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DETERMINANTS OF LEVEL OF ADOPTION OF IMPROVED SOYABEAN POST-HARVEST TECHNOLOGIES AMONG RURAL FARMERS IN NORTH CENTRAL NIGERIA

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Abstract

The study assessed determinants of adoption of improved soyabean post-hatvest technologies among rural farmers in North Central Nigeria. All the soyabean farmers in North Central Nigeria formed the population of the study. Multi- stage sampling technique was used to select 320 respondents for the study. Primary data were obtained by means of structured questionnaire administered to the respondents. The data were analysed using both descriptive and inferential statistics. The results shows that 58.9 % of the respondents were male, many (41.0 %) of the respondents were between 21 and 40 years of age with mean age of about 36 years. The result also shows that many (81.3%) of the respondents were married, while 12 % of them were single. The results further shows that 49.4 % of the respondents had household size ≤6 persons. Most (95.0 %)) of the respondents indicated farming as their primary occupation. Also, majority (92.8 %)) of them were into full time farming in the pooled results. The results shows that majority (66.9 %) of the respondents adopted improved storage facilities at high level. Many (64.7%) of the respondents had high level adoption of Soya milk processing machine. About 40.6 % of the respondents had high level adoption of soyabean threshing machine. The results on ordered logit Regression analysis shows significant effect of the selected farmers' socio-economic characteristics on adoption level. In conclusion, the adoption of improved soyabean post-harvest technologies by farmers led to increase in farm output as perceived by the respondents. It is recommended that farm input supply should be timely and at affordable price, there should be creation of awareness and farmers training on technology usage.

Key words: Adoption, Improved Soyabean, Post -harvest Technologies, Farmers

Introduction

Soyabean is scientifically called *Glycine max (L) Merrill* and popularly called the "poor man's meat". Contains 40.3% protein, 20% oil and as high as 91.9% total digestible nutrient (Fabiyi, 2007). Health benefits of soyabean include prevention of heart diseases, cancer, high blood pressure, diabetes-related diseases and many others. Soyabean oil is rich in fatty acids and devoid of cholesterol. It is an excellent source of calcium, iron, and vitamins such as niacin, thiamin and riboflavin (World's Healthiest Foods,2004). Post-harvest losses (PHL), which can and do occur all along the chain from farm to fork resulting in higher prices and lost revenue which reduces real income for producers and consumers and especially the poor, since such a high percentage of their disposable income is devoted to staple foods. It is now increasingly realized that reducing PHL along food chains can, in certain cases, provide a more cost-effective and environmentally sustainable means of promoting food and nutrition security. It can serve to reduce the wastage of scarce production resources (land, water, inputs) thus ensuring more sustainable food supplies. Some of the improved post-harvest technologies introduced to farmers by National Cereals Research Institute (NCRI) include; the use of threshing, cleaning, winnowing, drying and processing machines as well as the use of improved soyabean storage facilities in soyabean production, harvesting and processing. Against these methods, most rural farmers in Nigeria make use of the manual means of carrying out these agricultural activities, thereby leading to wastage of quantity and also reduce the quality of the product.

The adoption of new technology has been recognized as one of the essential tools to increase agricultural productivity. In spite of all efforts made by concerned agencies to bring scientific discoveries to the door steps of the targeted farmers in Nigeria, the farmers seem not to be responding much to the waves of these changes (Obinne, 1991). It is against this back ground that this work has been carried out to assess the determinants of adoption of improved soyabean post-harvest technologies among rural farmers in North Central Nigeria.

The specific objectives of the study were to: describe the socio-economic characteristics of the respondents in the study area; identify improved soyabean post-harvest technologies adopted by rural farmers; and ascertain the effects of socio-economic characteristics of the respondents on adoption level of improved soyabean post- harvest technologies in the study area.

Based on the specific objectives of this study, the following null hypothesis was stated and

tested:

Ho: Socio-economic characteristics of the respondents have no significant effect on adoption level of improved soyabean post -harvest technologies in the study area.

Methodology

Study area

The study was carried out in North Central Nigeria. The zone has a land area of 296, 898 km^2 representing nearly 32 percent of the country's total land area (NBS, 2008). There are six states in the zone and the Federal Capital Territory, Abuja. The States include Benue, Kogi, Kwara, Nasarawa, Niger and Plateau. It is located in the central part of Nigeria and in the sub-humid region of the country, and bounded to Bauchi, Kaduna, Zamfara and Kebbi States to the north; Cross-River, Ebonyi, Enugu, Edo, Ondo, Ekiti, Osun and Oyo States to the south; Taraba State and Republic of Cameroon to the east and the Republic of Benin to the west. Situated between latitudes 6° 30" - 11° 20"N and longitude 7°– 10°E, the zone has 20.36 million people with the rural population constituting 77 percent (NPC, 2006). The major ethnic groups of the study area are the Gwari, Baruba, Bargana, Nupe, Tiv, Yoruba, Igala, Idoma, Angas and Birom. According to Shaib, Aliyu and Bakshi (1997), the total arable land in the area was estimated at 24.7 million hectares, but only 6.6 million hectares were under cultivation. This indicated that the zone had substantial scope for expansion of the agricultural area as only about 25 percent of the arable land was cultivated. Further, the large inter-annual variability of rainfall subjected the area to frequent dry spells that sometimes resulted in severe and widespread drought that imposed serious socio-economic constraints (FAO, 2001). Rainfall in the zone is largely seasonal and highly variable from year to year, with mean annual rainfall of between 1500 mm and 1800 mm in north and south respectively. Agricultural activities depend mostly on rainfall, with rain-fed agriculture accounting for more than 90 percent of the production systems. The estimated irrigable land in the zone was 1.5 million hectares, although only 64.007hectares (4.3%) are currently under irrigation. Fadama development under irrigation, therefore, has high potential in the area. The climate of the area is characterised with relatively high temperatures throughout the year. The average annual maximum temperature varies between 35ºC and 31ºC throughout the year while the average annual minimum temperature is between 23ºC and 20ºC (FAO, 2001). On the Jos plateau, altitude makes for relatively lower temperatures, with the maximum temperature of 28ºC and minimum temperature of 14ºC (FAO, 2001). Agriculture is the backbone of people's

economy: 85 % of the population depends either directly or indirectly on it for their livelihood, while others constituting (15 %) are involved in occupations such as white collar jobs, business, craft and arts. Crops grown in the State include cereals (guinea corn, millet, maize and rice), grains and legumes (cowpeas and bambara nuts), root and tubers (yam, cassava and potatoes), oil seeds and nuts (soya beans, sheanuts, groundnut and sesame), fruits (mango, orange, banana, melon, cashew and guava) and fibers (cotton and kenaf). Natural and mineral resources found in the State include talc, gold, silica, marble, copper, iron, lead, granite and limestone.

Population and sampling procedure

The population for the study include all soyabean farmers in the North Central Nigeria which include; Benue, Kogi, Kwara, Niger, Nasarawa,Taraba Plateau states and the FCT Abuja. Due to the enormity of the population of the study, a sample size of three hundred (320) respondents was selected using purposive and multi-stage sampling procedure to select respondents from the lists obtained from the Niger State Agricultural Mechanization and Development Authority (NSAMDA) and the Benue State Agricultural and Rural Development Authority (BNARDA). First, two States, namely Niger and Benue were purposely selected. Niger State was selected because NCRI headquarter is located in Badeggi Bida, Niger State where most of the improved soyabean production and post- harvest technologies are developed and disseminated to targeted farmers, while, Benue State was selected because it is the leading soyabean production State in the Zone. Secondly, two Local Government Areas from each of the three zones in the two States making twelve (12) LGAs were selected using purposive sampling technique base on the high concentration of soyabean production in those local government areas. Thirdly, from the sampling frame of each LGAs, 1% of the respondents was selected using simple random sampling techniques resulting to sample size of 320 respondents used for the study. Data for this study were collected from primary source. Primary data were collected using a well-structured questionnaire through the help of agricultural extension agents covering the selected extension circles.

Data analysis techniques

Data for this study were subjected to both descriptive and inferential statistics. Frequency, percentage and mean were used to analyze objective i and ii. The ordered logit model was used to analyze objective iii and test the null hypothesis. The logit model was specified as follows:

(18)

It then means that:

j = 1, 2, 3

where

Y = level of adoption of improved soyabean post-harvest technologies (which is categorized into 3: high level of adoption = 3, moderate level of adoption =2 and low level of adoption = 1).

α = threshold

β_1-β_{12} = estimated parameters

$X_{1\ldots\ldots12}$= Set of independent variables.

X_1: Sex (1, if male and 0, if female)

X_2: Age (years)

X_3: Educational status (years)

X_4: Household size (number of persons)

$X_{5...}$Farming experience (years)

X_6: Farm size (hectares)

$X_{7.}$ Annual farm income (₦, 000)

X_8: Marital status (1, if married and 0,if not married)

X_9: Access to credit (1, if have access and 0, no access)

X_{10}: Primary occupation ((1, if farmer, 2, if treading, and 3, if civil service).

X_{11}: Farming status (1, if full time and 0, if part time)

X_{12}: Membership of cooperative (1, if member and 0, if non member)

Results and Discussion

Socio-economic characteristics of the farmers

Results on socio-economics characteristics of respondents are shown in table 1. The results shows that many (58.9 %) of the respondents were male, while 41.1% of them were female. This indicates the dominance of male in soyabean production in the study area, which could be due to the tedious nature of farm work that requires enormous strength and energy. This result is consistent with the work of Agwu *et,al* (2008) who reported that majority (81.5 %) of the farmers were male in their study. The results show that a reasonable proportion (41.0 %) of the respondents were between 21 and 40 years age bracket, while 37.8 % were between 41and 60 years with mean of about 36, indicating that most farmers were young and able

bodied producers. indicating that most farmers were young and able bodied producers. The result agreed with the findings of Aphunu and Otoikhian (2008) that majority of the farmers in delta State belong to age bracket of 30-49 years. The results further revealed that majority (81.3 %) of the respondents were married. The analysis of the data on the level of education of respondents shows that 71.6 % of them had formal education bellow 6 years whereas 20.6 % of them had 7-12 years of education, with mean of about 5 years. This implies that farmers in the study area had low level of educational attainment which can hinder them from reading and understanding extension bulletins. Most of the farmers that are engaged in subsistence agriculture in Nigeria have low Education and poor technical knowledge about the use of agricultural inputs, due to the poor educational background (Nworgu, 2006).

The results further shows that 49.4 % of the respondents had household size ≤6persons, while a reasonable (44.4 %) Proportion had household size between 7-15 persons with mean of 7. Household size in traditional agriculture determines the availability of labour and level of production (Ani *et al.,* 2004). Most (95.0 %) of the respondents indicated farming as their primary occupation. Many (92.8 %) of them were into full time farming. From the pooled results majority (75.3) of the respondents had ≥10 years of farming experience while 18.4 % of them had years of farming experience ranging between 4-6 with mean of 19. Implying that farmers can easily accept new technologies and utilize them properly as increase in years of farming experience tends to increase adoption level. Improved agricultural technologies tended to be accepted and adopted by experienced farmers as they understand the importance of technologies in farming (Bello *et al*., 2011). The results further shows that most (49.7%) of them had farm size ≤ 2.5 hectares of land with mean of 3, implying that land area used by farmers in the study area is small and can hinder them from engaging in large scale farming. This result is in consistent with the findings of Agwu *et al.* (2008) who reported that most of the farmers in the country cultivate below 2 hectares, many (89.4 %) of the respondents indicated that they do not have access to credit. This could hinder farmers from carrying farm work in large scale, as capital is needed to acquire farm input. One of the reasons for the decline in the contribution of agriculture to the Nigerian economy is the lack of a stable national credit policy and paucity of credit institutions which can assist farmers (Odoemenem and Obinne, 2010). Results on annual farm income shows that a reasonable proportion (44.7%) of the respondents had their annual farm income of ≤ ₦ 100000 while 21.6 % of the respondents had annual farm income between ₦100001 – ₦ 200000. This could mean farmers had low level of income which can hinder them from purchasing farm input in the study area. Many (50.6 %) of the respondents do not belong to

farmers organization.High level of social participation leads to high innovativeness among the respondents due to group dynamic effects (Onu and Madukwe, 2002).

Table 1: Distribution of Socio -Economic Characteristics of Respondents (n=320)

Variables	Frequency	Percentage	Mean.
Sex			
Male	187	58.9	
Female	133	41.1	
Total	320	100	
Age (yrs.)			
≤ 20	24	7.5	
21 — 40	171	53.4	
41 — 60	121	37.8	
61+	4	1.2	
Total	320	100	36
Marital status			
Married	260	81.3	
Single	41	12.8	
Widow	18	5.6	
Total	320	100	
Level of formal ed.(yrs)			
≤ 6	229	71.6	
7 — 12	66	20.6	
13 — 18	25	7.8	
Total	320	100	5
Household size			
≤ 6	158	49.4	
7 — 15	142	44.4	
16 — 24	13	4.1	
25+	7	2.1	
Total	320	100	7
Primary occupation			
Farming	304	95.0	
Civil servant	4	1.2	
Trading	12	3.8	
Total	320	100	

Farming Status	Frequency	Percentage	Mean
Full	297	92.8	
Part time	23	7.2	
Total	320	100	
Farming exp.(yrs)			
≤ 3	0.0	0.0	
4 — 6	59	18.4	
7 — 9	20	6.3	
10+	241	75.3	
Total	320	100	19
Farm size (ha.)			
≤ 2.5	159	49.7	
2.6 - 5.0	144	45.0	
5.1 - 7.5	11	3.4	
7.6+	6	1.9	
Total	320	100.0	3
Access to credit			
Yes	34	10.6	
No	286	89.4	
Total	320	100	
Annual farm income(#)			
≤ 100000	143	44.7	
100001 – 200000	69	21.6	
200001 – 300000	51	15.9	
300001+	57	17.8	
Total	320	100	191063.25
Membership of co.			
Non member	162	50.6	
Member	158	49.4	
Total	320	100	

Source: Field Survey, 2019

Farmers' Adoption Level of Improved Soybean Post-harvest Technologies

Results in Table 2 show the adoption level of soyabean post-harvest technologies by farmers. The results shows that majority (66.9 %) of the respondents adopted improved storage facilities at high level, meaning that farmers are aware of the important of using improved storage facilities in the study area as this may lead to safety of the harvested crop produce. Many (64.7%) of the respondents had high level adoption of Soya milk processing machine. This could be as a result of the quality of processed soya milk derived from using improved processing technology over the use of local means of processing. About (40.6 %) of the respondents had high level adoption of soyabean threshing

machine. The results of the study revealed that 25.3 % of the respondents had high level adoption of Soyabean winnowing machine. Few (24.7%)) of the respondents adopted Soyabean cleaning machine at high level.

According to Agwu *et al.,* (2008) as a result of low improved technologies employed by most small scale farmers, the desirable level of increase in agricultural productivity have been difficult to achieve. The low level of adoption of some relatively high cost technologies could be explained partly by this limited access to loan funds, hence the low income farmers can not adopt such high cost technologies (Idu *et al.*, 2007).

Table 2: Distribution of' Improved Soybean Post -harvest Technologies Adopted by Farmers

Type of technology	Pooled Result					
	Adoption Level			N	S	
	H	M.	L			
	%	%	%	%	%	T.
Soyabean threshing machine	40.6	2.2	3.1	53.8	0.3	100
Soyabean drying machine	16.6	4.1	6.6	72.2	0.6	100
Soyabean oil proc. Machine	17.5	5.3	1.6	75. 0	0.3	100
Soyamilk pro. Mach	68.8	10.9	9.1	10.9	0.3	100
Soyabean win.mach	25.3	4.4	6.9	63.1	0.3	100
Soyabean cleaning machine	24.7	4.1	5.3	65.3	0.6	100
Improved storage facilities	66 .9	22.8	8.7	1.3	0.3	100

Note; H= high level of adoption, M= moderate level of adoption, L = low level of adoption, N= Not adopted , S = stopped using and T = total: Multiple responses recorded

Source : Field Survey,(2019):

Effects of Socio-economic Characteristics of Farmers on Adoption level of Improved soyabean post-harvest technologies

This study used the parameter estimates from ordered logistic regression analysis to interpret the effect of socio-economic characteristics of farmers on adoption level of improved soyabean post-harvest technologies. From the results shown on table 3, the probability of greater chi square (prob > χ^2) was low enough (0.0000) to reject the null hypothesis that says socio-economic characteristics of farmers have no significant effect on adoption level of improved soyabean post-harvest technologies., suggesting that not all factors were equal to zero. This implies that socio-economic characteristics of farmers influence adoption level of soyabean post harvest technologies in the study area. The log-likelihood ratio (LR) test is significant at 1% level of probability, meaning that the model is adequate in explaining the probability of the effect of the explanatory variables on adoption level of soyabean post – harvest technologies.

From the results, the coefficient of age (.110), had positive and significant influence of the respondents adoption level at 1% (P<0.01). This implies that older respondents adopted improved soyabean post-harvest technologies at higher level, while younger farmers adopted improved soyabean post-harvest technologies at lower level in the study area. This result is contrary to the finding of Lemma *et al*., (2012) who reported that older farmers may be more reluctant to adopt new technologies or practices. The coefficient of farm size (.496), was positive and significant at 5% (.P≤0.05). This implies that farmers with larger farm size tend to adopt technologies at higher level, while farmers with smaller farm size, are likely to adopt improved soyabean post- harvest technologies at lower level. Farmers who cultivate large farm holdings are more resource-endowed and therefore are more likely to adequately have the required resources for the acquisition of farm inputs (Ajibefun,2006).The coefficient of membership of cooperative (.646) was positive and significant at 10 % (P≤0.10) level. This implies that been a member of cooperative organization, a farmer tends to adopt technologies at higher level, while those who do not belong to cooperative organization are likely to adopt at lower level High level. Social participation leads to high innovativeness among the respondents due to group dynamic effects (Onu and Madukwe, 2002).

Table 3: Ordered logistic regression model Analysis Results Showing the Effect of selected Socio- Economic Variables of Farmers on Adoption Level of Improved Soyabean Post-Harvest Technologies

Independent Variable	Pooled Result		
	Regress. Coefficient	**Wald**	**P-value**
Sex	-.114	.158	.691
Age	.110	9.405***	.002
Education	.026	.797	.372
Household size	-.013	.060	.807
Farming experience	-.017	.224	.636
Farm size	.496	5.283**	.022
Annual farm income	2.115E-006	1.888	.169
Marital status	-.105	.075	.784
Access to Credit	-.026	.002	.961
Primary 0cupation	-.020	.001	.979
Farming status	.941	1.593	.207
Membership of organ.	.646	3.136*	.077
Number of observations	320		
Prob> chi^2	.000		
LR chi^2 (12)	211.268		

Note: 1***% , 5**% and 10* % levels respectively

Values in parentheses represent z-ratios.

Source: Computed from field survey,(2019)

Conclusion and Recommendations

The study was conducted to analyse the determinants of the level of adoption of improved soyabean post-harvest technologies among rural farmers in North Central Nigeria. Soyabean production in the study area is dominated by male who use more of traditional methods in soyabean productionstage, resulting to low level of adoption of improved soyabean

production technologies. Many farmers are still carryout small scale farming which involves low capital investment, resulting to low output and income of the farmers. Farmers in the study area adopted improved soyabean post-harvest technologies such as improved storage facilities, soyamilk processing machine and soyabean threshing at high level which leads to increase in farm output, In other words, income of farmers increases as a result of adopting the improved technologies introduced in the study area whereby resulting to improved social well-being of the rural farmers. Based on the findings of the study, the following recommendations were made: recommended post-harvest technologies such as improved storage facilities, soyamilk processing machine and soyabean threshing machine should be made available to farmers at the right time, place and at affordable price Also, agencies responsible for distribution of agricultural technologies should create awareness and training services to farmers on the use of agricultural technologies especially in the Local Government Areas where the technologies have not been introduced.

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