Journal of Agricultural Extension
Vol. 17 (1) June, 2013
ISSN 1119-944X

http://dx.doi.org/10.4314/jae.v17i1.14

Empowering Small-Scale Farmers through Improved Technology Adoption: A case study of Soybean Farmers in Borno State, Nigeria

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Abstract

The study examined factors that influenced the adoption of improved soybean seed as production technology in Borno State, Nigeria. Data for the study were collected from 360 small-scale farmers spread across nine farming communities in three local government areas. Respondents were selected through multi-stage sampling technique while the data were collected with the aid of structured questionnaire. Data were analyzed using descriptive statistics such as frequency count, percentage and rank while correlation coefficient was used to establish relationship between variables. Results of the study showed that 74.99% of the respondents were below 51 years of age; 52.51% attained at least the Junior Secondary School level of education; 32.50% of the respondents had income between ₦ 400,000.00k - ₦ 1,600,000.00k from the sales of soybean during the period under study. This led to the empowerment of the respondents mainly in catering for their household needs, expanding their agricultural production and purchase of landed property. Socio-economic characteristics such as age (-0.78), level of education (0.68), and farm size (0.62) had significant influence on the adoption of soybean production technology. The main constraints faced by the respondents in the adoption of improved soybean production technologies included the complex technicality of agronomic practices and limited access to extension services. It was therefore recommended that government should put in place definitive policy to encourage young people to venture into agriculture/farming and small-scale farmers should be given more agricultural extension educational opportunities.

Introduction

Small-scale farming is the most dominant mode of agriculture in most developing countries, Nigeria inclusive. Approximately, 3 billion people live in rural areas of developing countries with over 2 billion of them involved in agriculture as small-scale farmers or farm workers (World Bank, 2007). Nagoyetes (2005) also observes that at least 75% of farms in majority of African and Asian countries are only two hectares or less in size. It is for this reasons that any attempt at transforming agriculture should aim at transforming the small-scale farming. Small-scale farming is significant in many ways. In agriculture-based economies, such as in Nigeria, farming generates 34% of the Gross Domestic Products (GDPs) and 65% of employment (Jazairy *et al.,* 1992), with the farm owners mainly self-employed.

Small-scale farming therefore merits support for many reasons. For instance, Morton (2007) recognizes that the small-scale farmers can be efficient than the large-scale farmers in utilizing production resources, especially purchased inputs and labour. Other researchers (Thirtle *et al.,* 2005; de Janvry and Sadoulet, 2010) also reporte that small-scale farming has great capacity to reduce poverty if the small-scale farmers are connected to market and extension services. According to them, for each percentage growth in agricultural yield, there is 0.6% to 1.2% reduction in poverty. This therefore implies that empowerment of small-scale farmers through provision of appropriate agricultural technologies can go a long way in reducing poverty and food security in farming community. These benefits result from the direct effects of agricultural improvement on the small-scale farmers themselves and from strong agricultural linkages with other sectors of the economy, promoted by agricultural extension.

One way of transforming agriculture is by exposing small-scale farmers to improved agricultural production technologies, such as high yielding seed varieties. According to Sunding and Zilberman (2000), technological change has been a major factor shaping agriculture in the recent past. For instance, a comparison of agricultural production pattern in the United States in 1920 and 1995 shows that harvested cropland has declined (from 350 to 320 million acres), the number of people employed in agriculture has declined (from 9.5 million in 1920 to 3.3 million in 1995). Yet agricultural production in 1995 was 330% greater than its figure in 1920. This suggests that agricultural productivity has increased. The main explanation for such increase is change in agricultural production methods, chief among which is the use of improved/high yielding seed varieties.

The International Institute of Tropical Agriculture (IITA) has championed the course of developing improved agricultural technologies for possible adoption by farmers in Africa. One of such technologies developed and delivered to farmers is the improved soybean seeds. This technology was introduced into Borno State with the hope that, if adopted by farmers, it will lead to improvement in the nutritional status and food security of the small-scale farmers in the adopting communities. It was also hoped that the production of soybean will stimulate economic activities in the study area owing to its wide application locally and industrially.

The use of modern farming technologies such as improved seeds enhance crop yield and income of farmers generally (Bamire, *et al* 2002; Ouma, *et al* 2006; Onu, 2006). It is also expected that living conditions of the farmers would significantly improve as a result of the benefits of adopting this technology. This study was therefore conducted mainly to examine the effect of adoption of improved soybean seed on the livelihood of small-scale farmers in Borno State. The specific objectives of the study were to:

i. determine the income generated from soybean production;
ii. examine the utilization of income generated from soybean production by the respondents; and
iii. determine the constraints militating against the adoption of improved soybean seeds by farmers in the study area.

Methodology

The study was conducted in Borno State, Nigeria. Multi-stage sampling technique was used in selecting the respondents for the study. The three local government areas (LGAs) where IITA promoted soybean production were purposively selected out of the 27 LGAs in Borno state. The three LGAs included Biu, Hawul and Kwaya-Kusar. Four soybean producing communities each were selected from Biu and Hawul LGAs, while one soybean producing community was selected from Kwaya-Kusar LGA. This was done in proportion to the soybean producing communities in the LGAs. A total of 360 respondents were selected proportionately from the soybean producing communities. The numbers of respondents selected from each LGA were: Biu, 158 (43.89%); Hawul, 176 (48.89%); and Kwaya-Kusar, 26 (07.22%). The 360 respondents were administered structured questionnaire. The key dependent variables for the study are: adoption, which was measured in terms of the total land area devoted to improved soybean seed production, as used by Ojiako (2007); output of soybean, which was measured in quantity of soybean obtained by a farmer. This was multiplied by the market price of soybean to get the income farmers earn from soybean. The independent variables are: age, measured in years, educational qualification, measured in terms of the highest educational qualification attained; and farm size, measured in hectares. Descriptive statistics, namely the frequency count, percentage and ranks were used to categorize the respondents based on their socio-economic characteristics while the inferential statistics were used to establish relationship between certain socio-economic characteristics of the respondents and various parameters of the study.

Results and Discussion

Socio-economic characteristics of respondents

The results in Table 1 reveal that 53.03% of the respondents were within the active age group of 31-50 years. Only 25.10% of them were above 50 years of age, with the mean age being 42 years. This age range has some advantage for the adoption of improved technologies as Bamire *et al*., (2002); Sheik *et al.*, (2003) found that the age of individuals affects their mental attitude toward new ideas and hence influence adoption in several ways. Consequently, the high proportion of young farmers in the study area spells bright future for adoption of improved agricultural technologies in the study area. The study also reveal that more than half (52.51%) of the respondents attained at least the Junior Secondary School level of education and above, while about 22. % of the respondents had no formal education at all (Table 1). Education affects agricultural productivity by increasing the ability of farmers to produce more output from given resources. Earlier, Idrisa *et. al.* (2010) found that education was positive and significant in influencing the adoption of improved soybean seed among farmers in Borno State, Nigeria. As shown in Table 1, majority (67.50%) of the respondents devoted 0.5ha or less to soybean cultivation during the 2007 cropping season while only a dismal (0.28%) of them devoted more than 2.6ha to the cultivation of improved soybean. In fact, a vast majority (95%) of the respondents devoted the maximum of 1.5ha to soybean production during the study period. 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). This puts them in an advantage position to adopt improved technologies compared with farmers who have small farm holdings. The small family size, which translates into small labour supply forms

another possible explanation for the small farm size recorded among respondents in the study area.

Table 1

Distribution of Respondents based on their Socio-economic Characteristics (n = 360)

Socio-economic variable	Frequency	Percentage Standard Deviation	Mean
Age (in years)			
≤ 20	21	0 5.83	
21 – 30	58	16.11	
31 – 40	97	26.94	42
41 – 50	94	26.11	
51 – 60	50	13.90	
Above 60	40	11.11	
Educational qualification			
Tertiary education	72	20.00	
Senior secondary education	80	22.22	
Junior secondary education	37	10.29	
Primary education	61	16.94	
Adult education	30	08.33	
No formal Education	80	22.22	
	131	36.40	
Farm size (ha)			
≤0.5	243	67.50	
0.6-1.0	89	24.72	
1.1-1.5	10	02.78	
1.6-2.0	00	00.00	0.59
2.1-2.5	17	04.72	
2.6 and above	01	00.28	

Source: Field Survey, 2008

Adoption of improved Soybean seed by respondents

Results in Table 2 reveal that majority (96.93%) of the respondents have adopted improved soybean seed as production technology in the study area having devoted at least 10% of their total land area to soybean production. The mean adoption among farmers in the study area was 39.34%. This indicates that soybean had high level of acceptability among the small-scale farmers in the study area, being that on the average, every respondent has devoted 39.34% of his total land to improved soybean seed. Ojiako (2007) opined that a farmer that devoted at least 10% of his total land area to improved seed production is considered as an adopter for that technology. With regards to intensity of adoption, 24.51% of the respondents devoted 50% or more of their land to improved soybean production during the study

period while more than half (54.87%) of the respondents devoted at least 30% of their land to improved soybean seed.

Table 2
Distribution of respondents based on adoption of improved soybean seeds

Intensity of use (%) (given that adoption has occurred)	Frequency	Percentage	mean
10.0% - 29.9	151	42.06	
30.0% - 49.9	109	30.36	39.34%
50.0% - 69.9	56	15.60	
70.0% - 89.9%	06	7.24	
90.0 and above	26	01.67	

Source: Field Survey, 2008

Yield of Soybean and income from Soybean

Table 3 reveals that majority (67.50%) of the respondents had 1000kg or less of soybean during the study period. About one-quarter (23.89%) of the respondents had from 1001kg to 2000kg; 05.83% of them had between 2001kg and 3000kg while a dismal (2.78%) had more than 3000kg of soybean during the study period. This depicts that the yield of soybean in the study more than 2000kg of soybean during the study period, about the same proportion (92.22%) also operated at small-scale level (≤ 1ha).

When the physical output was converted into its monetary value (Table 3), it was found that majority (67.50%) of the respondents got up to ₦ 400,000.00k from the sale of soybeans, while additional 29.72% of the respondents got up to ₦ 1,200,000,00k from the sale of soybeans. Each 100kg bag of soybean sells for ₦ 40,000.00k. Mean income from sale of soybean among the respondents was ₦ 380, 000.00k which is equivalent to $2, 420.38. This helps to bring cash income into the soybean farming communities. de Janvry and Sadoulet (2009) found that introduction of cash crop into farming community has the capacity to empower the cash-trapped farmers in the rural communities. The World Bank (2007) also reported that Ghana reduced rural poverty by 24% between 1990 and 2005, principally as a result of empowering small-scale farmers through adoption of improved technologies.

Table 3
Distribution of respondents based on yield of Soybean obtained in 2007 production season and income from Soybean (n = 360)

Yield in kg (Naira Value)	Frequency	Percentage annual income	Mean
≤ 1000kg (≤ ₦ 400,000.00k)	243	67.50	
1001kg – 2000 (≤ ₦ 400,400 – ₦ 800,000k)	86	23.89 ($2, 420.38)	₦ 380, 000.00k
2001kg – 3000 (≤ N 800,400 – ₦ 1,200,000k)	21	05.83	
3001kg – 4000 (≤ ₦ 1,200,400 – ₦ 1,600,000k)	06	01.67	
4001kg and above (₦1,600,400 and above)	04	01.11	

Source: Field Survey, 2008

Utilization of Income from Soybean sales

Entries in Table 4 show the uses to which the respondents put the income they got from soybean production. Majority (94.44%) of the respondents used part of the income to attend to their family needs. These routine or day-to-day family problems included providing for the family during festivals, paying hospital bills of family members and other needs that may arise in the family. Also, majority (79.72%) of the respondents re-invested the income they got from the sales of soybean in farming business. This, they did through increasing their farm size (i.e expanding their farm size) and buying inputs that will help them expand production such as work bull/farm implements. About half (49.44%) of the respondents also used the proceeds to buy landed property, while 45.55% of them used the income to sponsor their children in school either at secondary school level or tertiary education including their university education. About 25% of the respondents used the income to start other forms of business, notably trading and livestock fattening. These show that the small-scale soybean farmers in these communities have been empowered through the introduction of improved soybean seed to them. Idrisa *et. Al.* (2012) in a study of the effect of adoption of improved maize varieties on food security in Gwoza local government of Borno State, Nigeria found that adoption of improved maize varieties significantly enhanced food security in the study area. One measure of empowerment is the ability of an individual to solve his/her felt needs which was impossible prior to the empowerment intervention. Farmers now produce soybean, which they readily sell through the well established market linkages and earn money to solve their household problems.

Table 4
Distribution of respondents based on their utilization of income obtained from Soybean production

Area for which money was used	Frequency	Percentage*
Re-investment in farming	287	79.72
Purchase of landed property	178	49.44
Invested in other form of business	89	24.72
Children's education	164	45.55
Attending to routine household needs	340	94.44

Source: Field Survey, 2008
*Multiple responses

Analysis of relationships between respondents' adoption and socio-economic factors.

The study looked at the relationships between some socio-economic characteristics of the respondents and their level of adoption of soybean production technology. Correlation analysis was used to achieve this. The correlation analysis revealed that there was a significant but negative (-0.78) relationship between adoption and age of respondents in the study area (Table 5). This finding corroborates earlier findings (Adesina and Zinna, 1993; Bamire *et al.,* 2002; Sheik *et al.*, 2003) which showed that young people are more likely to be better agents of technology adoption and transfer. Table 5 also reveals a significant and positive (0.68) relationship between educational level of the respondents and their adoption of technology. Education is essential for farmers to gather, process and interpret information needed for agricultural production. Availability of necessary information enables farmers to produce more output from a given input. Table 5 further shows that 95.00% of the respondents in the study area cultivate between 0.5ha and 1.5ha of land. This puts the effects of farm size to hibernating and asymptomatic to analysis.

Table 5
Correlation analysis between socio-economic characteristics of respondent and adoption of soybean production technology

Socio-economic Characteristic	Coefficient of Correlation	Rank
Age	-0.78***	1
Level of Education	0.68**	2
Farm Size	0.48*	4

Source: Synthesis from 2008 Field Survey Data

Constraints to respondents' adoption of improved Soybean seed technology

Only 87 respondents, representing 24.17% of the sample size reported having problems associated with the adoption of improved soybean seed in the study area. Table 6 shows the distribution of the problems encountered by the respondents. The technicality of the agronomic practices associated with soybean production ranked highest among the problems, as reported by 42.53% of the respondents. This is not surprising because the soybean crop was introduced into the study area only about four years ago. The agronomy of the crop is still complex to the respondents

especially that the crop requires a great deal of precision in terms of depth of sowing, spacing, weeding requirement and the need to harvest on time so as to escape pod shattering. The study also revealed that inadequate access to extension services as reported by 37.93% of the respondents ranked second among the problems. Access to extension service is important in popularizing technologies among farmers. Previous studies (Bamire *et al.*, 2002; Omolehin *et al.,* 2007) indicateded that in Africa, low level of contact between extension workers and farmers form one of the main reasons for low level of adoption of improved technologies. Farmers in the study area depend on extension agents for information on improved agricultural technologies as well as knowledge of how to use the technologies. A situation of low level of interaction between extension agents and farmers will retard the spread of innovations in the farming communities. It will also negatively affect the likelihood of adoption of innovations and the intensity of use of the technologies. A small proportion (19.50%) of the respondents reported untimely access to improved soybean seed as their problem. Alimi (1991) earlier recognized that accessibility to production resources is perhaps a more serious problem in African countries than inefficiency of use of the resources.

Table 6
Distribution of respondents based on problems encountered in the adoption of improved soybean seeds (n = 87)

Variable (Nature of problem)	Frequency	Percentage* (%)	Rank
Technicality of agronomic practices	37	10.28 (42.53)	1
Inadequate access to extension service	33	09.17 (37.93)	2
Untimely access to improved seed	17	04.72 (19.54)	3

Source: Field Survey, 2008
*****Percentages in parentheses were derived from respondents who encountered problems in the course of adoption of improved soybean seed: n=87

Conclusion and Recommendations

It can be concluded from the findings of the study that majority (62%) of the respondents adopted improved soybean seed as production technology. It was also concluded that adoption of improved soybean seed has significantly empowered the small-scale farmers in the soybean producing areas in many ways, notably: solving their day-to-day family problems; investing in their farming business; and buying landed property. The study also concludes that age of respondents, their level of education, farming experience and farm size significantly influenced the adoption of soybean production technology by the respondents. Based on the findings of the study, it is recommended that: Policy should be put in place to encourage young people to venture into agriculture/farming; and farmers should be given more agricultural extension educational opportunities.

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