic development, food insecurity, and poverty (Falusi, 2008). Food security implies that food is available, accessible and affordable when needed and in sufficient quantity and quality, in a sustained manner. To accomplish this, there must be a production system that produces enough in the short run and that is sustainable in the long run, which can be achieved through agricultural research.

The percentage of food insecure households was reported to be 18 in 1986 and over 40 in 2005 with the total population of about 133 million (Sanusi *et al*., 2006), while 16% of the country's population is undernourished (FAO, 2005). Agricultural research can play a critical role in breaking the vicious cycle of poverty and food insecurity, by several ways but primary through enabling poor farmers to increase their productivity and on-farm production (Pray *et al*., 2003).

In Nigeria, significant investment has not been made on Cocoa biotechnology research and regulation. A critical determinant of the availability and accessibility of biotechnology innovation in developing countries is the countries own national capacity in research. The levels of financial and human investments made in agricultural biotechnology are two indicators of national commitment to create or strengthen national biotechnology capacities but the situation in Nigeria, as in many Sub-Saharan African countries, stands in sharp contrast with what obtains in Asia and Latin America. Surveys by ISNAR and IITA (1999) and Alhassan (2003) showed that although biotechnology applications are increasingly incorporated in agricultural research programs, they primarily involve application of cell biology, micro propagation and disease diagnosis. Furthermore, research efforts are heavily dependent on donor funding. Advancement in cocoa biotechnology is severely constrained by a lack of funds, electricity, skilled human resources and equipments.

Nigeria as a developing country was rated the second largest world producer of cocoa in the 1960s (Adegbola & Abe, 1983), and, for a long time, the crop has been generating substantial foreign exchange earnings for the country. Cocoa has much potential to improve the economic welfare and health. Cocoa is produced in three different ecologies consisting of 14 states of the federation (Table 1).

Table 1: Agroecological areas suitable for coca cultivation in Nigeria.

Zone	Administrative area
Marginal climate	Ogun, Oyo, Kwara, Kogi, Taraba,Adamawa
Idealclimate	Osun, Ondo, Edo, Ekiti and Delta states
Ideal soils	Cross Rivers, Abia, Akwa-Ibom

However, the production of cocoa has suffered a reduction in the recent years in the country owing to a number of factors. Villalobos (1989) identified some of these factors as low yield, inconsistent production patterns, disease incidence, pest attack and use of simple farm tools. In addition, Adegeye (1997) identified ageing cocoa farms as one of the factors responsible for the decline in cocoa production in south western Nigeria. He observed that many farms were over 40 years old and such farms constitute as much as 60% of the cocoa farms in Nigeria. Apart from these, socio-economic variables of farmers such as age, sex, level of education and marital status have been found to have substantial impact on production. According to Nelson and Phelps (1966), education is a measure of human capital and it reflects the ability to implement technology. Hence, education is expected to increase technology adoption and output of the farmers. In this study, the socio-economic characteristics of the cocoa farmers were used to assess their food security status.

The specific objectives of the study were (1) to describe the socio-economic characteristics of cocoa farmers in the study area, and (2) to evaluate the effects of socio-economic variables on food security status of cocoa farming households.

METHODOLOGY

The study was carried out in states that are known for their high productive output of cocoa. Using a multistage sampling technique, two states were chosen for this study. These were Osun and Ondo states in which four LGAs each were selected. A total of 150 respondents were interviewed using structured questionnaire.

The data collected was analyzed using descriptive statistics and regression analysis. Descriptive statistics was used to analyze the socio-economic variables of the respondents, while regression analysis was used to analyze the effect of the socio-economic variables of the respondents on their food security status. Explicitly, regression model is expressed thus:

$$\ln FS = \alpha_0+\alpha_1X_1+\alpha_2X_2+\alpha_3X_3+\alpha_4X_4+\alpha_5X_5 + \alpha_6X_6 + \mu$$

Where:

FS = Food Security (Calories)
X_1 = Age (Years)
X_2 = Educational level (X_2 =1 if farmer has formal education, and X_2 =0 otherwise)
X_3 = Farm size (ha)
X_4 = Cocoa production output (tons)
X_5 = Household size
X_6 = Biotechnology adoption (X_6= 1 if farmer has adopted, and X_6 =0 otherwise)
μ = Random error term

RESULTS AND DISCUSSION

Table 2 showed that majority (38.67%) of cocoa farmers are between 51 to 60 years of age, followed by the 61-70 years old group (30%) and 41-50 years old (18.67%). This implies that cocoa farming is practiced by various age groups thus the crop has good prospects in this area. However, the production in the area is in danger as the majority of those currently engaged in cocoa production are no longer in their active and productive stage of life. There is therefore a need for the government to launch campaigns to attract the younger generation who are more receptive to adoption of new technologies, innovations and challenges to boost cocoa production.

Tables 2 shows that majority of the respondents (92%) are males while just 8% are females. Most of the respondents (86%) were married with only 14% single. Majority of the respondents as seen from Table 2 (80%) have formal education while 20% have no formal education at all, while 12% had tertiary education. This is an indication that some graduates are involved in cocoa production either due to inheritance or as a choice of occupation in the study areas. According to Nelson and Phelps (1966), education is a measure of human capital and it reflects the ability to implement technology. The educated group should be encouraged through incentives and production subsidies as they will be more receptive to improve on the current technologies and more liberal to adopt new ones to boost production of cocoa in the area.

Analysis of household size data shows that majority of the households have between 5 and 8 members which may be an indication of availability of family labour for the cocoa farms. For the farm sizes, a high proportion of the respondents (35.33%) had between one to two hectares of farm land while only 22% of the total respondents had above four hectares of farmland. This confirms that most of the respondents are small scale cocoa farmers. However, the reasons given by most of the farmers for not expanding their farms were low (output) productivity from the farms and lack of credit facility, rather than lack of space.

The result showed that 86% of the farmers have never adopted any form of biotechnology innovations, the reason being that researchers have not been involving them (diagnosing their problems before carrying out research). The food security status of the farmers showed that 32% are food insecure due to low production from their farms. This is a gap that biotechnology can address to help farmers get maximum yield from the little farm holdings existing within their means by increasing productivity. About 24.67% lack cash to buy food because of poor access of their goods to the markets, while 21.33% have food shortage prior to the harvest time of their produce. Only 22% of the farmers claimed to be food secure.

Table 2: Socio-economic variables of the respondents

Variable	Frequency	Percent
Age of household head (years)		
30-40	12	8.00
41-50	28	18.67
51-60	58	38.67
61-70	45	30.00
Above 70	7	4.67
Total	*150*	*100*
Sex		
Male	138	92
Female	12	08
Total	*150*	*100*
Marital status		
Single	21	14
Married	129	86
Total	*150*	*100*
Educational levels	40	20
Non-formal education	44	22
Primary education	69	46
Secondary education	18	12
Tertiary education	*150*	*100*
Total		
Household size		
0-4	19	12.67
5-8	74	49.33
9-12	43	28.67
Above 12	14	9.33
Total	*150*	*100*
Farm size (ha)		
Less than 1	12	8.00
1-2	53	35.33
>2-3	36	24.00
>3-4	16	10.67
Above 4	33	22.00
Food Security levels		
Low production level	48	*32*
Lack of cash to buy food	37	*24.67*
Food shortage prior to harvest	32	*21.33*
Food secure and have enough	33	*22.00*
Total	*150*	*100*
Biotechnology Adoption		
Adopters	21	14
Non- Adopters	129	86
Total	*150*	*100*

Source: Field survey data

Based on our observations, one of the problems affecting the farmers in the study area is a lack of good roads. Most of the farms could not be reached by vehicles; hence it is very difficult for the proceeds from such farms to be brought to the market.

The result of the regression analysis (Table 3) shows that out of six explanatory (socio-economic)

variables used, only one has a negative sign on the estimate and this conforms to a priori expectation that as the household size increase with the low production output from their farms their food security status will definitely drop.

The educational level of the respondents significantly affected their level of cocoa farming and household food security in the study area. This is due to the fact that the higher a farmer is formally educated, the more the ability to adopt new and beneficial technology, e.g. biotechnology innovations on their farms and hence the more would be the productivity of the farmer. Farm size of the respondents also significantly affected the food security of the farmers in the study areas ($p< 0.01$). This is expected since the larger the acreage, the more would be the output especially if yield increasing technologies are adopted. . The R^2 indicates that 50% of the variability in the food security status of the cocoa farming households was accounted for by the socio-economic variables of the respondents on their food security status.

CONCLUSION AND RECOMMENDATIONS

This study concludes that the food security level and the technology (biotechnology) adoption among cocoa producing households in the study area is low, and that the high family size with the low production from their farms without the adoption of yield improving technologies can lead to a poorer situation hence aggravating food insecurity. To alleviate this situation of food insecurity, the government should give to farming households' consumption and production credits which use the social capital strategy to enable them survive before the harvest season and also create good access to markets where farmers can have good prices for their produce.

Advancement in cocoa biotechnology is severely constrained by lack of funds, electricity, skilled human resources and equipments. It is recommended that government policies and priorities to support agricultural research in general be intensified in these areas and agricultural (cocoa) biotechnology in particular need to be geared up for improved productivity. Also, enough funds should be provided for research in order to make it more participatory so that adoption of research results will be easier and faster to increase returns.

Table 3: Results of regression of the socio-economic variables of the respondents on their food security status.

Variables	Parameter Estimates	Standard Error
Constant	-40978.6	6.643
Age	4217.5*	3.354
Educational level	8193.8*	6.944
Farm size	2784.8*	2.487
Production output	2185.7*	1.766
Household size	-383.4*	0.148
Biotechn. adoption	430.5*	0.566
R^2	0.5018	
Adj.R^2	0.4230	
F	19.01	

* Significant at 1% level

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