



## Assessing the factors influencing the utilization of improved cereal crop production technologies by small-scale farmers in Nigeria

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### Abstract

This paper identifies the major factors influencing the level of adoption of improved cereal crop production technologies in Nigeria. Intensity of extension contact, amount and use of credit, cooperative membership, all of which are institutional in nature, were found to be most important factors influencing the adoption of improved cereal crop production technologies. Data were collected from six Local Government Areas of Benue State through interview conducted among a total of 370 small-scale cereal crop farmers. The data were analyzed using descriptive and multiple regression statistics. Adoption of improved technology packages may, in part, be related to the way farmers receive the technologies introduced to them. The important factors in such a perception are the difficulties inherent in using a practice; the consistency or how adaptable the practice is in the context of the existing practices in which the farmers are already familiar with; and the expectations of the farmers using the practice.

**Keywords:** Small-scale farmers, innovation, adoption, Nigeria

### Introduction

The general food supply inadequacy in Nigeria led to breeding of high-yielding, disease-resistant and early maturing cereal crops. The National Accelerated Food Production Programme (NAFPP) was set up in Nigeria in 1972, to design, test and transfer technological packages for five crops, namely, rice, maize, sorghum, millet and wheat. The concerted efforts by the national and international research institutes have culminated into severally genetically improved cereal crops. These required some other associated technologies for optimum yield *viz.* application of fertilizers, herbicides or pesticides. However, the extent of sustained use and socio-economic factors influencing the use of the improved cereal with the associated technologies are not precisely known in Benue State (Odoemenem, 2007).

The major problem facing small-scale cereal crop farmers in the nation's "Food Basket" (Benue State) is the need to transform their agricultural industry from one depending on traditional inputs with low productivity to the one based on modern inputs with higher productivity. Benue State Government assists local farmers through the provision of fertilizers and seeds at subsidized rates and the services of agricultural extension workers, in addition to the availability of simple farm implements like machetes and hoes. In spite of these, there is a shortage of formal credit facilities to boost agricultural production (Onu, 2003).

One of the major challenges facing agricultural policy makers is the need for the investigation of those economic factors which contribute to the adoption of new and/or improved farm technology.

For farmers to adopt an improved agricultural technology, they pass through many stages such as awareness, interest, trial, evaluation and adoption. Previous work investigated that extension workers, mass media and individual contact with neighbours proved most effective determinants in the adoption process (William, 1969; Nweke & Akorhe, 1983; Monu & Omole, 1983).

Thus, agricultural development depends, to a great extent, on the willingness and ability of the small-scale cereal crop farmers to make use of new technology as developed in research laboratories. New innovations in agricultural development are of little value until they can be put to use for the economic and social well-being of the people involved.

The objectives of this: 1) determine the adoption level of improved cereal crop technology, 2) determine the socio-economic variables influencing adoption of improved cereal crop technology package, and 3) ascertain the source and uses of capital resource by small-scale farmers for the adoption of improved cereal crop production technologies.

### Methodology

#### *The Study Area*

Benue State derives its name from River Benue, the second largest River in Nigeria. The State, created in 1976, is located in the Middle Belt region of Nigeria, approximately between latitudes  $6\frac{1}{2}^{\circ}$  and  $8\frac{1}{2}^{\circ}$  N and longitude  $7\frac{1}{2}^{\circ}$  and  $10^{\circ}$  E. The State shares boundaries with five other states namely, Nasarawa, to the North, Taraba to the East, Cross River to the South-East, Enugu to the South-East, and Kogi to the West. The Southern

part of the State shares boundary with Republic of Cameroon. The State is also bordered on the North by 280 km River Benue, and is traversed by 202 km of River Katsina-Ala in the inland areas. The State has a total land area of about 30,955 square kilometers and administratively it is divided into 23 Local Government Areas. Benue State has an estimated population of 4,219,244, and is made up of 413,159 farm families (N.P.C 2006). Benue State has a tropical climate, which manifests two distinct seasons. The rainy season is from April to October while the dry season is from November to March. Annual average varies from 1750mm in the Southern part of the state to 1250 mm in the North. In the mountain region of Kashimbia area average rainfall rises up to 400mm. The hot season comes in mid April with temperatures between 32<sup>o</sup> C and 38<sup>o</sup> C with high humidity. Of relevant to this study is availability of formal credit institutions like Banks, and Cooperative societies in the rural areas as in the urban areas. However, the prevalence of informal credit institution in the rural areas is hoped to make up for the deficiency.

The system of cultivation by the farmers is mainly by the use of traditional hand-tools and implements especially hoes and cutlasses. Only a few farmers hire tractors for such operations as ploughing and ridging.

**Data collection**

A total of three hundred and seventy farmers were selected using multistage random sampling method and drawn from six Local Government Areas (LGAs) of Benue State. Structured questionnaire was used for the generation of data on the adoption index (summation of weights attached to each component technology) and socio-economic characteristics of the small-scale farmers. Descriptive statistics and multiple regression analysis were used for data analysis.

**Model specification**

The multiple regression is implicitly specified thus:  

$$Y_a = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + U_i$$

Where  
 $Y_a$  = Adoption index of improved cereal crop technology package;  
 $X_1$  = Extension contact;  
 $X_2$  = Amount and use of

- credit;
- $X_3$  = Use of information sources;
- $X_4$  = Farmers age;
- $X_5$  = Level of education;
- $X_6$  = Household size;
- $X_7$  = Cost of adoption (N/ha);
- $X_8$  = Cooperative membership;
- $B_0$  = Constant
- $b_1$ - $b_8$  = Coefficient ;
- $U_i$  = error term

**Results and discussion**

The sources of information on improved cereal crop technology package available to the farmers included extension workers, fellow farmers/neighbours and mediated information sources. The primary goals of these information sources are to create awareness by diffusing among potential adopters useful and practical information on the innovation and encourage its application.

Agricultural extension workers constitute the most important source of information to the farmers as 40.54% of them obtained information from the extension services (Table 1). The study revealed that 16.22% of the adopters got their information from the print media while 18.92% had their information on improved cereal crop technology package from the electronic media and 24.32% got their information through fellow farmers/neighbours. The results of the study showed that extension workers and fellow farmers/neighbours were more effective than the mediated information sources (Akorhe, 1981). The performance of the mediated information sources could be attributed to low level of education among the farmers, non-availability of newsletter, newspaper, and research bulletins in the rural areas as well as limited ownership of radio and television sets among the farmers.

The level of adoption, defined as the number of technologies used by a farmer (Akorhe, 1981, Nweke & Akorhe, 1983), varied among farmers. The improved cereal crop varieties available to the small-scale farmers in the area include, improved cereal crop seeds, fertilizer, pesticide and herbicide. These components of the improved cereal crops technology package, were adopted by the farmers in varying degrees. Thirty-two percent of the

*Table 1. Percentage distribution of adopters according to sources of information*

Sources	No.	%
Extension workers	150	40.54
Fellow farmers/neighbours	90	24.32
Radio farm programme	50	13.51
Newsletter	20	5.41
Newspaper	25	6.76
Research bulletins	15	4.05
Television farm programmes	20	5.41
<b>Total</b>	<b>370</b>	<b>100.00</b>

Source: Field Survey- 2008

*Table 2. Percentage distribution of the respondents according to the technological innovations adopted*

Technology	No.	%
Improved seed variety	120	32.43
Fertilizer	100	27.03
Pesticides	90	24.32
Herbicides	60	16.22
<b>Total</b>	<b>370</b>	<b>100.00</b>

Source: Field Survey- 2008

*Table 3. Constraints in increasing cereal crop production*

Constraints	No.	%
Labour	120	32.43
Timing	45	12.16
Disease	70	18.92
Fertilizer	55	14.86
Weather	20	5.41
Weed	20	5.41
Pest	30	8.11
Don't know	10	2.70
<b>Total</b>	<b>370</b>	<b>100.00</b>

Source: Field Survey- 2008

respondents adopted improved seed variety, while twenty-seven percent adopted application of fertilizer to cereal crop farm (Table 2).

Table 3 shows that 32% of the respondent farmers consider labour to be a constraint in cereal crop production. From this study, it was discovered that crop diseases (18.92%) and pests (8.11%) are additional constraints. Such diseases include blast, narrow brown leaf spot, rice smut and iron toxicity diseases. The pests are the birds, borers and rodents. Iron toxicity leads to red dish-brown discoloration of the leaves and sterile particles, thus causing yield reduction, whereas birds reduce yield by attacking the plants from the milk stage until harvest. Borers attack rice in large number causing stem damage and dead tillers.

The farmers complained of scarcity of fertilizers in their local markets. However, they reported that local cereal crop variety did not respond well to fertilizer when compared to improved cereal crop varieties. The next important constraints to cereal crop production as perceived by the respondents are timing (12.16%), weather (5.41%), and weed (5.41%). About 3% of the respondents did not have knowledge of any constraint.

In order to determine the factors which influence technology adoption, the level of adoption index of improved cereal crop technology package was regressed on Extension Contact, Amount and Use of Credit, Use of Information Sources, Age, Level of Education, Household Size, Cost of Adoption, and Cooperative Membership (Table 4). The coefficient of extension contact is significant at the 5% level and together with other significant variables accounted for 54% of the variability in the level of technology adoption. The factors are discussed below:

#### *Extension contact ( $X_1$ )*

The extension contact variable had a positive coefficient, indicating that adoption level increases with increase in the intensity of extension services offered to farmers. The constant meeting/frequency of extension contact between the extension personnel and the farmers would enlighten the latter and create better awareness for the potential gains of improved agricultural innovations.

#### *Amount and use of credit ( $X_2$ )*

There was also a positive relationship between the amount of credit received and adoption level. This suggests that farmers who received credit adopted more

technologies than those who did not. Thus implying that availability of credit facilitates technology adaptation (Odoemenem, 1992). Sustained use of improved cereal crop technology package involves purchase of the better inputs embodied in a new technology, expenses on external labour needed for the use of these inputs and improved management practices. Credit is therefore required to finance these incidental expenses.

*Table 4. Regression results of the factors influencing the level of technology adoption in cereal crop production in Benue State*

Variables	Coefficients	T-Value	SDE
Extension Contact	0.0256*	3.459	0.0551
Amount and use of credit	0.0003*	3.180	0.0013
Use of information sources	0.0473*	3.290	0.0441
Farmers age	-0.0006	-0.753	0.2322
Level of education	-0.1170*	0.688	0.0482
Household size	-0.0071	-3.323	0.1262
Cost of adoption (N/ha)	0.2021	2.023	0.3011
Cooperative membership	0.1011*	2.769	0.0365
R <sup>2</sup>	0.5421		

*Source: Field Survey- 2008; \*Coefficient significant at the 5% level; SDE= standard error*

#### *Use of information sources ( $X_3$ )*

Use of information sources was indexed by access to and use of mediated information sources. These included radio and television on agricultural programmes, bulletins, newsletters, and newspapers. The *a priori* expectation was that there would be a positive

relationship between the adoption index sources. Theoretically, the mass media are the most important source among the farmers. The coefficient of use of information sources was positive.

#### *Farmer's age ( $X_4$ )*

The importance of age lies in its effect on the adoption of innovations and the processing of information. It is well known that, in general, the older the farmers the less their willingness to try new innovations or take risks. The negative coefficient of age (regression equation) indicated that age was negatively correlated with cash income.

In the process of growing old, individual undergo social, psychological and physical changes. These changes results in the reduction of involvement with others and decline in physical energy (Phillips & Sternthal, 1977; Fabyan (1999). As a result, a substantial portion of their interpersonal contacts are with members of their extended families and friends.

#### *Level of education ( $X_5$ )*

Education had a very significant impact on the farmer's cash value. The expectation is that positive regression coefficient would imply that the higher the education level, the more the cash income. Generally, the low level of education of the farmers is inimical to the adoption of innovation, especially one that is complex. The National Economic Empowerment and Development Strategy (NEEDS) programme of the Government involves a package of improved planting materials, fertilizer application, pest and diseases management and irrigation where applicable. With lack of formal education, information cannot be passed to these farmers through

the print media or mass media, except through personal contact methods, personal discussion, result demonstrations, and visual aids.

#### *Household size ( $X_6$ )*

The household size variable had a negative coefficient, suggesting that adoption level was lower among large than small-sized households. Households with larger size tend to attach greater importance to food security than those that are small in size. This, also, depends on age structure and available farm labour among members.

#### *Cost of adoption ( $X_7$ )*

The cost of adoption of improved cereal crop technology package is the cost over and above the cost of producing local variety in an equivalent area of land. It is the additional cost due to use of improved cereal crop technology package. It is measured in Naira (Nigeria's currency) per hectare. The coefficient was negatively related to the cost of adoption.

#### *Cooperative membership ( $X_8$ )*

Cooperative membership had a positive coefficient. This implies that farmers who are members of cooperative organizations adopted more technologies than non-members. Cooperative membership enhances access to information on improved technologies, material inputs of the technologies such as fertilizers and chemicals, and credit for the purchase of inputs and payment of hired labour (Odoemenem, 2007).

### **Conclusion**

The most important factors influencing cereal crop technology adoption were extension contact, amount and use of credit and cooperative membership, all of which are, institutional in nature. The fact that credit is an important factor in determining adoption level points to the need for strong credit components in programmes designed to achieve small-scale adoption of improved technologies. It implies that credit is necessary for the purchase and use of new technologies by resource poor farmers. It is easier for Government assistance to reach widely dispersed small-scale farmers when they organize themselves properly into coherent groups such as cooperatives.

Agricultural innovations that are profitable to the farmers are readily adopted. The adoption of the innovations can be seriously hampered by poor distribution of technological inputs. Agricultural technologies that are not easily available at moderate prices are hardly adopted.

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