ECONOMIC ANALYSIS AND RESOURCE USE EFFICIENCY ON MAIZE PRODUCTION UNDER SASAKAWA TECHNOLOGIES IN BAUCHI, NIGERIA

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ABSTRACT

This study was conducted in western zone of Bauchi State Agricultural Development Programme (BSADP) to examine economic efficiency of maize production under adopters of Sasakawa global 2000 (SG.2000) maize production technologies. Ten (10) SG.2000 maize production package adopters randomly selected in these villages for administration of structured questionnaires. Results of the socio-economic status of respondents showed that majority of them were within the 31-50 years age group, with household sizes of 1-10 persons, having farm experience of 1-5 years with tertiary education sourcing their capital through personal savings and are civil servants. Results on the gross and return per naira invested ration were 0.38 and 1.62 respectively. Total cost and net farm income were ₦38,441.02 and ₦62,358.98/ha respectively. Double-log function gave the best fit with R^2 58.40% showing great variation in maize output in the study areas. Regression coefficients of land size (X_1) and seed (X_2) were negative while fertilizer (X_3), labour (X_4) and chemical (X_5) were positive and significant at 5% level of probability. Result of returns to scale of maize production estimated at 0.6767 (<1) reveals a decreasing trend. Estimated efficiency ratio (r) of the MVP/MFC is greater than one (>1) for all the inputs meaning a gross underutilization of inputs. Insufficient fertilizer, high cost and or late supply disclosed that SG.2000maize production package is viable and feasible and therefore non-adopters should be encouraged to adopt the new innovation for increased maize production in zone. This will be increase food production and stimulates more socio-economic activities in the area..

Keywords: Economic analysis, resource use efficiency, maize production, Sasakawa technologies.

INTRODUCTION

Agriculture has suffered from years of mismanagement, inconsistent and poorly conceived government policies, neglect and lack of basic infrastructure. Still, the sector accounts for over 26.8% of GDP and two-thirds of employment. Nigeria is no longer a major exporter of cocoa, groundnuts (peanuts), rubber, and palm oil (Anon, 2011). The agriculture sector recorded slight growth slows down in 2010 compared to corresponding period of 2009. The sector grew by 5.66% in the first half 2010 as against 5.73% in the half of 2009, on account predominantly of performance of crop production. Crop production decelerated by 5.57% in the first half 0f 2010, compared with 5.65% in the same period of 2009 (Nigeria Economy, 2010).

Agriculture has contributed to national food security and help to maintain healthy and peaceful population. It has also been a source of food and nutritional for households. With the country's oil boom around 1972, less attention has been accorded to the agricultural sector (NEEDS, 2005). Therefore, over the years the rate of growth in agricultural production has stagnated and failed to keep pace with the needs of a rapidly growing population, resulting to oil production caused the agricultural industry to be neglected for many years. Once a net exporter of food, Nigeria now has a substantial deficit. Apart from food deficit, youth unemployment is increasing and small holder farmers constitute 80% of all farm holdings; their production system is inefficient and there is regular shortfall in national domestic

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production. Also lack of attention to the agricultural sector led to the disappearance of prime components of the agricultural sector, including the groundnut pyramids and oil palm plantations, along with the general regression of the industry.

In an effort to find a lasting solution to agricultural problems in Nigeria, Sasakawa production technology (*SG.*2000) was introduced in 1992 in collaboration with federal ministry of agriculture and some agricultural development programmes were chosen serve as pioneers. The *SG.*2000 was later introduced in Bauchi state in 1998 with a sole objective of increasing food production by transferring proven and new technologies to small scale farmers in the area of food crops production such as maize, rice, wheat etc. The present study seeks to examine the economics and resource use efficiency of maize production under the *SG.*2000 technology in Bauchi.

METHODOLOGY

The study area

The study area is Bauchi State. The state was created in 1976 from the former North eastern state of Nigeria, occupying a land area of 66,510 sq km or about 7 percent of Nigeria land area (Bauchi, 2007). The study area is bounded by the states of Kano and Jigawa on the northwest, Kaduna on the west. Pleateau, Taraba and Adamawa on the South, while Borno and Yobe on the North east and Gombe on the east. The state has twenty (20) local government areas (LGAs), and divided into three (3) agro-ecological zones namely: Western, Northern and Central zones According to NPC, (2006) the population of the state was approximately 4.7 million. The state lies between longitudes $8^0$45' and $11^0$5E and latitude $9^0$28' and $12^0$3'N. it has an altitude of 121.92-304.80 metres in the Northern guinea and Sudan Savanna (BSADP, 1989). The vegetation of the western part of the state is woody shrubs, trees, and grasses on plains, and woodland on hills and mountains. The average maximum and minimum temperatures for the state are 36.5^0 and 13^0C respectively.

The state experiences highest temperatures in April (37^0C-40.5^0C) and January/February are its coldest months with average temperature of 6.11^0C (BSPC, 1998). The mean annual rainfall ranges from 800-900mm. Rainy seasons usually start from late April-early May and last between 4-5 months (BSADP, 1989). The soil profile is heterogeneous in nature and changes with the change in topography. The topography of the area consists of dissected plains and pediments with out-cropping hills of basalts intrusive rocks and young granites. The soil consists of weakly developed and non-leached ferruginous soil of alluvial deposit, and deep and very deep, well drained and course textured soils found in some parts of the area (Bauchi, 2008). Bauchi State is endowed with abundant land for agricultural activities, therefore agriculture dominates the economy, and millet, sorghum, maize, yams, rice, cassava, tomatoes and vegetables are produced. Cash crops such as cotton and groundnut are grown. From the mid-1970s irrigation schemes have greatly increased agricultural production in the area. Cattle goats and sheep are raised. Solid mineral resources such as limestone, silica sand iron-ore, antimony; and kaolin are found in abundant (Abdullahi, 2004).

The area of study; the western part of Bauchi State comprises of seven LGAs namely; *Bauchi, Alkaleri, Firfi Das, TafawaBalewa, Bagoro*and *Toro,* with a population of approximately 1.7 million out of 4.7 million in the state. The area has 75-80% of its land area as cultivable and over 85% of the population area peasants agrarian and rural based; whose farming system is mainly mixed farming with small holding of about 3-5 ha^{-1}farm family (*SG.*2000 and *SG.*2002).

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Sampling Procedure and Sample Size

A multistage random sampling technique was used in selecting the respondents to achieve the set objectives (Upton, 1997). Hence, the population was divided into three (3) strata. The first stage involved simple random sampling of three (3) out of the seven (7) LGAs in the zone. These were *Bauchi*,*Dass and Toro*. In the second stage two (2) villages known for maize production were selected through purposive sampling in each of the selected LGAs, namely *Zungur, Galambi, Wanda, Dabardak, Tumu*and *Tudun-Wada* respectively. Followed by random selection of ten (10) farmers as respondents from each village. This gives sixty (60) SG.2000 adopters as sample size in this study.

Structured questionnaires based on the research objectives were administered (with the help of some trained field enumerators) to the 60 *SG*.2000 adopters for the purpose of data collection between October-December in the 2007 cropping season. Data collected were analyzed using simple descriptive statistics, production functions; farm budgeting, financial/productivity ratios, production function and cost and returns analysis: Frequency distribution and percentages were used to determine the socio-economic characteristics of the respondents. A farm budget is simply an attempt to qualify the effects of a proposed plan. The farm budgeting is one of the oldest, familiar and simple method used in farm management and production economics (Idi, 2004). It is used for analyzing the productivity of a farm enterprise. It estimates the total cost and total revenue for the same production period, based upon input and out data relevant to the problem in question. The differences between the two parameters tellsa measure of net return which could be a profit or loss for the period. The farm budgeting techniques therefore gives a measure of the profitability of farming and productivity of all the resources used in the farm. However, according to Idi (2004), the inability of the technique to define an economic optimum of production is its major limitation

Net Farm Income (NFI)

The NFI is the difference between/total returns (TR) and the total cost (TC) of production. It expressed as:-

NFI = TR - TC ……………………………………………….. (1)

Where: NFI = Net farm income

TR = Total revenue/return on maize production

TC = total cost (variable cost = fixed cost)

The fixed cost (depreciation of farm equipment and tools and land rented). It was estimated using straight – line method of depreciation:

Depreciation = ………………………………………………………. (2)

Where" P = Purchase price of the asset

S = Salvage value (life span)

N = Number of years of the asset.

Production Function Analysis

A multiple regression model is a causal relationship between two or more independent variables and the dependent variable and was used in this study. The model is expressed fin its general form as:

$$Y = F(X_1, X_2, X_3, X_4, X_5 + U) \text{ ……………………………………(3)}$$

Where: Y= Quantity of maize output (Kg)

X_1 = Seeds (Kg)

X_2 = Fertilizer (Kg)

X_3 = Chemical (Litre)

X_4 = Labour (Man-day)

X_5 = Farm size (Hectare)

U = Error term

Productivity Estimate

Efficiency of Resource-Use

Economic theory states that for a firm to maximize its profit with respect to an input, the ration of its marginal value product (MVP) to its marginal factor cost (MFC) must be equal to 1. A ration less than unity shows over utilization of the resource and ration greater than unity indicates underutilization of the input and increasing the rate of that input, will increase the level of profit of the firm and ratio equal to one (1) shows efficiency use of resources (Idi, 2004). Following Ojo *et al.* (2008) efficiency of resource (r) is given as:

$$r = MVP/MFC \quad \ldots\ldots (4)$$

The values of MVP and MFC were estimated as follows:

$$MVP = MPP.Py$$

$$MFC = Px_i$$

Where: MNP = Marginal Value Product of variable input

MPP = Marginal Physical Product

Py = Unity Price of Output

Px_i = Unit price of input Xi

r =Efficiency ratio

Economic of Scale

The elasticity of production which is the percentage change in output as aratio of a percentage change in input was used to calculate the rate of return to scale, which is measure of a firm's success in producing maximum output from a set of input (Farrel, 1957). The elasticity of production was estimated using the following mode:

$$EP = MPP/APP \quad \ldots\ldots (5)$$

Where: EP = Elasticity of production

MPP = Marginal physical product

APP = Average physical product

If: EP = 1: constant return to scale

EP < 1: decreasing return to scale

EP > 1: increasing return to scale

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RESULTS AND DISCUSSION

Table 1 shows result on socio-economic characteristics of respondents. Majority of them were within the age group of 31-50 years (66.66%), owed by 20% of the respondents who were as the mean age of small scale rice farmers in Bauchi State. This shows that there are limited numbers of young persons' engaged in food crop agriculture. Reasons for this may be most young people who are supposed to be backbone of the maize production; are either in school or have migrated to urban centers in search of paid jobs. The results also indicated that, 96.67% were male and only 3.33% were female. This implies that maize production in the study area is amen dominated enterprise. Similar result was reported in a known vegetable food crop in northern agricultural zone of Bauchi state (Dantat and Damar, 2008). In addition, 100% of the respondents are married. A greater number of the farmers had household size of 1-10 person (53.33%) and indicates the possibility of using family members as source of farm labour.

The farming experience is determined by the number of years of years spent in the profession. Most of the respondents have 1-5 years (33.33%) of experience under *SG*.2000 maize production technologies. Possible reason could be because *SG*.2000 was recently introduced in Bauchi State. The study reveals that, many of the respondents have tertiary education (43.33%,) followed by Qur'anic/Arabic (30%).Thisshow that, the respondents are literates and this could be the basis for their decision to adopt the *SG*.2000 maize production package willfully. This finding is in line with that of Altine (2006) who found that, the level of education has a high and positive sign of coefficient of regression analysis value on maize production in Bauchi LGA. This further means that, there is positive and strong relationship between the level of education attainment of harmers and adoption of a technology; that with higher education easily adopts technology than those without.

Majority of the respondent (75%) acquired their capital for production through personal savings and followed by 144.r17% of the farmers who got credit from bank of agriculture (BOA). This is in accordance with Abalu,*et al.* (1980) findings. These workers reported that. Farmers in Adamawa state of Nigeria has limited capital to use. This implies that majority of them obtained their capital from informal sources and this could affect their scale of production. Low patronage in services provided by BOA could either be due to high interest charged on loans and credit facilities or unnecessary delays in the disbursement of loans. Further, the result reveals that 56.70% of the respondents were civil servants.

The result in Table 2 shows costs and return in maize production per hectare. The total return and total cost were ₦100, 800.00 and ₦38, 441.02 respectively. The net from income was₦62.358.98/ha. The result also disclosed that the operating, fixed and gross ration were 0.38, 0.03 and 0.38 respectively. The return per naira invested was ₦1.62. The gross ration of 0.30% implied that 38% of the revenue pays off the total cost of maize production. The returns to each naira invested implied that in every naira invested farmers realize a return of ₦1.62. Therefore, maize production in the study area is a profitable business.

On the basis of a priority expectation, the statistical significance of the coefficients in the coefficient of determination of the double-log function was chosen as the lead equation (Table 3) The (R^2) value 0.584 indicates that, 58,40% of the variation in output of maize production was explained by the variables (inputs) included in the model. The regression coefficient of land size (X_1) and seed (X_2) are negative indicating an inverse relationship with output in production. This justified *SG*.2000 technological package recommendation; land size, ¼ -1 hectare and one seed/hole. While, fertilizer (X_3), labour (X_4) and chemical (X_5) have positive coefficients indicating an increase in these inputs, holding others constant will lead to of land size and seed and more of fertilizer, labour and can increasing the output.

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Hence, the farmers can increase the output by the use of less of land size and seed and more of fertilizer, labour and chemical. The result also showed that, fertilizer, labour, and chemical were significant at 5% level of probability. The summation of the coefficient of the double-log is 0.6767which less one (<1) and this indicates decreasing return to scale and that maize production was inn stage iii of the production region. The farmers are at optimum stage of production. Any additional successive units of a variable factor will result in less additional units of output, especially in the case of land size, seed have negative contribution to the total output, while, fertilizer, .labour and chemical have positive contribution to output.

The result in Table 4 revealed that, farm size, seed, chemical, fertilizer and labour had MVPs of ₦18.77, ₦73.46, ₦17.60, ₦10.72 and ₦9.68 respectively. This means that by increasing each of the inputs by one (1) unit, the total value of product will increase by the respective MVP amounts. Similarly, farm size, seed, chemical, fertilizer and labour had MFC of ₦17.00, ₦38.01, ₦6.71, ₦4.10 and ₦3.68, respectively. This means that total cost of the will increase by the respective amounts if each of the input is increased by one (1) unit. The ration of the MVPs to MFCs of all the inputs (land, seed, chemical, fertilizer and labour) are greater than unity. This implies underutilization of all the inputs. The study further revealed that, the main constraints faced by farmers of *SG.*2000 were insufficient fertilizer, followed by high cost and or late supply of key farm inputs. Other was; high cost of labour, lack of credit facilities and low and unstable output or yield (Table 5). The implication of these is that resources are not readily available especially at the time when due for full implementation of the *SG.*2000 maize production package. This affects the optimization of inputs. Similarly, non-availability of inputs might have resulted to the underutilization of all the resources as revealed in Table 4 in this study.

CONCLUSION

Maize production under *SG.*2000 in the study area was profitable, though there was underutilization of all the resources. However, adjustments in resource use are required in order to improve farm profit at the present level of technology employed by adopters of *SG.*2000. Therefore, if other farmers (non-adopters of *SG.*2000) in the study area will adopt *SG.*2000 maize production technology; maize production will definitely be enhanced thereby making the study areas one of the maize producing zones in the state. Consequently, this will solve the question of food insecurity and poverty in the study area and the country at large.

RECOMMENDATION

Based on the findings the farmers in the study area should be encouraged to participate in adult education programme so as to acquire basic knowledge that would help them adopts viable technologies (innovation) that are targeted towards improving their standard of living. Extension workers in the study area should double their efforts to influence the non-adopters of SG.2000 to adopt the technology and use resources more efficiency (farm size, chemical, seed, fertilizer and labour). This will increase maize production and stimulates more socio-economic activities in the area

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