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FACTORS INFLUENCING PARTICIPATION OF OUTGROWERS IN CERTIFIED HYBRID MAIZE SEED PRODUCTION IN GIWA LOCAL GOVERNMENT AREA OF KADUNA STATE AND ITS POLICY IMPLICATION FOR FOOD SECURITY.

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ABSTRACT
The study analyzed factors that influence farmer's participation in hybrid maize seed production in the study area. A Logit analysis was used to analyze factors influencing farmer's participation in hybrid maize seed production while T-test was used to analyze if there is difference in the mean yields of farmers growing hybrid seeds and those involved in local maize production. Structured questionnaire was used to collect data from farmers based on the 2005 cropping season activities while on the spot observation data were also collected. Results of the Logit analysis has shown that age of farmers, educational qualification and expectation of prompt payment by the contracting company were the factors that facilitate farmers' participation in hybrid production in the area. Results have also shown that farmers that grow hybrid had yields that were significantly difference than those growing local varieties in the area. This is proof evidence that the hybrid maize technology with complementary packages holds promise for helping in solving the problem of food insecurity in rural areas and the country at large if its production is supported and encouraged. There should therefore be a deliberate policy by government at all levels, non-governmental organizations and the international organization to support and encourage farmers to get involved in the production of hybrid maize as a better alternative to the local maize varieties.

Keywords: Hybrid maize seed, Outgrowers, participation, Food security

INTRODUCTION
Maize is the third most important cereal crop in the world after rice and wheat (FAO, 1997), and the second most important cereal crop in the farming systems of the Guinea savanna of Nigeria (Tarfa *et al*, 2004). Among these three crops, maize has been found to have the highest average yield per hectare and a good source of energy for human and animal and has been discovered to be very easy to process and readily digestible (Okoruwa and Kling, 1996). In Nigeria, maize is very important cereal crop in the farming systems of the Guinea savanna and about 4.5 million tones was produced in the country from 3.5 million hectares of land in 1983 with the Guinea savanna accounting for 70 percent of this total production (Ewenzor *et al*. 1989). In 1984, land area under maize cultivation in Nigeria was estimated to be about 653,000ha and it has rose to about 5.4mha in 1994 and lately decreased to 4.5mha in 2004 (F. M. A., 2005). A number of factors could have been responsible for the decrease in production and productivity. These include inadequate use of fertilizer, lack of use of herbicides and pesticides, increased level of abiotic constraints, the fact that input prices have been more than triple the normal prices in the last ten years and little or no use of improved seeds (Ajala, 2005). It has also been observed recently that global warming and its associated effects have changed rainfall pattern leading to erratic and unreliable rainfall in some cases resulting in drought.

Furthermore, the little or no use of fertilizer and organic manure has resulted in soils becoming poorer with an opportunistic expansion of striga infestation problems and with the continuous growing of crop for cash, there is now a built and carryover of pest notably stem borers from one crop to the next within the same environment (Ajala, 2005).

Unfortunately, the spread of modern maize production technology in most of these maize producing areas especially northern guinea savanna, which provides the greatest potential, has been much less dramatic. In most areas, yields have been below 2 ton/ha. In fact, Nigeria's average yield is 1.36 ton/ha which is just about $^{1/}3$ of the worlds average of 4.13 ton/ha (FAO, 1997).

However, it has been found from demonstration conducted by IITA, National Rice/Maize Centre and Sasakawa Global SG2000 among others that yield levels of more than 3 ton/ha are achievable with the use of improved seeds, pesticides and adequate fertilizer application (Ajala, 2005). The way out of low productivity of maize is the adoption of improved seeds with other packages that go with the technology. However, production and use of improved seed depends on the availability of the improved, high yielding and well-adapted varieties (Muhammed, 2002). This is important since quality seed is one of the primary requirement for establishing food security to farmers and the nation at large (FAO, 1999). One of the problems militating against the use of improved seeds by farmers is the non availability of the improved seeds since their production were originally done by the few big commercial farms that are unable to produce enough to go round. The exclusive production of these seeds by big farms also made small farmers to consider improved seeds as foreign activities that are not made for their type of farming activities and participation. To solve this problem, many seed companies, Premier Seeds inclusive have engaged the services of rural farmers in Kaduna state in the production of improved seeds of various grains but maize grains in particular. This is a wise decision since this arrangement will also serve as an extension activities thereby exposing not only the farmers involved but other farmers in the same locality to the advantages offered by the adoption of these improved seeds by participating farmers. It is also hoped that the involvement of local farmers in the production of this hybrid seed will remove the erroneous belief that its production is the exclusive preserved of the rich farmers and will consequently encourage availability of the seed to desiring rural farmers as well as its policy implication for food security in the country as well as the West African sub-region.

However, since the commencement of this contract production arrangement between Premier Seeds and rural farmers, there has been little or no studies done to evaluate factors influencing these farmers participation in these contract arrangements and the impact it has had on farmers' productivity in the area. This study attempts to unraveled factors influencing farmers' participation in hybrid maize seed production in Giwa Local Government Area and the impact of the participation on farmers' productivity in the area.

MATERIALS AND METHODS

Study Area

This study was carried out in three villages located in Giwa Local Government Area of Kaduna State. These villages are Tumburku, Maje and Madugu. The entire State is located between Latitude 10^0 and 11^0 31' N and Longitude 7^0 30' and 9^0 E of the prime Meridian. The State is located within the Savannah ecological region of Nigeria and the vegetation of the entire state falls within the Guinea Savannah zone. With an estimated land area of 43, 000^2 Km (i.e. about 4.3 million ha), the state has a cultivable area of about 3.44 million ha while the total area of about 3.223 million ha is presently being cultivated (Anonymous, 1994).

The climate is generally characterized by alternating dry and wet seasons and the rains usually commence in April/May and end in October, while the dry season sets in late October and ends in March of the following year. The rainfall length varies from 150 days (in the

northern parts) to 190 days (in the southern parts) of the zone. The mean annual rainfall ranges between 1107mm -1286mm while relative humidity varies between 20 and 40 percent in January, and rising to between 60 and 80 percent in July. The mean annual temperature also varies between 34^0C and 28^0C. Crop farming is practiced in upland and lowland (fadama) areas. The cropping in upland is mainly under the rain fed condition while in the lowland, both wet and dry season farming are being carried out. The upland farming emphasizes mainly cereals (sorghum, maize, millet and rice); legumes (including cowpea, groundnut, and soybeans); and fibre crops (mainly cotton). The lowland farming involved mainly vegetable crops such as tomatoes, pepper, leafy vegetables and onion while rice is also cultivated in the flood plain of the fadama.

Sampling Procedure and Data Collection

Cross-sectional sample survey was adopted to generate data for this work and the population for the study comprised hybrid seed producers in Giwa Local Government Areas of Kaduna State as well as some farmers producing local varieties of maize. The list of outgrowers was obtained from the Premier Seed and this forms the sampling frame for the research. Three villages were selected for their great involvement in the outgrowers' participation of Premier Seed programme. These villages are Tumburku, Maje and Madugu. A sample of 30 made up of 20 growers and 10 non growers were randomly selected from each of the village making up a total of 90 respondents.

Primary and secondary data were used for this work and the primary data were collected based on the 2005 cropping season using structured questionnaire and on-the-spot observation of the daily activities of the farmers during the cropping season and crop output data during the period. The cropping season in the study area commences in June and ends in early October and data for this study were collected during this period. The secondary data were from monograph, published books and information available with the premier seed that are relevant to the study. The data collected focused on socioeconomic variables such as age, educational status, years of experience in farming, production goal and economic and social constraints. Others are the relationship with growers and the Premier Seed, factors affecting production processes. These data were coded and consequently analyzed.

The conceptual framework and modeling the adoption of farmer's participation in premier Hybrid maize outgrower seed production

The conceptual framework of this study is based on a new approach to consumer theory developed by Lancaster (1966) and modified by Somda *et al* (2002). It is assumed that adoption is an activity in which technologies, singly or in combination, are inputs and in which the output is a collection of characteristics. The neoclassical economic theory assumes that each decision-maker is able to compare two alternatives *a* and *b* in the choice set using a preference-indifference operator $\geq$. If $a \geq b$, the decision maker either prefers *a* to *b*, or is indifferent. Utility rankings are therefore assumed to rank collections of technology indirectly through the characteristics that they possess. A given agricultural technology embodies a number of important characteristics that may influence adoption decisions.

In addition, given characteristics of technology, other socio-economic and demographic characteristics of the farm household may influence technology adoption. Then the observed adoption choice for an agricultural (e. g. participation in premier hybrid maize outgrowing) is likely to be the result of a complex set of interaction between comparable technologies and farmers' socio-economic and demographic characteristics.

A Logit model was used to model the participation of farmers in Premier seed hybrid maize production. Let the perceived benefits derived from participating in hybrid seed production be represented by b(co) and b(o), respectively. Assume that B_i is the discounted

benefit from production with and without hybrid maize seed, and I_i is the 'utility index' of participating in hybrid maize seed production for individual ith. The index I_i is a function of the socio-economic characteristics of the farmer and the perception that he has on the participation in hybrid maize seed compared with other maize seed varieties. The farmers' behaviour towards participation in hybrid maize seed is described by Eqs. (1-3).

$I_i = X'_i\beta$ (1)

$B_i \leq 0$ if $I_i \in (0, -\infty)$ (2)

Bi > if Ii Є (0, + ∞) (3)

Where *Xi* is the vector of socio-economic and demographic characteristics of the farmers and his perception of the participation in hybrid maize seed production as compared with producing other maize seed varieties; β is a vector of parameters to be estimated.

As the value of the explanatory variables X_i change, the value of the index I_i varies over a real number line. The larger the value of I_i, the greater the utility individual I receives from choosing to participate in hybrid maize seed production, and thus the greater will be P_i, the probability that the individual *i* adopt participation as an option. That is discounted benefit from producing hybrid maize seed is greater than zero (Eq. (3)). The observed outcome is that farmer will participate in hybrid maize seed production. On the other hand, if the utility index which measures the individual's 'propensity' to participate in hybrid maize seed production lies between zero and minus infinity (Eq. (2)), the discounted benefit from participation in hybrid maize seed production will be negative or equal to zero, and farmers will not participate in hybrid maize production.

The Logical function used to model the dependent variable is defined as follows:

$$Pi = F(I_i) = F(X'_i\beta) = \frac{1}{1 + \exp(-X'_i\beta)} \quad (4)$$

The parameters are estimated by maximizing the value of log-likelihood stated as follows:

$$L(\beta) = \sum(Ii \ln(F(X'_i\beta)) + 1 - I_i) \ln(1-F(X'_i\beta)) \quad (5)$$

Where F (.) represents the cumulative normal density function.

Empirical Modeling

The estimation of the empirical models is discussed below. The model is based on Eq. (1) from which subsequent derivations is made using LIMDEP software (Greene, 2002). The dependent variable Y_i was chosen as binary variable with 1 for those farmers participating in Hybrid maize seed production and 0 for farmers growing farmers' varieties of maize seeds.

The explanatory variables in the model used are respectively, age of farmer = X_1, educational qualification of the farmer = X_2, average distance from contract company = X_3 and expectation of prompt payment by farmer from the contract company = X_4. The age of the farmers, educational qualification of farmers and distance of farmers to the contract company were all numeric while expectation of prompt payment by contracting farmers was binary response which was taken to be equal to 1 if farmers have positive expectation of prompt and better payment and 0 of a farmer say no to expectation of prompt payment. The results of the study are as presented in the following sections.

RESULTS AND DISCUSSION

Socio-economic characteristics of farmers in the study area

The socio-economic characteristics of farmers is very important in determining the way farmers react and make decisions about farming and other aspects of their lives. Tables 1 to 4 present some of these socio-economic attributes that are important here. From Table 1, it was discovered

all the farmers sampled had one form of education or the other. The table shows that majority of them, about 59 percent had Quranic education which is a form of religious education that can enable them read some instructions written in Arabic language. This means that a few farm chemicals, seeds and fertilizers with Arabic instructions could be understood by these farmers. On the other hand, about 26 percent of these farmers claimed they had primary education while about 13 percent claimed they had secondary education and about 2 percent had tertiary education. The implication is that about 41 percent of these farmers have western education and could therefore read and understand farm production instructions. It also means that this group of farmers could easily be opened to understanding and accepting production innovations that could enhance better productivity.

From Table 2, it was also found that all the farmers sampled were very experience in farming. About 13 percent of the farmers claimed they had 7 years experience in farming, about 17 percent had 12 years experience in farming, about 40 percent had 15 years experience in farming and about 28 percent had as much as 20 years of experience in farming. Experience in itself could contribute positively or negatively to technology adoption while at times, farmers that are already used to doing things in a particular old way may find it difficult to change and as such experience could become an impediment to adoption of innovation. However, experienced can also contribute positively since farmers that have seen and experienced the advantages of such innovations can share their experiences thereby encouraging other farmers to adopt.

From Table 3, it was found that only about 13 percent of the farmers were memberships of cooperative organization. Belonging to such association could be very helpful in farmers adopting an innovation since membership enhance empowerment and consequently empowered members find it easy to have the wherewithal to enable them adopt innovation. However, it was found here that majority of the farmers are yet to embrace becoming members of cooperative organization. From Table 4, 64 farmers representing about 71 percent of the respondent sampled planted hybrid maize while only 26 farmers representing about 30 percent planted farmer's varieties. The inclusion of farmers with local varieties was to enable us make comparison between the yields of the hybrid and the farmer's varieties. The model results and the yields comparison is presented in the following section below.

Table 1: Educational level of respondents

Level of education	No of farmers	Percentage of Total
Quranic	53	58.9
Primary	23	25.6
Secondary	12	13.3
Tertiary	2	2.2
Total	90	100.0

Table 2: Respondents year of experience in farming

Year of experience in farming	No of farmers	Percentage of Total
No response	2	2.2
7	12	13.3
10	15	16.7
15	36	40.0
20	25	27.8
Total	90	100.0

Table 3: Respondents membership of cooperative organization

Membership	No of farmers	Percentage of Total
Yes	12	13.3
No	78	86.7
Total	90	100.0

Table 4: Distribution of respondents according to types of maize produced

Types of crops	No of farmers	Percentage of Total
Hybrid Maize	64	71.1
Other maize types	26	28.9
Total	90	100.0

Results of Logit model estimation on farmers' participation in hybrid maize seed production

The results for farmers participation in hybrid maize seed production is presented in Table 5. The analysis shows that farmer's age (X_1) and expectation of prompt payment (X_4) by contracting company to the participating farmers were significant at 5 percent level of significant. Usually, age is a very important factor that can have serious effect on decision making. At times, it could have negative or positive effect. In the rural areas where most people are illiterate, age at times could have negative effect since old people that are already used to a particular way of doing things especially farmers that are already used to local seed varieties that requires little or no fertilizer to give little to moderate yields they could produce may not be interested in producing hybrid or improved seeds that would require fertilizer application before they could perform well. In some cases, among the educated individuals, with age, people tend to be more enlightened and hence able to understand innovation quickly and consequently adopt. In the study area, as earlier shown in Table 1, people in these communities are moderately educated and as such it was found that education among these people have significant influence on farmers adoption and participation in the production of premier hybrid contract seed production.

In the same vein, it was equally found that the expectation that there would be prompt payment for the hybrid maize seed produced by Premier Seed, the contracting company to the participating farmers was another inducement that encouraged the participating farmers to embrace the contracting arrangement. Farmers like other people in business are interested in having good market for their products and the fact that these farmers are aware that whatever

quantities of maize seeds produced would be moped up by the contracting firm enable them make quick decision to participate. We can therefore conclude that expectation of prompt payment of good price was an important determining factor in farmers' participation in hybrid maize production in the study area.

Moreover, it was also found that education (X_2) was a very important factor in farmers' decision to participate in hybrid maize production in the area as this variable was found to be equally significant at 10 percent. Acquisition of education makes individuals to be enlightened and open minded to innovation and it was therefore not surprising that education was an influential factor here in farmers' decision making process. From the analysis earlier presented in Table 1, farmers in these communities are fairly educated and this might be the reason why education has contributed to many of them accepting to participate in this important promising and high yielding maize technology. However, it was found from the analysis shown in the Table 5 that the distance of farmers' farms to the contracting company has nothing to do with farmers participation in hybrid maize seed production and as such, it is expected that if farmers in further away locations are approached to participate in hybrid maize seed production, they might willingly take decision to participate. It shows clearly that distance may not be a barrier to farmers' adoption of this high yielding maize variety.

Table 5: Estimated Logit Model for participation of Farmers in Certified Hybrid maize Seed Production in three villages in Giwa LGA

Variables	Coefficients	Standard error	T-ratio	P-value
Age of farmer X_1	0.118979**	0.40043695E-01	2.971	0.0030
Educational qualification X_2	0.729687*	0.39724852	1.837	0.0662
Average distance to contract Company X_3	129507769^{NS}	0.85666867	1.512	0.1306
Prompt payment to growers X_4	5.525386**	2.1684798	2.594	0.0095
Model chi-sq = 83.64***				
Log likelihood function = -12.28				
Restricted log likelihood = -54.10				
N = 90				

*Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level
NS = Not significant

Impact of the hybrid maize seed planting on yields and policy implication for food security

The independent T-test was carried out to show if there was any significant difference between the yields of farmers planting local maize varieties and those participating in the hybrid maize seed planting in the study area and the results as shown in the Table 6 revealed that there was a significant difference in yield at 1 percent level of significance with farmers planting hybrid maize seed having an average yield of 2937.50 Kg as against the local ones with 2576.92 Kg. It was actually surprising that the local varieties planted by these farmers could give high yield as recorded in this study. Most of the local seeds being planted by farmers these days are usually no longer pure local since they must have been mixed with improved ones due to the proximity of the study area to major research Institute like Institute for Agricultural Research (IAR), Zaria. However, it is very clear that the pure hybrid maize seed provided for these farmers by the contracting company performed better than the local ones being planted by the farmers. It is therefore very clear that hybrid maize is one of the best ways of improving farmers' productivity if effort is made to complement it with necessary packages like fertilizers and advice on

appropriate planting methods that will encourage adequate plant population so that optimum yields could be achieved.

As a policy, government, non-governmental organization as well as international organizations interested in solving the problem of food insecurity in Nigeria in particular and sub-Saharan Africa in general should encourage farmers' participation in the adoption of this important technology of hybrid maize production with a view to arresting food insecurity problem. This policy has worked in Malawi and some other part of the world and will work here if religiously and diligently executed.

Table 6: Results of independent T-test comparison of certified hybrid yield per ha of participating farmers with farmers growing other varieties of maize seed in Giwa LGA

Variables	Participants	Non-participants	T-statistic
Mean yield/ha	2937.50***	2576.92	5.2
Standard deviation	500.00	1026.57	
Observations (N)	64	26	

***Significant at 1% level

CONCLUSSION AND RECOMMENDATIONS

This paper shows that there are factors influencing farmers' participation in certified hybrid maize seed production in the study area. It was discovered that most of the variables tested in the model have their coefficient to be statistically significant in explaining farmers' decision to participate in hybrid maize seed production. The results have clearly demonstrated that farmers decision making are based on certain socio-economic factors. It also demonstrated that farmers are interested in economic gains apart from the usual assumption of subsistence living in making decision on what to produce and in adopting whatever technology is being sold to them. More so, the results also have demonstrated that hybrid maize seed holds the key to solving the problem of food insecurity prevalent in most of our rural areas if farmers are given the necessary encouragement and complementary packages to adopt its production. The study therefore recommend that there should be deliberate policy by all tiers of governments in this country to encourage and promote hybrid maize cultivation across the length and breath of this country as a way of promoting national food security since maize is an important staple food in the country. Farmers should also be encouraged to join cooperative organizations to facilitate group actions that could enable them benefit from governmental, non-governmental and international organizational supports that could expose them to innovations as well as the financial supports that will enhance adoption of such innovations.

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