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Full Length Research Paper

Evaluation of the use of certified maize seeds by farmers in the Ashanti Region of Ghana

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This study was conducted to examine key factors that explain the use or non-use of certified maize seeds by farmers in the Ejura-Sekyedumasi Municipal Area in Ghana. A standardized structured questionnaire was used to interview 106 farmers selected from five (5) communities through a simple random sampling method. The data were analyzed using descriptive tools such as frequency distribution tables, percentages and arithmetic mean. Binary logistic regression model was used to examine the main factors that determine the use of certified seeds. Even though 95% of maize farmers were aware of certified seed maize, only 27% of them used certified seeds to produce maize. Results from the study showed that farm size, level of education, extension contact and access to credit were the main factors that significantly influenced the use of certified maize seed by farmers. Whereas educational level, extension contact and credit access had positive effect on the probability of using certified maize seeds, farmers with larger farm sizes were found to have a higher probability of not using certified seeds to produce maize. To improve the uptake of certified seeds among farmers, the study recommended improved extension-farmer contact, continuous sensitization and education of farmers on the benefits derived from certified seeds and improved access to credit for farmers.

Key words: Certified seeds, maize, logistic regression.

INTRODUCTION

Maize is the largest staple crop in Ghana and contributes significantly to consumer diets. It is the number one crop in terms of area planted and accounts for 50-60% of total cereal production. Overall maize production in the country has remained relatively static both in terms of area planted and volume harvested because of reliance on traditional farming methods (MiDA, 2009). However, as the number one staple crop in Ghana, domestic demand for maize is growing. Maize demand was projected to grow at annual compound rate of 2.6% between 2010 and 2015. The country is not self-sufficient in this most important staple crop, as Ghana has experienced average shortfalls in domestic maize supplies of 12% (MiDA, 2009). Maize yields in Ghana average approximately 1.5 metric tons per hectare compared to attainable potential of 5.5 metric tons per hectare. Therefore, the Government of Ghana has an interest in increasing production of maize to meet the country's growing demand for the crop and to improve food security.

Quality seeds of improved crop varieties and other agricultural inputs are required to make this happen, and also to transform Ghanaian agriculture from its subsistence level to a profit-making enterprise. Seed is an important resource in crop production. Farmer saved seeds preserved from varieties best adapted to the environment, are the

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main planting materials used by many smallholder farmers (GRAIN, 2007). Figures compiled by GRAIN indicate that most developing countries still mainly depend on farmer-saved seeds (FSS)– in particular regions with a large peasant farming sector, such as South Asia and sub-Saharan Africa, where typically 80–90% of planting materials are produced on-farm. The limitations of this traditional source of seed are low yield and lack of guaranteed seed quality; after a short period of cultivation, mix up of varieties of seed occurs, leading to loss of desirable traits. Despite these limitations, farmers continue to use more of the farmer saved seeds and limited quantities of certified seeds (GRAIN, 2007).

Seed certification is a quality assurance system whereby seed intended for marketing is subject to official control and inspection. At its simplest, the system certifies that a sack, packet or box of seed contains what it says on the label and that the seed was produced, inspected and graded, in accordance with the requirements of a Certification Scheme (*http://www.agriculture.gov;accessed in January 2013*). The immediate objective of seed certification is to supply high quality seed to farmers and other growers, which is true to identity, high in purity and germination capacity and free from certain pests and diseases. Seed quality is most important in crop production, as high quality seed is essential for good crop yields and good returns, and minimises the likelihood of crop failure. The seed certification system is an official system supported by national legislation and international protocols to ensure that seed is produced, multiplied and marketed according to predetermined standards and systems while maintaining the genetic integrity of the product (*http://www.agriculture.gov; accessed in January 2013*).

One of the major causes of low maize productivity in West Africa is insufficient use of certified seeds of improved maize varieties (CIMMYT, 1998; 2002). International and national research institutes are continuously developing new maize varieties which are certified for farmer use by accredited agencies. However, these certified seeds sometimes do not reach farmers at all, or if they do, they get to them late. Morris et al. (1999) reported that certified seeds of improved crop varieties developed by agricultural research institutes very often fail to get adopted or used by farmers. According to Langyintuo et al. (2008), seed providers attribute the low adoption rate to a number of factors including high cost of certified seeds, high cost of inputs like fertilizer, unavailability of certified seeds in farming communities, illiteracy and lack of awareness among farmers. Others include, lack of access to credit, distance from home to the source of certified seeds, lack of association with local organizations and poor extension coverage due to limited financial and human resources.

The low level of certified maize seed uptake does not only affect farmers and consumers. It also affects seed producers. It is reported that about 60% of all private seed producers in Ghana produce certified maize seed (*Personal communication with SeedPAG executives*). Low uptake of these certified materials also means financial losses to such private producers and job losses as well. To be able to improve maize production in the country and to ensure the sustenance of private seed businesses in Ghana, efforts must be made to step up the current low level of usage of certified seeds by farmers. However, there is limited empirical information on the key factors that explain the use/non-use of certified maize seed in Ghana.

The main objective of this study was, therefore, to identify and evaluate the factors that determine the use of certified maize seeds by farmers in the Ejura-Sekyedumasi Municipal Area in the Ashanti Region of Ghana.

METHODOLOGY

Study area, sampling and data collection

The study was conducted in the Ejura-Sekyedumasi District. The District covers an area of 1,782.2 sq. km which is about 7.3% of the total land area of the Ashanti Region (www.Mofa.gov.gh/site accessed in February, 2013). The district is a major agricultural district in Ghana noted for the production of maize, yam, cowpea and different vegetables. It is the largest producer of maize in the Ashanti Region and 3rd largest in Ghana. In 2007, the district produced 28,861 metric tons of maize on 13486 ha (MoFA, 2007). The district has about six (6) registered private seed producers and a number of agro-input shops that sell certified seeds together with other agricultural inputs (*Personal communication with District MoFA officials*).

Both primary and secondary data were used for the study. Primary data were collected from maize producers and secondary data were obtained from the Ministry of Food and Agriculture (MoFA). The population of the study was all maize farmers in the district. A sample of 106 farmers was selected from five (5) communities through a simple random sampling approach. About 21 maize farmers were selected from each of the five communities (that is, Miminaso, Ejura, Babaso, Attakura and Ashakoko). A standardized structured questionnaire was used to elicit primary data from the selected farmers through personal interviews. The questionnaire sought information on farmers' profile, maize production activities, the use of certified seeds and the reasons for use or non-use of certified seeds.

Data analysis

Under descriptive analysis, frequency distribution tables,

percentages, charts and arithmetic mean were used to describe the data and to examine the level of farmers' awareness about certified seeds and proportion of maize farmers using certified seeds. Binary logistic regression model was used to examine the main factors that determine the use of certified maize seeds by farmers.

Mathematically, logit probability is represented by:

$$\phi(z_i) = e^{z_i}/(1+e^{z_i}) = 1/(1+e^{z_i}) \qquad -\infty < Z_i < \infty \quad \ldots\ldots (1)$$

Where:

$Z_i = ßX_i$; ßisa vector of unknown coefficients; $X_i$is a vector of factors/characteristics of the i^{th} farmer; $\Phi(ßX_i)$ is the probability that the i^{th} factor will affect farmer's use of certified maize seeds.

The probability that a given factor affects farmer's decision to use certified seed is the area under the standard normal curve between $-\infty$ and $ßX_i$. The larger the value of $ßX_i$, the more important the factor is in affecting farmer's decision-making. The change in $\Phi(ßX_i)$ relative to the change in X_i is given by:

$$\frac{\delta\phi(\beta x)}{\delta x_{ij}} = \left[\frac{\delta\phi}{\delta z_i}\right]\left[\frac{\delta z_i}{\delta x_{ij}}\right] = f(z_i)\beta_i \qquad \ldots\ldots\ldots(2)$$

Where $f(Z_i)$ is the value of density function associated with each value of the underlying Z_i index.

Farmers' decision to use certified maize seed is influenced by a vector of factors, X_i, including farmers' characteristics, socio-economic factors and institutional/technical factors.

The logit model was specified as:

$$\log\left[\frac{P_i}{(1-P_i)}\right] = \beta_0 + \sum_{ij=1}^{nk}\beta X_{ij} + \varepsilon_i$$

Where:

P_i = Probability that a farmer uses certified maize seeds β_0= Constant

$\sum\beta X_{ij}$ = vector of all the explanatory variables^{nk}

$ij=1$

β_i= Parameters/coefficients of the explanatory variables, and

ε_i = Random/disturbance term.

The empirical model for this study was specified as:

$Y = \beta_0 + \beta_i X_i + \varepsilon$

Where:

Y = Use of certified maize seeds during last cropping season (1 = yes, 0 = no)

X_i = a vector of explanatory variables, which included:

X_1= annual income (in GHC)

X_2 = access to credit (1=Yes; 0= No)

X_3 = degree of commercialization (i.e. proportion of harvested maize sold)

X_4 = farm size (acres)

X_5 = distance from home to nearest source of certified maize seed (km)

X_6= extensioncontact (1=Yes; 0=No)

X_7 = membership of Farmer Based Organizations-FBO (1=Yes; 0=No)

X_8= farming experience (years)

X_9 = educational level (years)

β_0 = intercept

β_i = coefficients of the independent variables, and

ε = disturbance term.

The maximum likelihood estimation procedure was used to obtain the model estimates. A number of similar empirical studies employed the binary logistic regression model (e.g. Feder et al., 1985; Munyua et al., 2010).

RESULTS AND DISCUSSION

Characteristics of respondents

Table 1 provides important characteristics of maize farmers interviewed. About 71% of the respondents were males, indicating that majority of maize farming households in the district were headed by males. Less than half of the sampled farmers (47%) were members of Farmer Based Organizations (FBOs). Whereas access to extension services was quite high, access to credit was quite limited among maize farmers. Although 95% of maize farmers knew about certified seeds, only 27% of them used certified seed to produce maize. This level of usage, though low by international standards, appears to be quite high in the Ghanaian context, where it is generally reported that only about 10% of farmers use certified seeds in crop production at the national level (Morris et al., 1999). The relatively high percentage of farmers using certified maize seed may be due to the long history of the Ejura-Sekyedumasi District as a major producer of certified maize seeds in Ghana.

Table 2 shows that a typical maize farmer interviewed was about 41years old with about six (6) years of formal education. Average household size was found to be five (5) people, reflecting the national picture. As far as maize production is concerned, majority of the farmers were not smallholders since they cultivated about 7.2 acres (2.9 ha) on average. Average amount of credit obtained for maize production during the previous cropping season was found to be GHC662.50 (US$339.74). The study showed that on average, farmers travelled a distance of about 7 km to obtain certified maize seeds from the nearest sales point/shop. Farmer-extension contact was estimated at three (3) times on average during the last cropping season.In terms of commercial orientation,

Table 1. Socio-economic profile of sampled farmers.

Variable	Frequency	Percent
Gender:		
Male	75	70.8
Female	31	29.2
FBO membership:		
Yes	50	47.2
No	56	52.8
Access to Extension service:		
Yes	74	69.8
No	32	30.2
Access to credit:		
Yes	28	26.4
No	78	73.6
Awareness about certified seeds:		
Yes	101	95.3
No	5	4.7
Use of certified maize seeds:		
Yes	29	27.4
No	77	72.6

Source: Field Data, 2013.

Table 2. Summary statistics of respondents.

Variables	Min.	Max.	Mean	Std. dev.
Age of respondent (yrs)	23.00	57.00	40.92	6.45
Household size	2.00	12.00	5.00	2.30
Years of schooling	2.00	12.00	5.57	2.64
Farming experience (yrs)	2.00	40.00	21.65	7.98
Total land cultivated to maize (acres)	2.00	25.00	7.21	5.07
Distance to cert. seeds sales point (km)	1.00	16.00	7.11	5.19
% of harvested maize sold	18.75	89.00	55.97	13.53
Amount of credit received (GHC)	300.00	3900.00	662.50	104.45
Freq. of extension contacts per year	1.00	6.00	3.00	1.27

Source: Field Data, 2013.

farmers were found to sell about 56% of their harvested maize produce.

Sources of seed and reasons for non-use of certified maize seeds

Table 3 shows that the main source of seeds for maize production in the Ejura-Sekyedumasi district was recycled seeds saved by farmers from previous cropping season. Certified seeds normally obtained through Agricultural Extension Agents (AEAs) or direct purchase from agro-input dealers was reported by only 27.4% of the interviewed farmers. This means that there is more room for the district to improve on its actual maize production and yield against the high potential presented by certified seeds.

Table 3. Sources of maize seeds for cultivation.

Source	Frequency	Percent
Agro-input dealers	16	15.1
Extension Agents	13	12.3
Fellow farmers	11	10.4
Farmer saved seed from previous season	66	62.3
Total	**106**	**100.00**

Source: Field data, 2013.

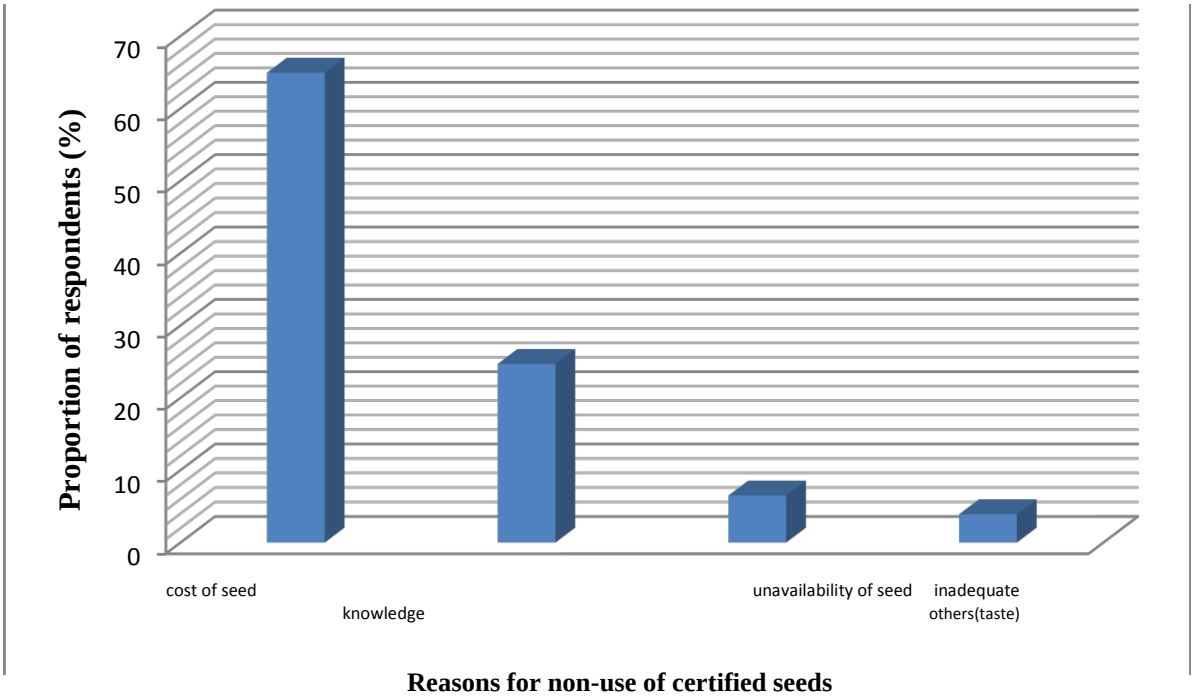

Figure 1. Reasons given by farmers for non-use of certified maize seeds.

The main reasons for non-use of certified maize seeds were cited as high cost of certified seeds and unavailability of certified seeds in the farming communities (Figure 1). This implies that reduction in the price of certified seeds and effective distribution and marketing of these superior seeds are likely to improve the uptake of certified seeds among maize producers in the district.

Factors determining the use of certified maize seeds by farmers

Table 4 provides the empirical model estimates for the factors determining the probability that a farmer will use certified maize seed or not. The *Chi-square* value shows that the regression model is significant at 1% level and best fits the data. The *pseudo R squared* value was 0.7048, indicating that the variations in the independent variables explain 70% of the farmer's choice to use certified maize seed or not. The main factors which significantly affect the probability of use/non-use of certified seed at the 10% level were found to be educational level, extension contact, farm size and credit access.

Education level, as expected, had a positive effect on the probability of use of certified seeds at the 1% significant level. This finding is consistent with studies by Feder et al. (1985) and Awe (1999) who noted that literacy level positively influenced the probability of use of improved technology. However, Munyua et al. (2010) in their study in Kenya did not find years of formal education to be a significant determinant of use/non-use of certified seeds.

The study revealed that farmers who have access to credit were more likely to use certified seeds than those without access to credit, *ceteris paribus*. This is not

Table 4. Logistic regression model estimates for use of certified maize seeds by farmers.

Variable	Coefficient	Std. Error	Z	Prob.
Constant	-14.4049***	4.6670	-3.09	0.002
Education level	3.6669***	1.1643	3.15	0.002
Income level	0.0097	0.0007	1.34	0.181
FBO membership	1.1215	0.9879	1.14	0.256
Farming Experience	-0.0257	0.0907	-0.28	0.777
Farm Size	-0.2745*	0.1606	-1.71	0.087
Extension contact	5.0917**	2.3396	2.18	0.030
Deg. Of commercialization	0.0237	0.0318	0.74	0.456
Dist. to certified seed source	-0.1718	0.1223	-1.40	0.160
Credit access	7.8662***	2.1432	3.67	0.000
Log likelihood		*-18.3619*		
Number of observations		*106*		
Chi square		*89.68 (sig@0.000)*		
Pseudo R^2		*0.7048*		

Source: Estimated from Field Data, 2013.

surprising since the main reason cited by farmers for not using certified seed was high cost of such seeds. Farmers with credit access will have the purchasing power to acquire this purchased input for use in their farming business.The positive effect of credit access is in consonance with findings by Ouma et al. (2006) and Omolehin et al. (2007) who noted that credit enables farmers to buy inputs required by improved technology.

Consistent with *a priori* expectation, extension contact was also found to have a significant positive effect on the probability of use/non-use of certified seeds, all things being equal. This was also consistent with the findings of Abebaw and Belay (2001) as they posited that sources of information, including extension, enhance the use of technology. Munyua et al. (2010) also found a negative relationship between distance to extension source and the probability of using certified seeds in Kenya. This goes to emphasize the important role played by extension contact in the process of certified seed uptake among farmers.

Farm size was found to influence the use of certified seed negatively. The probability that a farmer will use certified seed reduces as the scale of production increases. Farmers with large farm sizes are likely to spend more on seeds if they are to use the so-called 'expensive' certified seeds for maize production. All things being equal, such farmers are likely to opt for a cheaper source of seed which is the recycled farmer-saved seed. Shiyaniet al. (2002) also had similar findings and provided the following reason to explain the relationship.First, small farmers live at subsistence level that attracts them to use seeds of improved varieties which give better yields, earn more income and thereby help in raising their standard of living. Secondly, limited availability of improved certified seeds might compel large scale farmers to continue producing with recycled local seeds, as a result, they lag behind in using improved certified seed. Again, since the cost of improved certified seed is quite high, farmers with larger farms are not likely to obtain the resources to purchase the quantity required for planting the whole farm, all things being equal.

Variables which were expected to influence the use of certified seeds like income level, membership of FBO, degree of commercialisation, distance to source of certified seed and farming experience were not significant at 10% even though they had the expected signs.

Conclusion

The study revealed that even though 95% of the farmers interviewed were aware of certified maize seeds, only 27% used it; and the reasons for the non-use was found to be high cost of certified seeds and unavailability of certified seeds in farming communities. The main factors which had significant positive effect on the use of certified maize seeds by farmers were educational level, extension contact and access to credit. Farm size was found to be negatively related to the probability of a farmer using certified seed. Sensitization and periodic training of farmers on the benefits and proper use of certified seeds, improved access to credit and extension services, and effective distribution and marketing channels that ensure that certified seeds get to the remote areas in farming districts are recommended to improve the uptake of certified maize seeds by farmers. For further research, it is recommended that factors affecting the intensity of certified maize seed usage

should be explored since the current study only dealt with use and non-use of certified seeds.

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