NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 49 Number 1, April 2018. Pp.65-70
Available online at: http://www.ajol.info/index.php/naj

# ADOPTION OF IMPROVED SOYBEAN PRODUCTION TECHNOLOGIES IN BENUE STATE, NIGERIA

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**ABSTRACT**
Lack of appropriate technologies uptake among small scale farmers have always led to low productivity. This study examined the adoption of improved soybean production technologies by farmers in Tarka Local Government Area of Benue State, Nigeria. Data for the study were collected through the use of structured questionnaires from purposive randomly selected sample of 73 soybeans farmers. Descriptive statistics and Tobit regression model were used to analyze the data. The mean age of soybeans farmers was 41 years with an average farm experience of 17 years; access to credit and extension contact were relatively low. Tobit analysis results shows that household size, education, experience, membership of association, extension contact and output significantly affected farmers' decision to adopt improved soybean production technologies. The major constraints identified were costly technologies and lack of extension services. It was therefore recommended that farmers should make their cooperative societies more viable, strong and proactive so that their resources could be harnessed and adequately utilized for higher productivity.

**Keywords: Adoption, productivity, technologies and Tobit model**

## Introduction

Soybean (*Glycine max L.*) is a leguminous crop that grows in tropical, sub-tropical and temperate climates Adeniyan and Ayoola, (2006). It is originated from the People's Republic of China, other major producing countries include; U.S.A, Brazil and Argentina (Misari and Idowu, 1995). It was introduced to Nigeria in 1908 (Misari and Idowu, 1995). The world experienced shortage of oil seeds immediately after the World War II which accelerated the drive for increased Soya bean production in Nigeria (Dugje *et al.*, 2006). Furthermore, Soya bean cultivation in Nigeria has expanded as a result of its nutritive, economic and diverse domestic usage. The crop can be grown successfully in many states of Nigeria by the use of low agricultural inputs (Idrisa, 2009). In the traditional Soya bean growing areas, it is most commonly intercropped with cereal crops like maize, sorghum and millet (Adeniyan and Ayoola, 2006). Soya bean is consumed as food (milk), used for production of edible oil, animal feeds, edible protein and for industrial purposes (Abdullahi, 2004). One of the industrial uses of soybeans is in the production of biofuel. According to Hill *et al*; (2006), an acre of soybeans could yield 66 gallons of biodiesel compared to 84 gallons for sunflower and over 600 gallons of palm oil. Research efforts to improve the existing Soybean varieties, to expand and increase production in Nigeria were initiated in different research institutes from the mid 1970's (Misari and Idowu, 1995). Notably among the various research institutes is the International Institute for Tropical Agriculture (IITA) by initiating research work on Soya bean in the 1970's and has made substantial effort to improve the output of the crop (Abdullahi, 2004). The good varieties of soybean produced in Nigeria includes, TGX1448-2E, TGX1904-6F, TGX1830-2E; and TG X 1485-2E-ID

(Adeniyan and Ayoola, 2006). Idrisa (2009) reported that, with the development of improved varieties, commercial production of soybean has expanded beyond its "traditional home" (Benue, Kaduna, Niger and Plateau) states. It is now produced in other states, such as Bauchi, Borno, Jigawa, Kano, Kebbi, Kwara, Lagos, Nassarawa, Oyo, Sokoto, Taraba, Zamfara and Federal Capital Territory. Improved technology is the systematic application of collective resources to solution of problems through the assertion of control over nature and all kinds of human processes (Roggers, 1993). This underlies the reason for the use of improved technology in the development of agricultural resources to make a better living. Dugje *et al*; (2006) highlighted the agronomic practices recommended for soybean production in Nigeria to include; site selection, land preparation, planting time, spacing and seed rate, fertilizer application, weed control, pest and disease control, harvest and storage. Yet the adoption of the recommended practices for production and management technologies for soybean production is relatively low (Ani and Undiandeye, 2001). Therefore, it was found imperative to examine the adoption of improved soybean production technologies among soybean farmers in Tarka Local Government Area of Benue State. The technologies and management practices recommended to farmers, though technically feasible may not be easily utilized due to resources restriction, low technologies pay off and inconsistency in terms of government programmes and policies and level of mental intellectual development of farmers. These factors may prevent farmers from adopting these technologies in totality leading to a wide gap between what farmers are obtaining from field and those that are potentially possible under improved condition (Adekoya and Babaleye, 2009). As a result of limited technology uptake, productivity - a measure of output per hectare has been found to be very low. Therefore, this research provided answers to the following questions: (i) what are the socio-economic characteristics of soybeans farmers; (ii) what are the factors affecting adoption of improved production technologies and (iii) what are the constraints associated with adoption of production technologies among soybeans farmers in the study?

## M**ethodology**

This study adopted a random and purposive sampling technique to select ten (10) villages in Tarka Local Government Area (LGA) based on their performance in soybean production. The selected villages in the local government area are; Mbaikyo, Mbanonghul, Mbajir, Mbaigba, Mbaichoghul, Mbayia, Mbanyagber, Mbabanyi, Mbatahar, Mbampen. A total of seventy three (73) questionnaires were administered to seven (7) respondents that were randomly selected from each of the ten (10) villages. Primary data were collected for this study with the aid of structured questionnaires. Descriptive statistics and Tobit regression model were used for the analysis of the objectives of the study. Tobit regression model was developed for censored data to take care of qualitative difference between zero and continuous observations (Shwarze, 2004). Tobit model is appropriate in studying decisions where error terms are truncated or censored (McDonald and Moffit, 1980). The advantage of the Tobit model over the dichotomous choice models such as the probit model by Finney (1971) and logit model by Aldrich and Nelson (1984) is that it permits determining the intensity of use of technology once adoption has taken place. The Tobit model in case of censoring at zero can be expressed as:

$Yi^*=\beta X_{i+}\mu_i$…… …….. (i)

$Yi=max(0,Y_i^*)$…… …… (ii)

The implicit form of regression is given by:

$Yi=f(X_1,X_2,X_3,X_4,X_5,X_6,X_7,X_8+ X_9+\mu)$…….…… (iii)

$Yi=\alpha+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+ b_8X_8+ b_9X_9+\mu)$ …… (iv)

Where $Y_i$ = the observed censored variable (adoption index=no. of technologies adopted/total no. of available technologies). Production technologies considered were: use of improved seed, tractor use, recommended spacing (75cm x 20-30), and application of fertilizer at 200kg/ha, use of herbicides, storage chemicals, thinning, seed rate of 50-70kg/ha and timely planting (may/June). The independent variables used in the analysis are shown in Table 1.

## Results and Discussion

Table 1shows that the average age of soybean farmers was about 41 years, an indication that

majority of respondents are in their active stage. It was hypothesized that age which is a continuous variable is negatively related to adoption. Results from a study by Baidu-Forson, (1999) showed that age had no significant effect on the adoption of new technologies. The average household size of respondents was 9.3; it was hypothesized to be positively related to adoption of production technologies.The average number of years spent in school by the respondents was about 13 years, this is an indication that majority of respondents had at least a secondary school education. The level of education is expected to be positively related to adoption of innovations. The mean years of experience in soybean farming was about 17, this means that majority of respondents were experienced. It was hypothesized that experience will be positively or negatively related with adoption Agwu (2004) and Okunade (2006). Further descriptive analysis as shown in Table1, indicated that majority of respondents belonged to an association/cooperative organization, it is assumed that membership of association is positively related to adoption of production technologies. Number of contacts with extension agents was less than 1, an indication that most farmers had not been visited by them. Access to credit was low as majority (66%) had no access to any form of credit. The average output was 1,970kg per respondents while the average farm distance was about 2 km.

**Table 1: Description of variables used in the Analysis of Adoption of Soybean Production Technologies**

| Independent variables | Variable definition | Expected sign | Mean |
|---|---|---|---|
| Age ($X_1$) | Farmers age in years | - | 41.36 |
| Household size ($X_2$) | Number of people in a household | + | 9.32 |
| Education ($X_3$) | Number of years spent in school | + | 12.72 |
| Experience ($X_4$) | Number of years in soybean farming | + | 16.80 |
| Membership of ass.($X_5$) | Number of associations a farmer belongs to. | | 0.69 |
| Extension contact ($X_6$) | Number of contacts with extension agents. | + | 0.58 |
| Access to credit ($X_7$) | Access to credit (dummy) | | 0.34 |
| Output ($X_8$) | Value of output in kilogram | + | 1970.54 |
| Farm distance ($X_9$) | Distance of farm from home of farmers | + | 2.45 |

Before the data set was subjected to analysis using stata 11, a test of normality and heteroskedacity (Breusch-Pagan test) was carried out. There was no multicollinearity (VIF=1.48) and heteroskedacity (prob>chi2 =0.0246). The maximum likelihood estimates for the Tobit model are shown on Table 2. It may be noted that that the estimated model has explanatory power with a likelihood ratio of 39.42 and was significant at 1% level. The empirical results of the Tobit indicate that two of the nine variables tested had the expected signs. However, six variables- household size, education, experience, membership of association, extension contact and output significantly affect farmers' decision to adopt improved soybean production technologies in the study area.

**Household size**: Results in Table 2 revealed a negative and significant (P<0.05) relationship between household size and extent of adoption of soybean production technologies. This result is not in agreement with that of Idrisa *et al*; (2012).

**Level of Education**: Table 2 shows that the level of education of respondents was very important factor (P<0.01) that influence the adoption of improved soybean production technologies in the study area. The positive and significant relationship between level of education and adoption agrees with Awe (1999) and Idrisa *et al*; (2012).

**Experience**: the coefficient of farming experience was found to be significant at 5% in influencing adoption of improved soybean production technologies. This is expected because more experienced farmers may be more knowledgeable in agricultural innovations.

**Membership of Associations/cooperatives**: This had a positive and significant relationship with farmers' adoption of improved production technologies at 1% level of probability. This is in agreement with *a priori* expectation. This is because as they exchange their experiences and ideas, they learn from each other and get a lot of

useful information which compares favorably with the findings of Ofuoku *et al*; (2011)

**Extension contact**: Contact between farmers and extension agents were positively and significantly influence the extent of adoption of improved soybean production technologies at 5% level. This is expected as the more extension contacts determines the quality and quantity of information that farmers are likely to obtain on available technologies and their potential benefits. The result agrees with the findings of Lawal and Oluyole (2008) in their study on the adoption of research results and agricultural technologies among cocoa farming households in Oyo state, Nigeria and Idrisa *et al*; (2012); adoption of soybean improved seed technologies in Borno state, Nigeria.

**Output:** the results further revealed a positive and significant relationship between output of soybean and adoption of improved technologies. The result was significant at 1% level of probability (Table 2). This is expected because according to Idrisa *et al*; (2012); crop varieties that have high capacity to yield high stands a better chance of being adopted as well as being used intensively by farmers.

**Table 2: Maximum Likelihood Estimates of the Tobit Model**

| Parameter | Coefficient | T-Value |
|---|---|---|
| Constant | 0.2405 | 1.72* |
| Age ($X_1$) | -0.0004 | -0.18 |
| Household Size ($X_2$) | -0.1320 | -1.93* |
| Education ($X_3$) | 0.0187 | 2.90*** |
| Experience ($X_4$) | 0.0087 | 2.24** |
| Membership of ass. ($X_5$) | 0.1427 | 2.54*** |
| Extension contact ($X_6$) | 0.1230 | 2.35** |
| Access to credit ($X_7$) | 0.0129 | 0.23 |
| Output ($X_8$) | 0.00005 | 2.65*** |
| Farm distance ($X_9$) | -0.01285 | -1.12 |
| VIF =1.48 | | |
| Prob>$chi_2$ =0.0246 | | |

***, **, *** Significant @ 10%, 5% and 1% and log likelihood ratio= 39.42; Computed from Field Data, 2013**

**Constraints associated with adoption of improved soybean production Technologies**

Table 3 shows the constraints limiting adoption of improved soybean production technologies, notable among the constraints was costly technology (47.95%), small farm size (27.40%), and lack of extension services (36.99%). Poor extension services among the respondents is in agreement with the findings of Tiwari (2010), this implies that adoption level of respondents could be affected negatively. Constraints of costly technology were also one of the major factors affecting the respondents; this is in agreement with the findings of Oriole (2004). The findings also stressed that unless credit facility are provided to small scale farmers, majority of them will seriously be handicapped in adoption of new and profitable farm technologies.

**Table 3: Constraints to Adoption of Improved Soybean production**

| Constraints | Frequency * | Percentage (%) |
|---|---|---|
| Small farm size | 20 | 27.40 |
| Small house hold size | 11 | 15.07 |
| Costly | 35 | 47.95 |
| Lack of extension visits | 27 | 36.99 |
| No co-operation among farmers | 12 | 16.44 |

**Sources: Field Survey, (2013)**

**Conclusion**

It can be concluded from the study that the decision of a farmer in the study area to adopt soybean production technologies is dependent on the household size, level of education, farming experience, membership of association, extension contact and output. Based on the findings of the study, the following recommendations were made: farmers should make their cooperative societies more viable, strong and proactive so that their resources could be harnessed and adequately utilized for higher productivity. Inadequate extension services was one of the major constraints identified, therefore, Non-governmental organizations, farmers group, and cooperative societies should be more involved in the education and practical training techniques on the use of improved soybean production technologies. There is the need for more researches in the development of less expensive technologies locally by the agricultural research institutes and private agro-input companies.

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