Adoption of innovative cowpea production practices in a rural area of Katsina State, Nigeria

Tijjani, A. R.* • **Nabinta, R. T.** • **Muntaka, M**.

Department of Agricultural Economics and Extension, Federal University Dutsinma, P.M.B. 5001, Dutsinma, Katsina State, Nigeria.

*Corresponding author, E-mail: tijjaniaburimi@gmail.com.

Abstract. Adoption of agricultural technology is vital in improving crops output in developing countries. This article explores the extent of adoption of innovative cowpea production practices, developed by International Institute of Tropical Agriculture (IITA), Ibadan and Institute for Agricultural Research, Zaria. The research was conducted in Rimi Local Government Area of Katsina State, northwest of Nigeria. Data were collected through questionnaire surveys administered to 150 small-scale local farmers randomly selected from five communities in the area and descriptive statistics were used for data analyses. The results indicated that while only 20% of the respondents have ever adopted all the (eleven) innovative practices, the most commonly adopted practices were found to be weed control (35.3%), sowing date (33.3%), and storage (32.7%). This study also uncovers the factors that could be associated with low agricultural technology adoption among the respondents: educational levels, contact with Extension workers, access to credit facilities and membership of agricultural cooperatives. The result of the study showed that the adoption level of the improved cowpea production practices recommended by the Nigerian Agricultural Research Institutes was very low among the surveyed local farmers in the study area. The paper concludes by recommending ways of ensuring more adoption of the improved practices among rural farmers as well as how to sustain the adoption, given that low adoption of these practices could significantly lower farmers' income as well as living standards.

Keywords: Technology adoption, agriculture, cowpea farmers, Katsina.

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is one of the most important staple food crops in sub-Saharan Africa, especially in Nigeria. With protein content of 25%, cowpea remains one of the cheapest sources of protein in the diet of many Nigerians, in addition to its several mineral and vitamins contents (International Institute of Tropical Agriculture, 2014). Cowpea is also one of the most important economic crops in the tropics for the fact that all of its parts are useful for human consumption and for the provision of livestock feed. The crop tolerates drought and performs well in a wide variety of soils. Similarly, the bacteria in the root nodules contribute to soil fertility through fixation of nitrogen in the soil and production of organic matter. As such, cowpea is broadly cultivated around the world. Nigeria, with an estimated

annual production of 2.17 million tons, is the highest producer of cowpea in the world (FAO, 2014). The northern region of Nigeria produces about 1.7 million tons from about 4 million hectares, which represents over 60% of total national production (FAO, 2014). Katsina, Kano, Jigawa and Borno are notable States in cowpea production in northern Nigeria.

However, in these States cowpea yield has been in decline due to problem such as outdated farming practices, parasitic weeds, insects and diseases (FAO, 2014). An effort to reverse this decline and improve cowpea production in the country began in the 1988 when the Federal Government of Nigeria mandated two agricultural research institutes – International Institute of Tropical Agriculture (IITA), Ibadan and Institute for

Agricultural Research, Zaria – to develop some cowpea production technologies suitable for different country's ecological zones. The research project came up with some improved practices for cowpea production and the task of propagating and demonstrating the application of these innovative practices to farmers is the responsibility of Agricultural Development Programs of various states of the federation.

The above impetus notwithstanding, the expected increase on cowpea production in Nigeria has not been realized due to reasons such as lack of acceptance and use of agricultural technologies by farmers (Agwu, 2004). About two decades since the inception of the program, there has been studies that attempt to explore the level of acceptance and adoption of these new cowpea production technologies in Nigeria. While a study by Agwu (2004) researched the factors influencing the adoption of improved cowpea production technologies in Bauchi and Gombe States, Inaizumi et al. (1999) study on adoption and impact of dry-season dual-purpose cowpea in semi arid zone in Kano State Nigeria, no known study investigates the subject in Katsina State, which is culturally, climatically and geologically different from the northeast.

As such the objective of this paper is to investigates the adoption of recommended cowpea production practices in Rimi Local Government Area of Katsina State, specifically the innovative packages developed by the previously-mentioned research institutes for improved cowpea production. Studying this topic is important because, although cowpea is among the major crops produced in Katsina State, its yield remains very low from 2005 to 2008 (MOA, 2008).

METHODOLOGY

This study was conducted in 2011 in Rimi LGA of Katsina State, northwest of Nigeria. The study area is located in the northern part of Katsina State close to the state capital. It has an area of 452 km², situated on latitude 12° 51′ 0" N and longitude 7° 42′ 56" E with a population of 153,744 at the 2006 census (en.wikipedia.org/wiki/Rimi_Nigeria). The area is predominantly agricultural and cowpea is one of the dominants crops produced in the local government area (LGA). Questionnaire survey was carried out in five wards (Rimi, Abukur, Kadandani, Makurda and Kurabau) purposively sampled because they are the most populous and renowned for cowpea production in the area. Data were collected from a random sample of 150 cowpea farmers and the analysis was done using descriptive statistics of frequency distributions, means, ranges and percentages. The questionnaire contains close-ended questions about farmer's socio-economic characteristics, adoption of recommended technologies and availability of support for adoption— contact with extension agents, access to credit and membership of cooperatives.

Trained enumerators in the local language (*Hausa*) administered the interview schedule. This is because of the respondents' inability to comprehend the language, hence, they could not understand the questionnaire which was structured and written in English language.

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

Table 1 shows the distribution of the surveyed farmers by their socio-economic characteristics. More than three-quarter (77.3%) of the respondents are within the range of youthful age (20 to 49 years), who are considered to be agile, more likely to adopt innovative ideas and are ready to take chances. Table 1 further indicates that more than half of the respondents (54%) have never attended formal educational institutions and 40% were educated not beyond secondary school level. This finding is consistence with Ogieve (1998) where he reported that several small-scale farmers in rural parts of Nigeria have no formal education.

With regards to family size, the findings indicate that about one of nine (89.3%) of the respondents have large family sizes of more than five people and more than half (56.6%) have families in excess of 10 people. Even though the average family size in the state is seven, this large family size found in this study is not surprising considering the culture of early marriage and polygamy among the rural people in the study area. Concerning the farm sizes of the respondence, majority (65.4%) owned their farms whose sizes range from 1 to 5 ha, implying that they operated at small scale, going by Erie's (1996) classification of farms between 0.1 and 5.9 ha as small scale. This finding on farm sizes in Katsina State is consistent with Katsina State Household Baseline Survey Report, where 78% of respondents cultivated 1 to 5 ha and only 6.6% cultivated 5 ha and above (CBARDP, 2004).

Adoption of innovative cowpea production practices

Table 2 reveals that 36 (24.0%) of the respondents have planted the improved cowpea varieties and 39 (26.0%) have implemented the recommended seed rates. The study also found out that 49 (32.7%) and 43 (32.7%) of the respondents have adopted recommended storage techniques and seed spacing practices respectively. Further more, 35 (23.3%) and 33 (22.6%) respondents have adopted the improved methods of seed treatment and fertilizer application respectively. On the otherhand, 32 (21.3%) and 30 (20.0%) have taken on pest control and land preparation respectively while surveyed farmers recorded the highest adoption level in harvesting (38%), followed by weed control (35.3%) and then sowing date (33.3%). The result indicates that only 30 respondents

Table 1. Respondents' age, educational level, family size and farm size.

Variables	Frequency (n = 150)	Percentage
Age (years)		
20 – 29	1	0 .7
30 – 39	51	34.0
40 – 49	64	42.6
50 – 59	31	20.7
≥ 60	3	2.0
Educational qualification		
No education	81	54.0
Primary education	43	28.7
Secondary education	17	11.3
Post-secondary	9	6.0
Family size		
1 – 5	16	10.7
6 – 10	49	32.7
11 – 15	50	33.3
16 – 20	24	16.0
>20	11	7.3
Farm size		
1 – 5	98	65.4
6 – 10	17	11.3
11 – 15	14	9.3
16 – 20	13	8.7
>20	8	5.3

Source: Field survey 2011

Table 2. Ranking of respondents according to their level of adoption.

Level of adoption	*Frequency	Percent	Rank
Harvesting	57	38.0	1
Weed control	53	35.3	2
Sowing date	50	33.3	3
Storage	49	32.7	4
Spacing	43	28.7	5
Seed rate	39	26.0	6
Planting improved varieties	36	24.0	7
Seed treatment	35	23.3	8
Fertilizer application	33	22.0	9
Pest control	32	21.3	10
Land preparation	30	20.0	11

*Multiple responses. Source: field survey 2011.

(20%) reported using all the eleven (11) recommended cowpea production technologies. The data further revealed an average adoption level of 3% of the recommended practices by each farmer, an indication that majority of the respondents were able to implement a few of the innovative practices.

Since about eight in ten of the surveyed farmers have no education beyond primary school (Table 1), this low-adoption level found in this study is not surprising given that technology adoption levels is directly related to

Table 3. Distribution of respondents according to extension contact, membership of cooperatives and access to credit.

Variables	Frequency	Percent
Extension contact		
Yes	28	18.7
No	122	81.3
Membership of cooperative		
Yes	43	28.7
No	107	71.3
Access to credit		
Yes	22	14.7
No	128	85.3

Source: Field survey 2011.

educational levels of individuals. This is consistence with the finding of the study by Centro International de Majoramento de maiz Y Trigo, that is, International Maize and Wheat Improvement Centre (CIMMYT) (1995), that education is important for easy understanding of improved methods of agricultural production and make farmers more receptive to advice from extension agency or be able to deal with technical recommendations that require a certain level of numeracy and literacy. Similar findings on low adoption of agricultural innovations in rural areas of Nigeria have been reported in the works of Adejoh (2009) and Unuigbe (2010). Other factors resulting to low adoption in the study area are; socio-economic factor and lack of technical knowledge on some aspects of the technology. This corroborates with the findings of Harris et al. (1995) and Sasinga (1998) hinted that lack of proper understanding of the innovation and improper implementation as the causes. Subsequently, we aim to ascertain factors affecting adoption with a view of proffering possible solutions.

Contacts with extension agents

Adoption of cowpea production technologies is highly facilitated by the efforts of extension workers in introducing and demonstrating to farmers how to use the technologies (Bzuga and Guary, 2004 cited in Oladosu and Okunade, 2006). However, majority (81.3%) of the respondents had no contact with extension agents but adopt the practices on their own or with the help of a neighbor. This insufficient level of famers' contact with extension agents negates the theoretical role extension is supposed to play in technology diffusion and adoption Polson and Spencer (1991) which might be due to inadequacy or insufficient logistics for the extension worker to reach farmers or incompetency of the personnel to be conversant with the technical aspects of the technology due to lack of attending workshops,

seminars, on-station demonstration and fortnightly/monthly technology review meeting geared to update knowledge on technological innovations.

Membership of agricultural cooperatives

Farmer's cooperative is an association where farmers pool their resources in certain areas of agricultural activity for mutual benefits. Cooperatives supply their members with inputs for agricultural production, including seeds, fertilizers, and insecticides/pesticides at subsidized rates or on loan. In this study, it was found that majority (71.3%) of the respondents did not belong to any farmers' cooperatives. The remaining ones (28.7%) who indicated they belong to cooperatives, they indicated that the organizations are informal without official government registration and recognition (Table 3).

This result concurs with Chikezie (2009) who found that majority of the respondents (80%) in her study also do not participate in cooperatives which denied them the opportunities to enjoy the benefits attached with participations interms of access to technical assistance as well as competitive credits, loans, subsidies and source of farm information. Other benefits of farmers' cooperatives include: improved income from the marketplace; strengthening of their bargaining power; and better risks management.

Access to credit facilities

Because several studies have shown that the success of agricultural technology adoption depends partially on the ability of farmers to obtain credit facilities that would enable them procure the needed agricultural inputs such as improved seeds, fertilizer and insecticides/pesticides as well as storage facilities (Agwu, 2004; Chiekeze, 2009), this study also asked respondents about their

sources of credits for farming activities (Table 3). The results of access to credit facilities shows that most of the respondents (85.3%) had no access to credit but utilize their personal savings as capital in cowpea production. The survey data also shows that while 15 respondents (10%) got loans from banks, six (4%) got theirs from friends and relatives. In a similar vein, Unuigbe (2010) affirmed that majority of the respondents in his study area have no access to credit facilities which tremendously affect their ability to produce more owing to peasant nature of their farming.

CONCLUSION AND RECOMMENDATIONS

Adoption of cowpea production technology would lower costs of production per unit, cause productivity gains and more income. This would in turn reduce poverty among rural farmers. Because agriculture is the largest employer of labor in Nigeria, efforts towards improving agricultural productions such as in implementing innovative technologies should be given priority by the decision makers in the agricultural sectors at local, state and federal levels. The implication of low technology adoption found in this study is very worrying because if this trend continues to exist, the local farmers might not continue with implementing the innovations all together as reported by similar studies (Adesina and Baidu-Forson, 1995). This could lead to decline in cowpea production that would consequently lower farmer's income and social wellbeing. Evidence for that has been found by a study of rural farmers in China that shows that those who adopted rice production technologies had incomes approximately 15% higher than non-adopters (Ding et al., 2011).

Recommending mitigating measures to this problem of low adoption of recommended practices in the study area is not possible without understanding the possible causes. A number of factors could be attributed to this dismal finding in terms of adopting the recommended practices in the study area such as inadequate or expensiveness of inputs as supported by lack of access to credits, low level of education, poor extension outreach, limited source of information, low or non-functional farmers cooperatives and small land holdings among others. Some of the surveyed farmers were skeptical about the recommend practice of applying pesticides and insecticides because of the fear of hazards on farmers' health. In view of the above implications, the following measures have been recommended.

Given the low level of farmers' education found in the study, there is the need for urgent attention to improve their literacy so that not only their farming activities but their general wellbeing could be improved. As such, Rimi Local governments should organize adult education classes for the farmers to assist them develop reading and writing skills as all of them are over 20 years. This

would enable them to be receptive on the technology and explore other sources of information. On the part of Katsina State Government, the ministry of agriculture should employ sufficient field extension staff, make all the logistics available and provide avenues for extension trainingby sponsoring the workers to attend seminars, workshops, and technology review meetings, On-Station/On-Farm adaptive research that serves the need of the rural farmers and their families and are more relevant to farmers' circumstances. Production inputs should be provided to farmers through institutional sources in good time, in enough quanitities and at affordable cost through farmers functional groups for regular disbursement of soft loans at a prime time and low interest rate. More so, farmers cooperatives should be revived by government to became more functional with emphasis on farmers participations. Efforts should be made by the government, research agencies, policy makers and field extension staff to simplify the technological packages to fit into farmers circumstancies and ensure strict compliances. Also, all aspect of farmer's production system and economic bahaviour should be taken into cognizance when developing technologies and that farmer's involvement in technology development and delivery should be encouraged. So that farmers' do not use the technology just becouse it is available, but because there are genuine advantages in doing so. Further more, government should resustitate difffusion of innovation channels by making the extension agents to become more competent and confident in using the information sources to solve their problems using the general information.

Considering that the Federal Government of Nigeria has established credit schemes such as the Agricultural Credit Guarantee Scheme (ACGS) and Agricultural Credit Support Scheme (ACSS) to ensure farmers' access to agricultural credit Badiru (2010), this study recommend to Katsina State Agricultural and Rural Development Authority to liaise with these credit institutions and find a way to assist local farmers secure a loan.

REFERENCES

Adejoh SO (2009). Socio-economic factors affecting the use of improve cassava processing technology by women processors in Kogi State. MSc. Thesis, Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University Zaria, Nigeria.

Adesina AA, Baidu-Forson J (1995). Farmers' perceptions and adoption of new agricultural technology: evidence from analysis in Burkina Faso and Guinea, West Africa. Agric. Econ. 13(1):1-9.

Agwu AE (2004). Factors influencing adoption of improved cowpea production technologies in Nigeria. J. Int. Agric. Ext. Educ. 11(1):81-88.

Badiru IO (2010). Review of small farmer access to agricultural credit in Nigeria. NSSP, Policy Note (25):2.

Centro International de Mejoramento de Maiz Y Trigo (CIMMYT) (1995). The adoption of agricultural technology: A guide for survey design. Mexico, D.F.

Chiekeze NP (2009). Factors influencing youth adoption of cassava recommended production practices in Onu-Imo Local Government Area of Imo State. MSc Thesis, Department of Agricultural

Economics and Rural Sociology, Ahmadu Bello University Zaria, Nigeria.

Community Based Agriculture and Rural Programme (CBARDP) (2004). Katsina State Household Baseline Survey Report. Federal Ministry of Agriculture and Rural Development, Nigeria. http://www.fidafrique.net/IMG/pdf/Household_Survey.pdf.

Ding S, Meriluato L, Robert RW, Dayun T, Wu H (2011). The impact of agricultural technology adoption on income inequality in rural China: Evidence from Southern Yunnan Province. China Econ. Rev. (22):344-359.

Food and Agriculture Organization (FAO) (2014). How to grow a good cowpea crop in Nigeria. http://www.fao.org/sd/erp/ toolkit/ books/cowpea_illust_guidebook.pdf. Accessed June, 2014. en.wikipedia.org/wiki/rimi_nigeria.

Erie AP (1996). Diffusion of innovation: Facul. Soc. Sci. Quart. J. Edo State Univ. pp. 24-31.

Harris RP, Bridger JC, Sachs CE, Tallichet SE (1995). Empowering rural sociology: exploring and linkage alternative paradigms in theory and methodology. Rural sociol. 60(4):585-606.

IITA (n.d.). Cowpea. http://www.iita.org/cowpea;jsessionid=77F383. FF296B6B1B70E2958F7BF5033FAccessed June, 2014.

Inaizumi H, Singh BB, Manyong VM, Adesina AA, Tarawali S (1999). Adoption and impact of dry-season dual-purpose cowpea in semi arid zone of Nigeria. In: Alene, V.M. Manyong, J. Gockowski and S. Abele. 2006 (eds). A framework for conceptualizing impact assessment and promoting impact culture in agricultural Reseach. A publ. Int. Instit. Trop. Agric. (IITA) Ibadan, Nigeria (29):1-80.

Ministry of Agriculture (MOA) (2008). "2008 cropping season annual report" Katsina State Ministry of Agriculture. Katsina, Nigeria: Government Printing Press. pp. 1-43.

Ogieve E (1998). Comprehensive agricultural science. Ibadan: Johnson Pub. Ltd.

Oladosu IO, Okunade EO (2006). Perceptions of village extension agents in disseminating agricultural information in Oyo agricultural zone of Oyo – State. J. Soc. Sci. 12(13):187-191.

Polson RA, Spencer DSC (1991). The technology adoption process in subsistence agriculture: The case of cassava in Southwestern Nigeria. Agric. Syst. (36):65-77.

Sasinga PC (1998). Adoption and social impact of agricultural technologies. A case of soya beans in Benue State, Nigeria. PhD Thesis, University of Ibadan, Nigeria

Unuigbe SE (2010). Adoption of natural rubber production recommendations among rural farmers' in Uhonmwode and Esan Local Government Area of Edo State. Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University Zaria, Nigeria.