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Effects of Farmers' Demographic Factors on the Adoption of Grain Storage Technologies Developed by Nigerian Stored Products Research Institute (NSPRI): A case study of selected villages in Ilorin West LGA of Kwara State.

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Abstract

This study was carried out to identify the factors that determine farmers' adoption of NSPRI grain storage technologies in selected villages of Ilorin West Local Government Area of Kwara State. Data used were collected from a total of 120 respondents who were randomly selected from 6 villages of the Local Government Area. 10% of all the farmers in each of the villages were interviewed. The variables examined in the study are sex, age, marital status, primary occupation, secondary occupation, level of education, number of dependents, years of farming, farm size, years of grain production, means of farm land acquisition and types of grain produced. Descriptive statistics and logistic regression model were used to analyze data. The inferential statistical tool used indicated significant relationship between sex and NSPRI grain storage technologies' adoption. Level of education and occupation were also significantly related to adoption of NSPRI grains storage technologies. This study recommends a wholesome dissemination model that will benefit both educated and uneducated farmer and also the involvement of farmers' group or representatives in participatory approach of technology development, introduction and use.

Keywords: Education, farming, occupation, participatory development, logit regression model.

1. Introduction

The increase in food production awareness in Nigeria and the world in general calls for an equal awareness on adequate storage of agricultural produce in order to achieve food security. Although the rate of growth in agricultural production stagnated and failed to keep up with the need of the increasing population of Nigeria, it has remained a crucial sector in Nigeria (Jubrin, 2007). Considering the contribution of agriculture to food and life security, storage is important. The necessity for food storage is food security. Food security; "access by all at all times to enough food for an active, healthy life" is an important commitment for every nation (World Bank Policy Study, 1998). The Nigerian food security programme is centered on three tier grain storage; strategic grain reserve, buffer stock and on farm storage which mandated farmers to store 85% of grain required for food security needs (Olumeko 1998).

Grains are staple food. They are consumed by humans and livestock. The major grain crops cultivated in Nigeria are maize, rice, millet, guinea corn, cowpea and soya beans. The Nigerian government in recent years has provided incentives to the rural farmers which has tremendously increased the grain production output per hectare in the rural area. A large proportion of the population continues to remain dependent on agriculture with production pattern being governed by food requirement for home consumption (Olumeko, 1991). The increase in yield through improved cropping systems and the introduction of high yielding varieties has re-emphasized the need for more resources to prevent post harvest losses (Adejumo and Raji, 2007).

The traditional grain storage structures in different parts of Nigeria are made of varying locally available materials. Usually, the types of locally available materials indicate the type of structures. The structures are usually made of paddy straws, split or whole bamboo poles, reeds, ropes, mud bricks etc. Most of the structures are usually constructed at the beginning of harvesting season. The time of harvesting vary slightly throughout the

agro-climatological zones usually between the month of August and January. The grains are stored either in threshed or unthreshed forms. (Igbeka and Olumeko, 1996).

The main objectives of grain storage are to maintain the quality of the produce for a long time. The basic requirements of every grain storage structure or system are to protect the grains from insects, rodents, and prevent deterioration of the grains by activities of microorganisms (Hall, 1970).

Storage is an important activity which enhances marketing efficiency by providing utility. Storage is particularly important in agriculture because agricultural commodities are not spread throughout the year. In this circumstance, there is need to meet average demand by storing excess supply during the harvesting season for gradual release to the market during off season periods. In the process, seasonal prices are stabilized. (Adejumo and Raji, 2007)

Over the years agricultural extensionists and economists have shown interest and studied the importance of farmers' adoption of new agricultural technologies. The concentration of some studies have been on the theory of adoption processes, some on identifying significant characteristics associated with adopters and non-adopters. Also some recent studies took a novel approach to investigate factors influencing technologies adoption while some others studied the rate of adoption of agricultural technologies. Generally, researchers and extensionists are often frustrated by slower than expected adoption levels of agricultural technologies. Slow rates of adoption cause a loss of potential benefit of sustainable practices to growers and the public. This is the main reason why so much attention has been given to try and understand what drives adoption of new technologies among farmers (Pannell *et al*. 2006 and Rogers, 2005).

Adoption of technology is the decision to make full use of a new idea as the best course of action available and involves a change in the orientation and behaviour of the farmer from the time he/she becomes aware of the technology to its adoption (Akubuilo *et al*., 2005). Oladele(2005), cited Rogers saying adoption of technologies refers to the decision to apply innovation and to continue to use it. Factors such as age, farming experience, training received, socio-economic status, cropping intensity, aspiration, economic motivation, innovativeness, source of information and agent credibility have been found to have positive and significant association with adoption (Rao and Rao, 1996). Moreover characteristics of change agents or advocates for the techno logy such as competency, credibility, communication ability and confidence are identified as factors which influence adoption (Rogers, 2005 and Okunade, 2006, Polson and Spencer 1991). Agbamu's (1993) finding states that farmers' knowledge of technology made contribution to its adoption. Arene, (1940) reported a positive and significant relationship between family size and adoption. Sanginga (1995) found a positive significant relationship between extension contact and farmers adoption of technologies. Burkman, (1987) postulated that opinions, needs and perceptions of potential adopters are the primary forces that influence adoption. According to Rogers (1995), technology characteristics are the degree to which a technology is perceived as being better than the idea it supersedes, (relative advantage) consistency with the existing values and experiences (compatibility), difficulty to understand or use (complexity), availability to use on a limited basis (triability) and visibility to others (Observability).

Technology means materials, artefacts, machines and other physical devices and products. Agricultural technology is understood in its broad sense to encompass plant varieties, animal breeds, farming practices, agricultural production, processing tools, specific mental constructs, cultural codes, forms of management and cooperation (Okali, 1994). Technology adopters are categorized into two; instrumentalists believe that the causes of change are in human aspirations and social conditions for change and improvement(Surry and Farquar, 1997) whereas determinists assumed that successful adoption is as a result of technology's superiority (Kaplan, 1996).

Post harvest facilities or appropriate storage technology has been the major problem of Nigeria agriculture for a long time. This has resulted in considerable waste of agricultural output and hence considerable loss to the economy. Nigeria is losing about 2.4 billion tonnes of food yearly to poor harvest and storage facilities (Olumeko, 1999). The losses were mainly in maize, rice, sorghum, millet, cowpea, groundnuts, soya beans, yam, cassava, plantain and fruits. In monetary term, the country is losing a total of ₦48 billion annually on post harvest losses. It has been observed that different localities in Nigeria have peculiar storage methods depending on the types of crop grown. (Adesida, 1988).

A technical survey of all the village level of grain storage structures existing in the Sudan Savannah Climate zone in Nigeria has been undertaken. Preliminary investigation result shows that the common grain storage structures

existing in this zone are the mud rhombus, thatched rhombus, underground pit and earthen pot and ware house storage. Most of these structures have defects. There is therefore need for some technical improvement on construction materials, elevation and loading/unloading facilities. The farmers show willingness in adopting new storage techniques provided such structures are cheap and affordable (Adejumo and Raji, 2007).

In line with the need to provide the needed technical improvement in grain storage structures, the Nigerian Stored Products Research Institute an organ of government saddled with the responsibility of reducing post harvest losses in food crops through research and development of appropriate technologies have introduce some grain technologies. These grain technologies that have been disseminated to farmers include the hermetic storage (for household storage of grains), maize crib for the storage of maize on cob (unshelled maize), improved ware house storage and inert atmosphere storage. (NSPRI guide, 2000 and Post harvest News, 2011) The grain storage technologies examined in this study include, air tight container (hermetic storage), crib (out door or on farm storage), grain stores, fumigants and polypropylene lined bag.

The main objective of this study was to examine demographic factors affecting farmers' adoption of selected NSPRI grain storage technologies in the study area in relation to the socio-economic characteristics of the farmers and suggest possible dissemination method that will improve the adoption of appropriate technologies by farmers.

2. Methodology

2.1The study Area

The study area was Ilorin West Local Government Area of Kwara State Nigeria. It is one of the 16 Local Government Areas in the State. The people are predominantly farmers and they produce crops like maize, cocoa, yam, cassava, guinea corn, beans, millet, tomatoes, pepper and vegetables. The respondents were farmers at different levels of grain production. They were selected randomly from six villages of the local government area namely, Olatunji, Oshin Kawu, Bude Are, Oshin Alagbado, Oshin Aremu and Idi –Omi.

2.2. *Data Collection*

Simple random sampling technique (selection without any plan or system) was used. A total of 120 farmers were interviewed from the selected villages. To be eligible for interview, the farmers must have been actively involved in farming activities in the area. The questions in the interview schedule were made simple and translated to farmers in their various local languages at the point of information and data collection. The interview schedule was directed towards the farmers. A well structured open ended and close ended set of questions were put in the instrument. Questions were asked on farmers' personal socio-economic characteristics. Other information provided by the farmers were; farmers' technology assessment, constraints and farmers' adoption of NSPRI grain storage technologies.

2.2 NSPRI Grain Technologies used by farmers

2.2.1 Hermetic storage

This is the use of air tight containers to store grains. This is usually used to keep enough quantities to be used by the house hold. Grains to be stored in air tight containers should be adequately dried to the level that will prevent mould growth. Containers used include plastic drums, used oil drums, pots and polythene bags.

2.2.2 Maize crib

This is used for the storage of maize on cob. It serves dual purpose of preserving the maize as well as providing a means of drying the maize. Maize can be harvested from the farm with the moisture content still high as it is usually the case in raining season maize production. The maize is stored in the cribs where the drying is done by the natural movement of air in the crib. The use of crib has been found effective in the Southern and central part of Nigeria.

However, maize must be treated with Actellic dust or Coopex dust to prevent insect infestation.

2.2.3 Grain stores

Shelled grains are stored in bags are arranged properly on pallets in the store. This is used for storing large quantity of maize. The bags in stalks are arranged such that adequate spaces are provided for treatment and monitoring of the consignments. Grains are protected from insect damage by admixing Actellic dust.

2.2.4 Polypropylene lined bags

Grains are stored in polypropylene lined bags to prevent insect infestations. This is used where quantities involved are small.

These technologies have been proven and have been in use by farmers for some time.

2.3 Statistical Analysis

The analytical tools employed in this study were both the descriptive and inferential statistics. The descriptive statistical tools used were frequency counts, percentages and means, while the inferential statistical tool used was the logit regression model. This was meant to show the relationship between the dependent and the independent variables in testing the null hypothesis. The logit regression model was used to analyze the factors which influence the adoption of NSPRI grain storage technologies.

The models used for the logit regression analysis are as follows;

X_1: Sex

X_2: Age

X_3: Marital status

X_5: Occupation

X_6: Level of education

X_7: Years of farming

X_8: Farm size

X_9: Farm acquisition

X_{10}: Years of grain production

X_{11}: Awareness

X_{12}: Types of grains produced

Y: Adoption

U: Random error

$Y = (X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8 X_9 X_{10} X_{11} X_{12} + U)$

This statistical tool measures association of dependent variable with each independent variable. This tool is usually employed when there are more than one independent variables associating with a dependent variable having numerical values.

2.3.1 Test of hypothesis

H_{01}: There is no independent or joint significant relationship between socio-economic status and adoption of NSPRI grain storage technologies by farmers.

3. Results and Discussion

3.1 Socio-economic profile of farmers on Adoption

Table 1 shows that respondents within the active age engage more in farming. Three- quarters (75%) of respondents engaged in farming are within the age range of 30-50 years. Younger people are more likely to adopt improved technological practices (Akubuilo, 1982). A significant percentage of respondents (75%) are married. Marriage serves as a means of generating family labour and since women and children are able to participate in crop production, processing and marketing, farming practices and use of technologies are related to marital status. Owokunle (1983), agrees that majority of land development scheme participants in Kwara state of Nigeria receive assistance from their wives and children to operate their farms. 68.3% of respondents were men while 31.7% were women. Jibowo (1992) said men engage more in farming than women in Western Nigeria. The table also shows distribution of respondents according to their level of education. More than two-thirds (70%) of respondents have formal education ranging from adult literacy, primary education, secondary education to tertiary education while 30% have no formal education. Agbamu (1993) stated in his findings that farmers' knowledge of innovations made contribution to adoption.

3.2 Effects of demographic factors on adoption of NSPRI's grain storage technology

The result of logistic regression model fitted is as summarized in Table 2.

The model Chi-square is the difference between – 2LL for the model with only a constant (base model) and - 2LL for the current model.

As shown in Table 2, the logistic model explains 70% of total variables in adoption status of respondents. The Chi-square statistics shows that three of the parameters included in the model were significantly different from zero at 5% level. At this level, all specified variables namely, sex, occupation and level of education significantly affected the adoption of NSPRI grain storage technologies. The study shows a significant relationship between occupation and adoption of technologies. A total of 70% had formal education and logistic regression analysis shows significant relationship between level of education and adoption

Expected β statistics suggested that odds in favour of adoption of NSPRI grain storage technologies increased by 0.459 for sex, 0.418 for occupation and 1.387 for level of education.

$Y= X_1\ X_2\ X_3\ X_4\ X_5\ X_6\ X_7\ X_8\ X_9\ X_{10}\ X_{12}+U$

Y= dependent variable; adoption

$X_1\ X_2\ X_3$---------- X_n= independent variables

This shows that for the farmers that have adopted the technologies their level of education plays an important role which is while the odds in favour of adoption of NSPRI grain storage technologies increased by 1.378 for level of education. This result is in agreement with previous studies as pointed out by Jibowo (1992), more men engage in farming activities than women confirming while sex is significantly related to adoption. This findings show there is need for introduction of adult education programme as extension package for farmers. Extension needs equal if not greater attention at farm level storage in relation to production. Incentives like subsidies, credits, inputs and loans should be extended to farm level storage so as to sustain the Nigerian food security programme.

4. Conclusion and Recommendation

This study has shown that farmers are aware of NSPRI's grain storage technologies. Farmers adoption of the technologies examined are related to a number of socio-economic factors of which the occupation, sex and level of education are the ones affecting the adoption of the technologies significantly. Since farming is a predominant occupation in the study area, farmers needed to be trained on effective use of the grain storage technologies that has been developed by the Institute. This may be through adult literacy classes. A wholesome dissemination approach which can be beneficial to both the educated and the uneducated should be employed to facilitate better adoption by

the farmers in the area. To ensure that research outputs are not confined to the shelves of researchers a participatory approach in technology development and use should be adopted. This will ensure that problems that are targeted by research emanated from farmers and as such solutions proffered are carried out with the interest of farmers at heart.

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Table 1: Percentage distribution of the respondents by personal and socio-economic characteristics (N=120)

Characteristics	Percentage
Age Range	
30-40	44.1
41-50	31.7
51-60	19.2
Above 60	5.0
Marital status	
Single	7.5
Married	75.0
Divorced	7.5
Widowed	10.0
Occupation	
Farming with other occupation	27.5
Farming only	72.5
Level of Education	
No formal Education	30.0
Adult literacy	9.2
Primary Education	24.2
Secondary Education	24.2
Tertiary Education	12.4

Table 2: Parameters Estimated for the Logistic Regression Model

Variable	β	S. E	Dt	Sig.	Exp$^{\beta}$
Sex	-0.7787	0.467	1	0.096*	0.459
Marital status	0.003	0.220	1	0.986	0.997
No. of dependent	0.047	0.054	1	0.388	0.954
Occupation	0.872	0.521	1	0.094*	0.418
Level of education	0.327	0.157	1	0.037*	1.387
Age	0.007	0.034	1	0.847	1.007
Farm size	0.040	0.097	1	0.678	1.041
Years of grain production	0.087	0.057	1	0.125	1.091
Constant	0.777	1.462	1	0.595	2.176

Model Chi- square 17.214

21og likelihood for the model 138.173

Overall case correctly predicted 70.0%

* Co-efficient significant at 5%

Source: Data Analysis, 2008