

Resource Use Efficiency of Maize Farmers in Rural Nigeria: Evidence from Ekiti State

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Abstract: This study examined resource use efficiency among maize farmers in rural Nigeria. The study area (Ekiti State) was particularly chosen for this study because of its prime place in staple food crops production in Nigeria and for the fact that the state depicts a true agrarian setting in the country. The results presented were based on data collected from a random sample of 200 maize farmers in four villages in the study area using well-structured questionnaires. Analytical tools employed include descriptive statistics, ordinary least squares regression analysis and the stochastic frontier production function. Descriptive statistics like tables, frequencies, mean e.t.c were used to analyse the socioeconomic characteristics of the maize farmers. The results of the descriptive statistics indicated that about 58 percent of the farmers are over 50 years in age. In other words maize farmers in the study area are old and they are too weak for the arduous farming activities (main occupation of the inhabitants) in the study area. Again, the results further reveal that we have more male (92 percent) maize farmers than female (8 percent) maize farmers in the study area. Also, majority of the maize farmers are married (83 percent) while only a few (17 percent) are single, divorced or married. More so, about 54 percent of the surveyed farmers have no formal education with about 46 having primary, secondary or tertiary education. The reason could be attributed to that fact that most of the farmers are too old and could not afford to go to school when they were young. The results of the regression analysis showed that farm size, labour (availability and nature), pesticides, herbicides and fertilizer usage are positively related with maize output and these variables are equally significant in determining the output of the farmers. Farmers who use fertilizers are found to obtain higher yields than those who did not use it. The stochastic frontier production function was also used to determine the technical efficiency of these farmers. The estimated technical efficiency of the maize farmers obtained was found to be 0.68 indicating 68 percent efficiency in their use of production inputs. In this regard, some of the factors found to influence the level of technical efficiency are amount of hired labour, amount of family labour, use of pesticides, use of herbicides and fertilizer application.

Key words: technical efficiency · stochastic frontier · maize farmers · rural Nigeria · Ekiti State

INTRODUCTION

A key feature of the Nigerian Agriculture is the dominance of small-scale farms, which constitute an important and invaluable component of the Nigerian economy. It is a known fact that over 12 million farmers, scattered in different ecological zones, engage in the production of a wide variety of arable crops and this is done under traditional subsistence agriculture. Individually, while not exerting much influence, they collectively form an important foundation on which the nation's economy rests [1, 2]. It has been established that 90 percent of Nigeria's total food production comes from small farms and at least 60 percent of the country's

population earns their living from these small farms. Therefore, effective economic development strategy will depend critically on promoting productivity and output growth in the agricultural sector, particularly among small-scale producers since they make up the bulk of the nation's agriculture.

It has been realized that domestic production of food has not been able to meet the domestic demand for food crops. The reason for this is that there are some problems at the micro level, one of which is the relationship between inputs used in production such as seeds, land, labour and capital. Also, it has been established that appreciable yield increase could be obtained through the use of modern technologies in production of crops.

Hence, this has been chosen as a vital way to improve total farm output and to curb food shortages because of its great impact on production [3]. With the recent population explosion and the ongoing trend of continual increase in the population density, man may have no option than to make the best and most efficient use of the land available for farming as there may not be so much land as to allow for shifting cultivation. Hence, there will have to be intensification if production must increase. The problem is that most rural farmers are not exposed to these new technologies and do not have access to the basic resources. In cases where they have been exposed to it, financial constraints will not afford them the opportunity to use. Hence, most farmers still depend on their old methods, manual labour etc for farming.

In view of these problems encountered by the rural farmer, this paper examined the resource use level and efficiency of farmers in the study area vis-a-vis the technology used by them and the effect of the variety of seeds and chemicals used with respect to productivity.

Theoretical framework/literature review

Theoretical framework

Production theory and farm efficiency: Production is the process of transforming inputs such as capital, labour and land into goods and services called output. These resources can be organized into a farm-firm or producing unit whose ultimate objectives may be profit maximization, output maximization, cost minimization or utility maximization or a combination of the four. In this production process, the manager or entrepreneur or the firm as the case may be is concerned with efficiency in the use of inputs to achieve his aim i.e. the technological vs. economic efficiency. The economic efficiency occurs when the cost of producing a given output is as low as possible. The objective of efficiency will provide us with some basic rules about the manner in which firms should utilize inputs to produce goods and services.

The basic theory of production is thus simply an application of constrained optimization: the firm attempts to either minimize the cost of producing a given level of output or to maximize the output attainable with a given level of costs. Both optimization problems lead to the same rule for the allocation of inputs and choice of technology. Since there are alternative means of attaining the production goals i.e. the theory of production presents the theoretical and empirical framework that facilitates a proper selection among alternatives so that any one or a combination of the farmer's objectives can be attained. However in order for

the farmer to make decisions that will enable him attain the goals above, certain parameters of interest must be known and this is derived through the production function.

A production function stipulates the technical relationship between inputs and output involved in production. Usually denoted as:

$$Q = f(x)$$
$$AP = \frac{Q}{X} = \frac{F(x)}{X} \quad \text{-Average product}$$
$$MP = \frac{dQ}{dX} = f^1(x) \quad \text{-Marginal product}$$

These parameters AP, MP, RTS help the farmer in determining or specifying the use of resources and the pattern of outputs which maximize farm-firm profits. These parameters can be derived for the various forms of production function-exponential, power, semilog and applied to both short and long run productions. However, efficiency analysis is an issue of interest among economists in recent times, given that the overall productivity of an economic system is directly related to the efficiency of production of the components within the system. As such agricultural productivity is said to be a measure of efficiency [4]. Also, the 'maximum resource productivity will imply obtaining the maximum possible output from the minimum possible set of input. In this context, optimal productivity of resources involves an efficient utilization of resources in the production process [5]. Agricultural productivity is defined as a measure of efficiency with which an agricultural production system employs land, labour, capital and other resources. Economists have defined different types of productive efficiency and widely accepted definition is the one commonly quoted in literature. Farrell specified two types of efficiency: technical efficiency and allocative efficiency. He defined technical efficiency as the ability to extract the maximum output from a given level of input. Allocative efficiency refers to the farmers' ability to achieve the optimal mix i.e. having the right and efficient combination of inputs that gives optimal output [6]. Greene records that the level of technical efficiency of a particular firm is characterized by the relationship between the observed and some ideal or potential production. The measurement of firm specific technical efficiency is based upon deviations of observed output from the best production or efficient production frontier. If a firm's actual production point lies on the frontier, it is perfectly efficient; if it lies below the frontier, then it is technically

inefficient with the ratio of the actual to potential production defining the level of technical efficiency of the individual firm [7, 20]. Technical efficiency is just one component of overall economic efficiency. However, in order to be economically efficient, a firm must first be technically efficient. They went further to say ‘profit maximization requires a firm to produce the maximum output given the level of inputs employed (i.e. be technically efficient), use the right mix of inputs in light of the relative price of each input (i.e. be input allocative efficient) and produce the right mix of output given the set of prices (i.e. be output allocative efficient) [8].

Efficiency can be considered in terms of the optimal combination inputs to achieve a given level of input (an input orientation) or the optimal output that could be produced given a set of inputs (an output orientation). Efficiency of farms is estimated using various techniques such as linear programming technique of data envelopment analyses (DEA), LIMDEP and frontier production function.

Stochastic frontier production function: Since Farrell’s proposition, a great deal of effort has been directed towards as the estimation of frontier models of a production technology and obtaining production efficiency measures. The types of model used include non-parametric deterministic models, deterministic full frontier models, stochastic full frontier models and stochastic frontier models. The basic concept of a stochastic frontier production function as proposed by Aigner, Lovell and Schmidt is that the disturbance component of these frontiers is composed of a systematic random variable which captures the effects of weather, luck and other factors outside the control of the economic agent and a one-sided disturbance which measures technical efficiency [9, 19].

The stochastic frontier model for the maize farmers is expressed as:

$$Y_t = \alpha + \beta X_1 + \beta X_2 + \beta X_3 \dots \dots + \beta X_n + V_t - U_t$$

$$\ln Y_t = \alpha + \beta \ln X_1 + \beta \ln X_2 + \beta \ln X_3 \dots \dots + \beta \ln X_n + V_t - U_t \dots \dots$$

Where ln = Natural Logarithm

Y = Output

V_t = Assumed independency distributed random errors

U_t = Technical inefficiency effects

X_n = Vector of inputs

Also the technical inefficiency effects in the stochastic frontier above are expressed in terms of various explanatory variables which include the socio-economic characteristics such as age, gender etc. This is given by

$$V_1 = \delta + \delta_1 Z_1 + \delta_2 Z_2 \dots \dots \delta_n Z_n$$

There are two objects in stochastic frontier analysis. The first is the estimation of a stochastic frontier function serving as a bench mark against which to estimate technical efficiency of producers. Its goal is to estimate an efficiency level of each producer. The second objective is the incorporation of exogenous variables which are neither inputs to the production process nor output of it, but which nonetheless affect producer performance with the intent to identify the determinants of efficiency.

Literature review: In past and even at recent times, a lot of works has been done on how to achieve or bring about a sustainable agriculture in Nigeria and the world at large. These efforts include considerations for future adequacies and also address issues such as resource use efficiency, profitability for farmers and impact on the environment. In order for agriculture to be sustainable, to meet today’s world food needs as well as those in the future, it must do a better job of communicating with its clientele-World food consumers. According to B.C Darst (2001). In early 2000 world population stood at 6.0 billion people. It is projected to reach 8.0 billion by 2025, a 33 percent increase only in 25 years. During that period, little change in total arable land available for food production is expected. In fact, arable land per person continues to shrink, forecast to fall from slightly more than 1.1 acres in 1965 to about 0.5 acre by 2025 [11].

If agriculture is to be sustainable; it must feed the growing world population. Higher yields must happen and will be the result of improved management. Agricultural production will then include: higher input and resource use efficiencies, including nutrient balance, nutrient application rates and land use; adequate crop protection including an appropriate mix of cultural practices, judicious use of pesticides and genetically enhanced crops.

Farming in Nigeria: Before independence in 1960, agriculture was the foundation for the human economy in Nigeria and Nigeria was self sufficient in terms of food. Nigeria’s soils and climate allow cultivation of a wide variety of food crops including beans, cashew nuts, cocoa, groundnut, maize, melon, millet, palm oil, plantains,

rice, sorghum, yams, cassava (of which Nigeria is one of the leading producer) and various types of livestock. Most part of Nigeria experience rich soil and good rainfall, not to mention the warm temperature all the year round. About 80 percent of the land is cultivable and about 13 percent of the land is forested and livestock are also maintained by farmers. Agriculture is Nigeria's biggest employer, accounting for about 60 percent workforce, working mainly in small holdings using basic tools. Together with livestock raising, it provides a third of gross domestic product [12, 17].

Farming is practiced widely in the country; the vegetation of the area determines the crops grown in different parts. Apart from crop production, livestock and fish farming is practiced in different aspects of the country cattle production, goats and sheep production is pronounced in the northern part of the country, also grown in these areas are crops like groundnut, pepper etc. Irrespective of the aspect of farming practiced, the fact remains that farming is practiced on a largely subsistence scale. Farm sizes are small, generally less than 2 ha, tools are simple and hand operated. There is very limited mechanization, tractor-drawn implements is increasing but is of no general significance. Land is almost universally cleared by manual cutting and burning, crops are grown on the flat, mounds or ridges which are manually constructed; weeding is also carried out manually. Farming in Nigeria is characterized by a division of labour between the sexes, with women specializing in some operations e.g. harvesting, processing, marketing and the men in others. There is often acute shortage of labour on farms due largely to seasonal demand peaks for farm operations and division of labour between sexes and age-groups. This problem is aggravated by rural-urban migration, children attending schools and competition from the non-agricultural sector.

In short, farming system practiced in Nigeria is highly traditional and complex. They do not only involve several species of crops but often include livestock. Shifting cultivation and nomadic herding are the dominant farming systems, true shifting cultivation is however disappearing due to population explosion except in isolated areas. Yields per unit area is usually low under this traditional farming systems and in most cases, farmers get very little profit. AR (1999), reported that growth in agricultural output averaged 3.5 percent over 1993-97, higher than the population growth rate [12]. AR also said that much of the increase in agricultural output in recent years has resulted from expansion of the area under cultivation rather than from increased productivity. It claims that the

agricultural sector has been hampered by lack of investment in improved farming technology. It has also been said that the share of agricultural products in total exports has plummeted from over 70 percent in 1960 to less than 2 percent in 1999. The decline was largely due to phenomenal rise of oil shipments [12].

Despite the great inherent potential for farming in Nigeria, the country has been importing food due to the fact that agriculture has not kept up with the rapid population growth and also because of the decline to the agricultural focus as a result of the discovery of oil and industry. However, programs have started to develop and government is also encouraging private investments in Agriculture and agro industries by providing incentives including tax breaks, extension services but without much success.

The Nigeria farming situation could be understood. According to Abdullahi (2001), 'general lack of scientific and technological capacity will severely limit actual production in spite of great inherent potential'. Also, 'poor resource base, coupled with competing demands for other developmental needs, makes public funding for agriculture grossly inadequate. Mention could also be made of poor prioritization, mismanagement of limited resources and lack of sufficient political will as additional factors limiting agricultural growth in most developing countries' [13, 18].

Maize farming in Nigeria: Maize belongs to the family-*gramineae*, the genus-*zea* (tribe: *maydeae*) and the species-*mays*. Maize belongs to a highly specialized tribe. It is a large annual with a single stout stem, usually 2-3m high (but can vary from 1-6m), with approximately 14 nodes. Leaves have long lanceolate blades and are at large 30-150 by 5-15 cm. The terminal panicle bears only male flowers and is called the tassel; it can be up to 40 cm long. The female inflorescence is ear borne in the axils of middle leaves approximately half way up the stem, 1-3 per plant.

Maize has been in the diet of Nigerian's for centuries. It started as a subsistence crop and has gradually become more important crop. Maize has now risen to a commercial crop on which many agro-based industries depend on as raw materials. After wheat and rice, maize is the most important cereal in the world [14].

Iken and Amusa [13], reports that most of the work done on maize prior to 1950 can be described as agronomic [15]. Research on methods of cultivating maize was to a large extent secondary since the designing of efficient farming system was given priority. The first

attempt at agricultural research in Nigeria was made in 1998 [16]. The advent of a very destructive rust disease known as American rust that entered West Africa in 1950, called attention to the importance of maize as a food crop. Until in recent years, the bulk of maize grain produced in Nigeria was from the Southwest zone.

MATERIALS AND METHOD

Study area: The study was carried out in Ekiti State. Ise/Orun-one of the Local Government Area in Ekiti State was chosen for this study because of the prime importance of the local government area in terms of arable crops production. Major crops grown are maize, yam, rice, cassava, cocoyam, plantain and banana. Random sampling procedure was employed to get a representative sample. Farmers are selected at random from the villages within the sampling frame. The sampling frame consists of 10 villages from the local government area. Twenty farmers were selected at random for interview from each of the villages resulting in a total of 200 respondents. The respondents are farmers who produce maize (*Zea mays*) regardless of whether or not they produce other arable crops. Resources on which data were obtained include land, labour, capital (pesticides, herbicides, fertilizers, seeds) and other factors that contribute to the output obtained. Data were collected and analyzed.

Analytical techniques: In this study, descriptive statistics and regression analysis were employed as analytical tools.

Descriptive statistics: Percentage and frequency tables were used in the analysis of the socio-economic characteristics.

Regression analysis: Ordinary Least Square (OLS) was used to obtain the determinants maize output. The production frontier model was then used to determine the resource use efficiency of the farmers. The production frontier model used is the stochastic production frontier model of the form:

$$Y = f(X_1, \dots, X_n)$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots + \beta_n X_n + e_t$$

$$= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots + \beta_n X_n + V_t - U_t$$

Where:
 $e_t = V_t - U_t$

$V_t = A$ symmetric random error which captures the effect of weather, luck and other factor outside the control of the farmer.

$U_t =$ Technical inefficiency i.e. what is left for the farmer to reach the outer bound of the production frontier or operate on the frontier.

- Y = Output in Kilograms
- X_n = Vector of inputs i.e.
- X₁ = Farm size in acres
- X₂ = Use of tractor as dummy
- X₃ = Number of days for which tractor is used every season
- X₄ = Amount of hired labour used on the farm (man/days)
- X₅ = Amount of family labour used on the farm (man/days)
- X₆ = Quantity of pesticides used
- X₇ = Quantity of herbicide used on the farm
- X₈ = Quantity of fertilizer used on the farm (in kg).

In the frontier model specified, to estimate β , which is vector of parameter to be estimated, the stochastic production frontier model is linearised thus;

$$\ln Y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 \dots + \beta_n \ln x_n$$

The technical inefficiency is outlined by the equation

$$U_t = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 \dots + \delta_n Z_n$$

The above equation outlines the technical inefficiency effects and it also indicates that these effects in a stochastic frontier are expressed in terms of various explanatory variables, which include the education of the farmer, the age etc (represented as Z):

- Z₁ = Marital status of the farmer as dummy
- Z₂ = Age of the farmer
- Z₃ = Gender of the farmer as dummy
- Z₄ = Family size
- Z₅ = Number of years of formal education
- Z₆ = Number of years of farming experience

RESULTS AND DISCUSSION

Socioeconomic characteristics of maize farmers in Ekiti State: Analysis of socioeconomic characteristics of these farmers shows that about 58 percent are above 50 years of age and 42 percent below 50 years of age. This

Table 1: Socioeconomic characteristics of maize farmers in Ise/Orun LGA

Socioeconomic characteristics	Frequency	Percent distribution (%)
Age		
<30	24	12.0
31-40	21	10.5
41-50	40	20.0
>50	115	57.5
Sex		
Male	183	91.5
Female	17	8.5
Marital status		
Married	166	83.0
Single	24	17.0
Farming experience		
<20	40	20.0
21-30	40	20.0
31-40	40	20.0
>40	80	40.0
Education		
No formal education	107	53.5
Primary	78	39.0
Secondary	15	7.5
Tertiary	0	0.0

Source: Computed from survey data, 2005

implies that most of the farmers are old with less energy. Since the bulk of the farmers' population is old, output productivity will be quite low. From the table, it is shown that 92 percent are males while only 9 percent are females. The women also engage in farming but only on their husband's farm. The belief in the study area is that a woman should not own a farm of her own when she has a living husband. She is expected to work with her husband on his farmland. Nevertheless, widowed women who are single at the time engage in farming on their lands which are the one passed to them by their late husband so as to fend for their family. It is also shown that 83 percent of maize farmers are married; only 17 percent of the sample population is single. It is also observed that most of the farmers usually have more than one wife with a large family for the purpose of having more access to family labour, it is only the younger farmers who keeps lesser wife or just one and the few young men who are single but with individual farmlands. Therefore, a lot of money will be needed to pay for hired labour by the middle-aged farmer. These younger farmers are also observed to be the ones within the population who are enlightened enough to send their wards to school for primary education and in some cases junior secondary education unlike the older ones. As such, these kids are only available on farm when

school is not in session, hence, a lot of hired labour will be needed to supplement the insufficient family labour they have, if larger area of land is to be cultivated and if yields must increase.

Furthermore it is shown that majority of the maize farmers have 21 years experience or more in maize farming. It is of general opinion that experienced farmers would be more efficient, have a better knowledge of climatic conditions and market situations and are thus expected to run a more efficient and profitable enterprise. Table 1 also show the educational level and since the bulk of the population are older people, it is not surprising that most of the maize farmers interviewed received no formal education. This explains why they have used no modern inputs. This also corroborates the fact that low yields were obtained on their farms. The more educated a farmer is, the more exposed he/she is and the more the chance that he/she'll readily accept and adopt new innovations than the uneducated ones. Who claim the soils are fertile and do not need fertilizers.

Explaining the determinants of maize farmers' output:

Regression analysis (Table 2) was used to determine the factors that affect maize output in the selected villages. The variables were fitted into four functional forms:-linear, semi-log, Cobb-Douglas and exponential forms. The variables tested include farm size, use of tractors, number of days for which tractor is used per season, use of pesticides, use of herbicides, fertilizer amount of hired labour and family labour used.

The lead equation (i.e. exponential function) was chosen based on the statistical certain statistical criteria ranging from the sign of the coefficients, R^2 value and number of significant variables. This function has a R^2 value of 93.0 percent and an adjusted R^2 value of 92.2 percent. Table 2 on the appendix shows the result of the regression of output, Y in kilogrammes against the independent variables. The results indicate that farm size is a significant determinant of the output. Farm size has a positive relationship with the output and it is significant at 1 percent. This means that output is affected greatly (99 percent) by farm size. The positive relationship follows the a priori expectation that increase in farm size will result to increase in output. The larger the farm size, the higher the yield obtained. Use of tractor also has a positive relationship with output tractors help to hasten farm operation.

For output to be optimal (Table 3), farm operations needs to be carried out at the right time. Hence, the faster and timely the operations are, the better the yield. This

Table 2: Result of regression analyses (OLS)

Functional forms	Constant	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈
Linear	322.56 (231.77)	***441.49 (25.23)	**265.96 (128.15)	32.93 (62.30)	**8.11 (3.52)	9.15 (11.83)	**45.78 (19.63)	***1.44 (0.32)	***1.16 (0.16)
Semilog	***6.15 (0.22)	***0.33 (0.02)	***0.38 (0.12)	***-0.17 (0.06)	0.01 (0.01)	0.01 (0.01)	***0.05 (0.02)	0.01 (0.00)	***0.01 (0.00)
Cobb douglas	***6.001 (0.25)	***0.31 (0.02)	***0.36 (0.12)	***-0.15 (0.06)	0.06 (0.04)	**0.14 (0.06)	***0.177 (0.05)	0.03 (0.02)	***0.035 (0.01)
Exponential	**670.04 (279.87)	***439.14 (26.14)	*235.76 (130.08)	235.76 (130.08)	*81.57 (48.60)	22.64 (72.21)	**131.19 (53.72)	***97.01 (21.56)	***63.72 (8.98)

Z ₁	Z ₂	Z ₃	Z ₄	Z ₅	Z ₆	R ² (%)	Adjusted R ² (%)	F
-115.68 (88.354)	-1.613 (2.965)	50.106 (87.962)	3.941 (4.421)	-4.355 (5.079)	0.129 (2.376)	93.1	92.3	***126.234
-0.0316(0.082)	-0.0007(0.003)	0.0011(0.082)	0.0029(0.004)	-0.0033(0.005)	0.0013(0.002)	86.9	85.5	***63.302
-0.102(0.082)	-0.002(0.003)	0.0593(0.081)	0.0036(0.004)	-0.002(0.005)	0.0016(0.002)	88.0	86.7	***68.782
*-161.397 (92.143)	-1.604(3.056)	88.054(91.253)	2.555(4.439)	-3.825(5.114)	0.599(2.388)	93.0	92.2	***124.617

Source: Authors' Computation from Survey Data, 2005, Standard Errors are in parenthesis

***Coefficients significant at the 1% level, ** Coefficients significant at the 5% level,

* Coefficients significant at the 10% level

Table 3: Stochastic frontier regression result

Variables	Coefficient	Standard error
Constant	6.4773**	0.0863
Amount of hired labour	0.0153*	0.0049
Amount of family labour	0.0233	0.0062
Pesticide	0.1914**	0.0206
Herbicide	0.0011***	0.0008
Fertilizer	0.0014***	0.0004
Vt	1.1717	0.4941
Ut	0.3857	0.0488

Log likelihood function = -46.78

(Farm efficiency) = 0.68

***, **, * Coefficients significant at 1, 5, 10% levels respectively

Source: Authors' Computation from survey data, 2005

factor is significant at the 10 percent and this may be due to the fact that, tractor users in the study area do so for land clearing purposes only and not for driving planters or other farm operations. Both family and hired labour have a positive relationship with the output and are significant at the 10 percent level. Availability of labour is important for timeliness of operations and for obtaining the desired output. Most farmers interviewed cannot afford to increase the size of their maize farms because there is insufficient labour. The few young men around are being demanded for by a larger number of farmers. Hence, unavailability of labour could lead to reduced output.

Use of chemical inputs such as pesticides, herbicides and fertilizers are also significant to the output at the 5 percent, 1 percent and 1percent level respectively. This shows that output is greatly affected by the use of chemical input. Chemical input has 95-99 percent effect obtained in maize farms. With increasing population pressure that is being encountered in most developing countries today, arable land continues to reduce and so, there is not enough land to practise fallow, rotation with legumes to make up for the lack of mineral fertilizer. In view of this Louise Fresco (2003) says organic agriculture, which eliminates the use of synthetic inputs, does not appear to be a feasible alternative. For production to increase, maize farmers must embrace use of chemical inputs.

Summary, conclusion and recommendations

Summary of major findings: In summary, of the eleven variables tested, factors which contribute significantly to maize output among the farmers are; farm size, use of tractions, family and hired labour, use of pesticides, herbicides and fertilizers. The OLS results reveal that for the socioeconomic characteristics regressed against the output, age and experience follows the a priori expectation. From Table 2 it can be observed that age has a negative relationship with output, i.e. the older a farmer becomes, the less his output will be. Experience on the other hand has a positive relationship with output i.e. the more experienced a farmer is, the more likely he is able to perform better.

The determinants of output included in the frontier model are amount of hired labour used, amount of family labour used, pesticide, herbicide and fertilizer use.

Result of the analysis on Table 3 shows that herbicide use and fertilizer are the most important explanatory variables in the frontier estimates, having a significant level of 1 percent. The efficiency of the farmer is given to be 0.68. According to Battese and Coelli (1995) [17, 19], this is estimated using:

$$\alpha = \exp(-U_i)$$

Where α = Technical efficiency.

Note that technical efficiency of a farmer is between 0 and 1. Although, the value obtained is close to the 1.0 mark (0.68), it still shows that the farmers are not efficient in their use of production inputs (resources). The technical efficiency index shows that the farmers are 68 percent efficient in their use of resources. This calls for improving the efficiency of maize farmers in the study area.

CONCLUSION AND RECOMMENDATIONS

In this paper, the production problems of small-scale farmers have been examined, their importance and contribution to food production in Nigeria and the implications of neglecting these food producers, as well as resources available to small scale maize farmers have also been discussed. Activities of farming in Nigeria, the present situation of farming in Nigeria, Maize farming in the country, efficiency and its impact on food production and having a sustainable agriculture were discussed extensively.

From all indications, it is clear that maize farmers in rural Nigeria operates majorly on small scale, their farms are too small to permit economic efficiency. A lot of maize farms cultivated are less than or just equal to an hectare. More than 60 percent of respondents have less than 1ha farm. They usually plant maize on just 2-3 acres. Hence, the resultant low yields. Also, family sizes are large, mainly for the purpose of having family labour, but this also affect their economic gains. Farmers claim that even when yields are considerably fair, the large number of family members being fed leaves little or nothing for the market. Hence, most times, money is being imputed with little or no financial gain realized.

The fact that the bulk of maize farmers are also old accounts for low output obtained. This further makes clear the problem of rural-urban migration. Majority of the farming activities are left for the older ones to do and there is low output, which is inevitable due to lack of energy and effectiveness arising from old age. The findings also revealed that 70 percent of maize farmers in the area do not use any form of chemical inputs and machineries. They practice shifting cultivation, which leads to fragmentation of their land and they obtain low yields. Majority of them claim to have only heard of these inputs but have not used them on their farms. Even those that are aware said their use of inputs depends on how financially buoyant they are in that season. It was shocking when one of the farmers simply comments that 'when did tractors arrive, that you expect it to be widely used'. All these reflect that fact that major technical innovations are not getting to the grassroots and that diffusion rate is slow.

Based on the findings above, the following recommendations are made:

- Investing in agriculture to raise agricultural productivity, especially among small farmers should therefore be given the highest priority to achieve a secure food supply in the country. It is expected that the fall in the efficiency of maize should attract policy attention since maize is a widely consumed staple food both by man and his animals.
- To improve the technical efficiency of maize farmers, further promotion of rural household education, better access to credit facilities through improving rural financial markets, improvement in rural infrastructure (mainly roads) would be needed. Some form of informal adult education will assist farmers to be better managers of their farms. Governments should provide subsidy to farmers as most of them cannot afford technological innovations due to lack of credit facilities.
- Finally, an appraisal of the activities of the extension service in the State is suggested so as to discover and improve on weak points, or better still modify their plans of operations to bring about better reach to farmers.

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