Vol. 12(4), pp. 221-228, October-December 2020
DOI: 10.5897/JDAE2020.1175
Article Number: BDF793965550
ISSN 2006-9774

http://www.academicjournals.org/JDAE

Journal of Development and Agricultural Economics

Full Length Research Paper

Economic resources utilisation in maize production: Evidence from Central Region, Ghana

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Received 4 April, 2020; Accepted 18 August, 2020

This study was undertaken to improve the efficiency of maize farming in the Central Region of Ghana. A stochastic frontier cost function, applied to cross-sectional data, was used to analyse firm level cost efficiency of production and its determinants. Efficiency of resource utilization was analysed using marginal value product of inputs. Results from the Cobb-Douglas stochastic cost frontier model and a farm-specific efficiency model showed that the mean cost efficiency was 94.95%. Furthermore, all production inputs were inefficiently allocated. Access to extension services, experience and access to credit had positive relationships with cost efficiency. The study concludes that maize farmers are not fully efficient in resource combination and allocation. Improved technologies and innovations should be made accessible to farmers by public and private extension service providers to increase efficiency of their maize farms.

Key words: Cost efficiency, allocative efficiency, cost frontier, marginal value product, maximum likelihood estimates.

INTRODUCTION

The prospect of increasing agricultural productivity to cope with the problem of feeding the nine billion of the world's population by 2050 has been given impetus by scientific breakthroughs in crop and animal research. While this is good for global food security, the same argument cannot be made for the African continent (Godfray et al., 2010). Maize production in Ghana is predominantly done under rain-fed conditions by smallholder farmers who are often poorly resourced despite the crop accounting for 50% of the total cereal production in Ghana (Darfour and Rosentrater, 2016). This lack of resources makes increasing the efficiency of the farmers very difficult.

Schultz (1964) suggests that there are relatively few inefficiencies in the allocation of production inputs in traditional agriculture, and hypothesizes that when peasant farmers are given the right economic and environmental conditions, they can efficiently allocate factors of production. Hence, this study looks at efficiency as the best option in productivity improvement and puts to test Schultz's proposition with regard to economic conditions. Efficiency in production and allocation of resources is also crucial to ensure sustainability of small-scale maize production in Ghana.

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Conceptualisation of what constitute inputs with respect to the outputs they generate or are expected to generate and measurement of the levels of use of such inputs often poses serious challenges. Varian (1992) offers a valuable approach. He notes that a firm produces outputs from various combinations of inputs and in order to study firm choices we need a convenient way to summarize the production possibilities of the firm, i.e., which combinations of inputs and outputs are technologically feasible.

Farrel (1957) was the first to introduce the measure of productive resource use efficiency. He proposed that efficiency is measured in a relative performance rather than the absolute performance. A firm is said to be efficient if it is operating on the production frontier. This study was therefore undertaken to analyse the resource utilisation of maize farmers in the Central Region of Ghana to find out how efficient the farmers are in their allocation of resources.

METHODOLOGY

Study area and population

The Central Region of Ghana is the study area. The region covers a land area of 9830 km^2 with a coastline of 168 km bordering its southern part and a rural population constituting 62.5% of its total population of 2,563,228. Majority of the labour force in the region (55.4%) are into agriculture. Maize is the predominant staple crop in the Central Region of Ghana (Ghana Statistical Service, 2019).

Design

A cross-sectional survey research design with quantitative approach was adopted for the study. The design was employed because the study sought to bring to fore causal relationships between sets of variables.

Sampling and sampling technique

A multi-stage sampling procedure was adopted. A sample of 101 maize farmers were chosen from each of three participating districts to give a total sample size of 303 randomly selected maize farmers. This was based on Bartlett et al. (2001) sample size determination table for obtaining data meant for regression analysis. However, 302 respondents were valid for analysis, giving a response rate of 99.7%. The rejection of one of the case was due to the fact that most of the items were not fully completed by one of the enumerators. Fryrear (2015) recommends response rate of 80% and above for surveys of this kind. Since the response rate was way above the benchmark, the study proceeded with the analysis.

Instrumentation and data collection

A structured interview guide was used for the collection of data from participants. Levels of formal education among the farmers, and their ability to read and write, were uncertain, hence the use of this particular instrument to enable interviewers to aid respondents in the interpretation of questions. Data was collected on the following defined variables:

Output (Y): Quantity of maize grains harvested which is measured in kilograms/ha.
Land (Lan): Total area planted to maize in hectares. The variable was used to investigate the influence of farm (land) size on output.
Labour (Lab): Total number of family and hired labour employed in maize production, measured in person-days. Eight man-hours is equal to one person-day.
Equipments (Equ): Cost of items (cutlass, sprayer, hoe, tractor, sack, etc.) that are directly involved in the production process, measured in Ghana Cedis.
Fertilizer (Fer): Quantity of commercially formulated plant nutrient used per hectare of land, measured in kilogram.
Seed (See): Total quantity of maize seed sown, measured in kilograms. The quantity of seeds per hectare determines the plant population which has influence on yield. This variable was averaged over the cropped area.
Extension: Number of times a farmer had access to extension service during the production season.
Age: Age of the primary decision maker, measured in years.
Gender: Measured as a dummy variable and has the value of 1, if a farmer is a male and 0, if female.
Household size: Number of persons in the farmer's household.
Experience: Number of years engaged in maize farming.
Access to credit: Measured as a dummy variable; 1 represents a yes response and 0 for a no response.

Analytical framework

Descriptive statistics is used as the framework for describing the state of resource utilisation in maize production in the region. Statistical techniques such as means, percentages, frequencies and standard deviations (with the help of SPSS Statistics version 21 outputs) are used to describe the state of maize production by analysing:

1. The socio-economic characteristics of the farmers,
2. Techniques of production,
3. Levels of inputs and output,
4. Cost of inputs and output and
5. Market information

Further, the determination of efficiency is done for both the cost and allocative efficiencies of the maize farmer. The framework for the cost efficiency determination in this study is input-output analysis and also makes use of the Cobb-Douglas production function technique. In assessing the determinants of production efficiency, a causal relationship framework is adopted. This allows for the relation of the farmer's level of efficiency to the various factors that bring about this level of efficiency. A multiple linear regression is used to show how each of the determinants influence the dependent variable-cost efficiency. Marginal analysis is used to determine the allocative efficiencies of the farmers. The software used for this part of the analysis is frontier 4.1.

Analytical model of stochastic frontier cost function

This study adopts the stochastic production frontiers (SPF) analysis to estimate the allocative efficiency of maize farmers in the Central Region of Ghana. This is achieved by transforming the production frontier into cost frontier. According to Coelli (1996), the composite error term specification of the production frontier is simply converted from (V_i - U_i) to (V_i + U_i) in order to specify the cost frontier function. The cost frontier dual to the production frontier is thus specified as:

$$\ln(C_i)=\alpha_0+\Sigma_i\alpha_i \ln P_{ij}+\gamma \ln(Y^*_i) \quad (1)$$

where C_i is the minimum cost to produce output Y, P_{ij} is a vector of input prices, and α is a vector of parameters to be estimated. Y^*_i is the observed output adjusted for statistical noise and is specified as:

$$\ln(Y^*_i)=\beta_0+\Sigma\beta_i \ln X_{ij} - u_i = \ln(Y_i) - v_i \quad (2)$$

According to Coelli (1996), the computer programme, Frontier 4.1, calculates predictions of individual firm technical efficiencies from estimated stochastic production frontiers, and predictions of individual firm cost efficiencies from estimated stochastic cost frontiers. The measures of technical efficiency relative to the production frontier $Y_i = x_i\beta + (V_i - U_i)$, and of cost efficiency relative to the cost frontier $Y_i = x_i\beta + (V_i + U_i)$, are both defined as:

$$EFF_i = E(Y_i^*|U_i, X_i)/ E(Y_i^*|U_i=0, X_i), \quad (3)$$

where Y_i^* is the production (or cost) of the i^{th} firm, which will be equal to Y_i when the dependent variable is in original units and will be equal to $\exp(Y_i)$ when the dependent variable is in logs. In the case of a production frontier, EFF_i will take a value between zero and one, while it will take a value between one and infinity in the cost function case. In this cost function the U_i now defines how far the firm operates above the cost frontier. If allocative efficiency is assumed, the U_i is closely related to the cost of technical inefficiency. If this assumption is not made, the interpretation of the U_i in a cost function is less comprehensible, with both technical and allocative inefficiencies possibly involved.

The cost efficiency of individual farmers is now defined in terms of the ratio of the predicted minimum cost (C_i*) to observe cost (C_i). That is:

$$CE_i= C_i^*/C_i = \exp (U_i) \quad (4)$$

From Equation 4, cost efficiency is simply the reciprocal of the cost efficiency given by the production frontier model generated by the Frontier 4.1 computer program. Hence, cost efficiency varies between zero and one.

Empirical model for estimating cost efficiency of maize farmers

Cost efficiency has been investigated in a number of papers. In this study, the cost frontier dual to the production frontier function presented in Equation 1 is used for the estimation of cost efficiency. In this function, independent variables are the prices of inputs for production and the total output that is adjusted for any statistically noise calculated by function 2. The operational model in this study is

$$\ln C_i = \ln \beta_0 + \beta_1 \ln P_1 + \beta_2 \ln P_2 + \beta_3 \ln P_3 + \beta_4 \ln P_4 + \beta_5 \ln P_5 + \beta_6 \ln Y^* \quad (5)$$

where C_i stands for cost of production per farm, measured in Ghana Cedis (GH¢); P_1 represents hired price per hectare of land, in GH¢; P_2 symbolizes hired price per person-day, in GH¢ /persons-day; P_3 signifies cost of equipment, in GH¢; P_4 stands for cost of fertilizer, in GH¢/kg; P_5 represents cost of seeds in GH¢/kg; Y*represents the observed output (maize) adjusted for any statistical noise, contained in v_i; $\beta_0, \beta_1, ..., \beta_6$ are coefficients of unknown parameters to be estimated.

Factors affecting efficiency of farmers

The inefficiency model is implicitly defined for this study as:

$$\mu_i = \delta_0 + \sum_{m=1}\delta_m W_{mi} \quad (6)$$

Explicit function is defined as:

$$\mu_i = \delta_0 + \sum^7_{m=1}\delta_m W_{mi} \quad (7)$$

where W = farmer specific variables and δ = Coefficient of unknown parameters.

The operational Cobb-Douglas function for the inefficiency is specified as:

$$\mu = \delta_0 + \delta_1(Ext) + \delta_2(Age) + \delta_3(Gen) + \delta_4(HHs) + \delta_5(Exp) + \delta_6(Cre) \quad (8)$$

Empirical model of cost inefficiency

The distribution of mean inefficiency (µ) is related to the farmer's demographic variables and allows heterogeneity in the mean inefficiency term to investigate sources of differences in technical efficiencies of the farmers. Cost inefficiency effects are a function of various observable factors, such as access to extension services, age, gender, household size experience and access to credit, experience, occupation, location of firm, and availability of buyers. Following Onumah et al. (2010), the model for various operational and firm-specific variables hypothesized to influence technical efficiency in traditional maize production is defined in Equation 9.

$$\mu_i = \delta_0 + \sum_{m=1}^{7} \delta_m z_{mi} \quad (9)$$

where Z_s are exogenous variables, δ_0 and δ_m are coefficients of inefficiency, Z_1 is access to extension services, Z_2 age of farmer, Z_3 is gender of farmer, Z_4 is household size of farmer, Z_5 is experience of farmer, and Z_6 is access of credit by a farmer.

Operationally, Equation 9 can be expanded as follows:

$$\mu_i = \delta_0 + \delta_1(Ext) + \delta_2(Age_i) + \delta_3(Gender_i) + \delta_4(HHSize_i) + \delta_5(Experien._i) + \delta_6(Credit_i) \quad (10)$$

Empirical analysis of efficiency of resource utilization

The study assumed that maize production is a function of land, labour, equipment, fertilizer and seed. Efficiency of input allocation was estimated following physical production relationships derived from the Cobb-Douglas production function.

The resource utilization efficiency index (r) was obtained by using MLE estimates of the Cobb-Douglas function. The marginal physical product of land was estimated based on its estimated regression coefficient. This was followed by estimating the marginal value product (MVP) of land. The MVP of land was then compared with its marginal factor cost (MFC). Thus, the efficiency of land allotment (r) was determined by the ratio of MVP to MFC.

The allocative efficiency index of capital employment was calculated from:

$$r = \frac{MVP}{MFC} \quad (11)$$

The value of MVP was estimated from Equation 2. The same procedure was followed to estimate the allocative efficiency of labour, equipment, fertilizer and seed.

Table 1. Descriptive statistics of farmer and farm specific variables.

Variable	N	Min.	Max.	Mean	Std. dev
Age (years)	302	23	76	46.15	10.15
Household size (#)	302	1	20	5.40	3.40
Level of education (years)	302	0	15	5.04	4.55
Income per annum (GH¢)	302	50	8000	1479.97	1292.52
Level of experience (years)	302	2	55	19.84	10.19
Home-farm distance (km)	302	0	7	2.47	1.14
Extension visits (#)	302	0	31	2.47	2.50

RESULTS AND DISCUSSION

The state of resource utilisation in maize production in the Central Region of Ghana

This description of the state of resource utilisation in maize production covers farmer characteristics as well as access to and usage of resources and the outputs of maize churned out from the production process.

Mean age of maize farmer

The average age of farmers was 46 years with a range of 23 to 76 years (Table 1). The age distribution indicate that majority of the farmers are youth and are within the working age group.

Household size

Farmers have an average household size of 5 with a range of 1 to 20 (Table 1). This means that about four dependents of the farmer may contribute efforts towards the production of maize.

Level of formal education

The average number of years of schooling was estimated to be 5 years with a range of 0 to 15 years (Table 1). This shows that majority of farmers have not gone beyond primary education level which is an indication that they have low level of education.

Annual income of farmers

On the average, maize farmers earn GH¢1,480 with a range of GH¢50-GH¢8000 as income per annum (Table 1).

Experience in maize farming

The level of experience of farmers was estimated to be 20 years on the average with a range of 2 to 55 years (Table 1). This is an indication that the maize farmers in the study area are mostly experienced.

Access to extension services

Some farmers reported that they had no access to extension services during the production season. The mean extension visits in the study area is 2.5 visits per production season with minimum of zero and a maximum thirty one visits and a standard deviation of 2.50401 (Table 1). Although extension services accessed at no direct cost to the maize farmer, its usage is known to impact positively on the overall output of the farmer (Owens et al., 2001).

Summary statistics of input and output variables

Table 2 shows summary statistics of output and input variables as well as some inefficiency source variables. There were differences in the number of observation (n) due to the fact that some of the respondents could not provide responses of some of the variables of interest. Hence, the differences in the number of observation.

Cost of inputs

The mean cost values of the individual variables are displayed in Table 2. The average cost of land was GH¢170.10 with a standard deviation of 348.18. This variation in standard deviation is an indication that farmers operated at different land sizes. The average cost of labour was GH¢ 801.56 with a standard deviation of GH¢ 827.96. The variability and mean of average cost of labour incurred by the farmers is a reflection of the fact that most of the farm operations were done manually which are labour intensive and costly. Farmers spent GH¢ 32.02, GH¢ 44.20, GH¢26.38 and GH¢105.90 on equipment, fertilizer, pesticide and seed, respectively.

Cost analysis

The mean total cost of production is GH¢1173.59. The

Table 2. Descriptive statistics of input and output variables.

Variable	n*	Minimum	Maximum	Mean	Std. Dev.	% Input Costs
Land size	302	0.40	23.00	1.83	2.11	-
Cost of land	302	15.00	345.00	170.10	348.18	14.38
Persons-day	302	17.50	435.90	63.91	59.99	-
Labour cost	302	200.00	7200.00	801.56	827.96	68.19
Cost of equipment	302	0.00	621.50	32.02	74.49	2.62
Quantity of fertilizer	302	0.00	475.00	58.11	81.46	-
Cost of fertilizer	302	0.00	372.00	44.20	61.57	3.66
Quantity of pesticide	289	1.00	22.00	3.64	3.31	-
Cost of pesticide	289	7.50	165.00	26.38	10.12	2.14
Quantity of seed	302	1.00	100.00	21.10	12.13	-
Cost of seed	302	8.00	1750.00	105.90	186.37	9.01
Total cost	302	248.00	1725.00	1173.59	1131.34	100.00
Quantity of output	302	38.00	12000.00	1166.91	1117.15	-
Value of output	302	190.00	60000.00	2240.47	2144.92	-

n* is number of participants who responded to the items, those who did not respond to the items are excluded from the analysis.

cost analysis shows that cost of land accounts for 14.38% of total cost, cost of labour accounts for 68.19%, cost of equipment accounts for 2.62%, cost of fertilizer accounts for 3.66%, cost of pesticide accounts for 2.14% while cost of planting materials accounts for 9.01%.

Summary of input-output analysis

On the average, farmers spent GH¢1173.59 on inputs used to produce the maize, obtained a revenue of GH¢2240.48. Thus, making a gross profit of GH¢1066.89 per one maize production season. This profit is 90.91% of the total cost of production and 47.62% of the total revenue obtained.

Efficiency of maize production in the Central Region of Ghana

The cost efficiency of maize production as well as the allocative efficiencies of input utilisation for the various inputs is presented as the following.

Analysis of cost efficiencies of maize farming at firm level

The cost efficiency (CE) indices of the maize farmers in the Central Region ranged from 85 to 99%, with an average of 95.95%. This means that if the average farmer in the sample was to achieve the CE level of its most efficient counterpart, the farmer could realize a 4% cost saving (that is, 1–[95 /99]) which falls far below the 63%. Paudel and Matsuoka (2009) reported among maize producers in the Chitwan District of Nepal. Moreover, farmers who got the highest score of cost efficiency above 95% were 238 households which represented 88% of the total surveyed farmers.

Resource utilisation

Table 3 shows that the quantity of seed used in farming maize has the highest efficiency index of resource utilization (21.11), followed by land (2.63), fertilizer (2.54), labour (0.39), and equipment (0.14). Wongnaa et al. (2019) reported that maize production in Ghana is noted to be profitable but this profitability will be adversely affected if prices of relevant inputs, such as pesticides, fertiliser, herbicides, labour and seeds, are increased.

The allocative efficiency ratios (r) for land, fertilizer and seed are greater than 1 and are in agreement with Ogundari (2008) study of rain-fed rice farmers. These resources are, therefore, underutilized in maize farming. The farmers need to increase the quantity of these inputs to enable them maximize profit since marginal value product is greater than marginal factor cost or unit price of inputs.

The allocative efficiency ratios (r) for equipment and labour are below a score of 1. This means that these resources are over utilised in maize farming. It also means that the over utilised inputs are paid more than their marginal value products. By implication, the use of these resources should be reduced. The over utilization of equipment may be due to the fact that many equipment and tools are used at a time than as required, hence, unnecessarily increasing the cost of equipment. The result also shows that maize farming in the region involves the intensification of labour by the maize

Table 3. Marginal value analysis of input utilisation in the Central Region of Ghana.

Variable	Mean	Elasticity	MPP	MVP	MFC	r
Output	1166.91					
Land	1.83	0.20	127.53	244.86	92.95	2.63
Labour	63.90	0.14	2.56	4.91	12.54	0.39
Equipment	32.02	0.002	0.07	0.14	1.00	0.14
Fertilizer	58.11	0.05	1.00	1.92	0.76	2.54
Seed	21.10	0.99	54.75	105.12	4.98	21.11

Average price of output= GH¢1.92.

producing farm firms. A similar study by Kuwornu et al. (2013) on resource use efficiency of maize production in the Eastern Region of Ghana revealed that agro-chemicals and hired labor are under-utilized whereas seed, fertilizer and family labor are over-utilized by maize farmers in the region.

Bravo-Ureta and Pinheiro (1997) carried out study to estimate economic, technical and allocative efficiencies of peasant farming in the Dominican Republic. Results indicated that farmers were 0.44 efficient. These results were said to be in line with a 0.43 allocative efficiency for a sample of wheat and maize farmers in Pakistan, though peasant farms in Paraguay were said to be more efficient with 0.70 and 0.88 allocatively efficient compared with peasant farmers in the Dominican Republic.

Determinants of maize production efficiency in the Central Region of Ghana

The determinants of cost efficiency of maize production among the maize farmers of the Central Region of Ghana are shown in the stochastic cost frontier model below. Also shown are the effects of these determinants.

Maximum likelihood estimates of stochastic cost frontier function and inefficiency model

The stochastic frontier production function estimates of maize farming in the Central Region of Ghana are presented in Table 4. The table shows that the coefficients of all the parameters are positive and significant at 1% level. It is therefore concluded that maize yields are more responsive to the entire regressor variables included in the model.

Gamma (γ) has a value of 0.9999 and is significant at 1% level. This is an indication that almost all the variation observed from the frontier cost can be attributed to cost inefficiency among the maize farmers but not to random shocks such as statistical and data collection errors which are outside the control of the farmers. It implies that the one-sided cost inefficiency error component dominates the symmetric random error component in explaining the variation between frontier cost and actual cost of maize farmers. Again it also means that the model fits the data. The non-zero value of γ suggests that there are differences in cost efficiencies among maize farmers. It implies that inefficiency effect is present in the model and so the stochastic frontier model is adequate representation of the data but not the ordinary traditional average response function. The statistically significant value of 0.0201 in the stochastic cost frontier is significantly different from zero, indicating a good fit of the model and the correctness of the specified distributional assumptions.

Cost inefficiency source model

In the cost inefficiency model, results showed that the coefficients of all the exogenous variables included in the model are significant. Coefficients of extension, experience and credit had their expected negative signs. This implies that when the levels of these variables are increased, output and for that matter cost efficiency of farmers will increase accordingly. Coefficient of age also had its expected positive sign.

Coefficient of extension was expected to be negative. Accordingly, the coefficient of the variable is negative implying that the higher the number of times the farmers receive extension services, the less their level of inefficiency and hence the higher will be the level of efficiency (Kuznets, 1966).

Coefficient of age variable was expected to be positive. Findings from this research showed that the variable is positive and significant at 10% level. Younger farmers are likely to have some formal education, and therefore might be more successful in gathering information and understanding new practices, which in turn will improve their cost efficiency through higher levels of allocative efficiency.

Debebe et al. (2015) posited that the important factors that affected technical, allocative and economic efficiency of smallholder maize producers in Southwestern Ethiopia are family size, level of education, extension service, cooperative membership, farm size, livestock holding and use of mobile. It is established that for optimal use of

Table 4. Maximum likelihood estimates of stochastic frontier cost function for cost efficiency in the Central Region of Ghana.

Variable	Coefficient	std. error	t-ratio
Regressor			
Constant	-0.0073***	0.0017	-4.2049
Output	-0.0013**	0.0005	-2.4060
Land	0.0230***	0.0027	8.6632
Labour	0.0090***	0.0024	3.7988
Equipment	0.0035***	0.0007	4.9586
Fertilizer	0.9496***	0.0023	412.2862
Seed	0.0119***	0.0009	12.9851
Exogenous			
Constant	-0.3245***	0.0465	-6.9855
Extension	-0.0375***	0.0017	-22.0021
Age	0.0027**	0.0012	2.2239
Gender	0.0378*	0.0209	1.8117
HHSize	0.0171***	0.0054	3.1721
Experience	-0.0051**	0.0020	-2.5744
Credit	-0.7133***	0.0365	-11.9525
Variance parameter			
Sigma-squared	0.0201***	0.0012	17.2096
Gamma	0.9999***	0.0000	74083.9080

*, **, ***Statistically significant at levels of 10, 5 and 1% respectively.

resources in maize production in Ghana, quantities of fertilizer, herbicide, pesticide, seed, manure and land should be increased while the use of labour, farm tools and equipment should be reduced (Awunyo-Vitor et al., 2016).

Gender variable (being male) was positive. This means that male farmers are more inefficient compared to female farmers in maize farming in the study area. This finding is consistent with the results of Dolisca and Jolly (2008). These authors related their result to the fact that after land preparations women normally carry out the remaining activities involved in production process at the farm and this is more evident in Africa.

Coefficient of household size is significantly positive in the model. This means that maize farmers in the study area become more cost inefficient with increase family size, consistent with Abdulai and Eberlin (2001).

Experience, the number of years of maize cultivation achieved by household head, is used as a proxy for managerial input. Increased farming experience may lead to better assessment of importance and complexities of good farming decisions, including efficient use of input. The expected sign for experience variable is negative. In accordance with this expectation, the variable is negative in the cost inefficiency model. This implies that farmers who had more experience on cultivating maize had lower cost inefficiency, and this result agrees with Khai et al. (2008), Kareem et al. (2008) and Rahman (2003) findings that more experienced farmers are less cost inefficient in their allocation of resources for production than the new farmers who are progressive and willing to implement new production systems.

Access to credit is negative in the cost inefficiency model, meaning that this factor increases the cost efficiency of maize farmers. This is in conformity with the work of Abdulai and Huffman (1988). The estimated coefficient of credit availability in profit inefficiency model in their study on rice farmers in Ghana was negative which meant that their profit inefficiency decreased with increase in credit availability.

Paudel and Matsuoka (2009) analysed the cost efficiency of maize production in the Chitwan District, Nepal with a view to predict economic efficiencies using stochastic frontier cost function. Maximum-likelihood (ML) estimates of the parameters revealed that estimated coefficients of cost of tractor, animal power, labour, fertilizer, manure, seed and maize output gave positive coefficients and were significant at 5% levels. This study therefore agrees with most of the findings of Paudel and Matsuoka.

Conclusions

Based on the results of this study, the following conclusions were made about the state, efficiency and efficiency determinants of maize production in the Central Region of Ghana. Maize farming in the Central Region is predominantly the work of adult married males who have relatively low level of formal education and majority of whom do not have access to credit. Of the total cost of maize production in the region, land accounts for 14.38%, labour accounts for 68.19%, equipment accounts for 2.62%, fertilizer accounts for 3.66%, pesticide accounts for 2.14% while cost of planting materials accounts for 9.01%.

Maize farmers in the Central Region are not fully cost efficient and can increase yield with no additional resources. Resources employed in maize farming are not efficiently allocated, whiles equipment and labour are over utilised, land, fertilizer and seeds are underutilised. The effects of extension, experience and credit are negatively related to the level of cost inefficiency effects, whiles age, gender and household size are found to be positively related to cost inefficiency. The results indicate a significant random component in the cost inefficiency effects and that all the variables have significant influence on the magnitude of cost inefficiencies of farmers in the study area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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