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Productivity of Farm Inputs on Small-Scale Maize Production in Busia County, Kenya

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ABSTRACT: Despite there being enough knowledge and farming resources in Busia County, to be able to efficiently produce the staple food of the County, maize productivity in the County is well below its potential level. This study analysed the yield levels of maize production among small scale farmers in Busia County with regard to selected farm inputs. It adopted a causal research design on a sample of 399 small scale maize farmers, and used regression analysis on cross sectional data collected in 2014 to determine the level of efficiency of inputs among the small-scale maize farmers. It was found at α = 5%, level that: Synthetic fertilizer bore a positive but not statistically significant relationship to yields of maize (β = 0.079305463); hired labour hours and maize yields were negatively (β = -0.0014898) and significantly related (p=0.027); use of certified seeds is positively (β = 0.2027262) and significantly related to yield (p<0.001); mechanization was positively (β = 0.0184989); and significantly (p<0.001) related to yield. This meant that while the increased use of the other inputs raised the maize yields, more hired labour reduced maize production in Busia County.

KEYWORDS: Technical Efficiency, Hired labour, Synthetic/Inorganic Seed, Mechanisation, Maize yields, stochastic frontier.

INTRODUCTION

Maize is the principal staple food of Kenya. However, Kenya normally has a deficit in maize production. Rational government policies have been put in place and various non-governmental organizations have intervened to try and alter the economic contribution of the subsector and make it a key element in accelerating growth and reducing poverty (WEMA, 2010; MOA, 2013). Maize in Busia County is grown by small scale farmers who cultivate maize on a farm of typically three acres or less (Woolverton, 2012). They are located rurally and are usually to be considered financially poor. They produce a relatively small amount of maize and they rely on their harvest both for their own consumption and as a cash crop. In general small scale farmers depend on rain fed agriculture. Since they don't have access to irrigation systems because of its high costs they are severely affected when dry spells occur and generally lose all or a large part of their harvest because of it (Skjöldevald, 2012). This leaves Busia County food insecure. Its residents rely mainly on the importation of its staple food (maize) from outside the county- mainly Uganda (KIPPRA, 2013).

LITERATURE REVIEW

Literature points out a number of factors affecting maize production. Notable on this list is the use of fertilizer. It has been estimated that the average fertilizer application in sub-Saharan Africa is a mere 7 kg per hectare (Muasya & Diallo, 2001). The situation is not different in Kenya. Fertilizer use in the Kenya is below the recommended rates among most of the small scale farmers leading to reduced productivity per unit area (KFSSG, 2012). According to Ariga only 13% of the maize farmers in the western Kenya region were using fertilizer on their farms by 2007 and they applied 12 kg per acre (Ariga et al., 2008). The situation had not changed much by 2013 where the proportion of the maize farmers in the western Kenya region who were using fertilizer had risen only marginally to 44% (Karanja D. et al,. 2013). According to KFSSG, many farmers in East and Southern Africa plant the wrong maize seed varieties, ending up with poor yields for lack of correct information (KFSSG, 2012). As far as seed variety planted is concerned, the challenge facing farmers in western Kenya is the choice of seed varieties because most maize seed varieties are manufactured or imported by thirty (30) companies located outside the region, mainly in Nairobi (Ali-Olubandwa et al., 2011). Nearly 80% of the farmers in this region predominantly grow local maize varieties, whose seed they recycle for many seasons,

while about 20% grow improved varieties, often in addition to the local varieties (Odendo et al., 2002). Indeed, in neighbouring Bungoma County, only 30% of the maize farmers use recommended variety seed for planting (Woolverton, 2012). A report by FAO indicates that farmers in western Kenya region choose their maize seeds based on: high yield, early maturity, tolerance to weeds, low cost of seed, tolerance to diseases, and ability of a variety to perform reasonably without application of fertilizers and resistance to insect pests (FAO, Soil fertility management in support of food security in sub-Saharan Africa, 2011). Havrland *et al* note that the most commonly used in Kenya and in Busia County in maize farming is the classic mechanized technology. This is mainly used for soil preparation and to a lesser extent for seeding operations (Havrland *et al*., 2006).There is a commonness in the factors influencing production efficiency in Busia County just like in the rest of the country and in Africa as a whole. Reduced soil fertility is compounded by planting the wrong variety of seed; labour is used where machines would do better.

METHODOLOGY

Data was collected from small scale maize farmers in Busia for the planting season of 2014, as observations of farm output of maize in terms of 90kg bags. Data also included the use of the following farm inputs: the amounts of synthetic or inorganic fertilizer that were applied, the amounts of certified seed planted, the hours of hired labour put in and the cost of machinery used.

The double tier Stochastic Frontier Analysis (SFA) regression model based on the Cobb- Douglas production function was used: $Y = AL^{\alpha}K^{\beta}$.

It was linearised in its parameters: $\ln Y = A + \alpha \ln L + \beta \ln K$,

so that its general form was expressed as follows: $\ln Yi = \beta_0 + \beta_i \ln X_i + U_i$

Where: Y_i is the production of the i^{th} farmer; it represents the dependent variable or maize output. The measurement for this variable was the yield of maize crop or the number of 90 kg bags produced per acre planted

β is a vector of unknown parameters;

U_i is the error term representing the effect of statistical noise.

X_i*s* represent the independent variables, which measured the inputs of the maize farm as follows:

X_1= the quantity of synthetic or inorganic fertilizer used for planting and in top-dress the crop. It was measured by the number of kilograms of fertilizer applied per acre.

X_2= the quantity of certified seed planted. The yield should improve with suitable and adequate use of certified seed. It was measured by the number of kilograms of certified seed planted per acre.

X_3= the amount of hired labour used. This was measured by the number of man-hours used per acre.

X_4 =Mechanization. This was the use of machines to plough and plant the fields. It was measured by the cost of machinery used per acre in Kenya shillings. The cost of machine hire was fixed by the County government throughout the County at between ksh.3,000 and Ksh.3,500 in the year 2014 (Buluma, 2014).

Given functional and distributional assumptions, the values of unknown coefficients in equations were obtained jointly by the maximum likelihood method.

RESULTS AND DISCUSSION

Among the 399 study participants that were targeted, 322(81%) responded to the questionnaire. The output per acre in 90 kg bags ranged from a highest 26.3 (90 kg) bags to a lowest 0.3 (90 kg) bags among the firms that responded: Figure 1

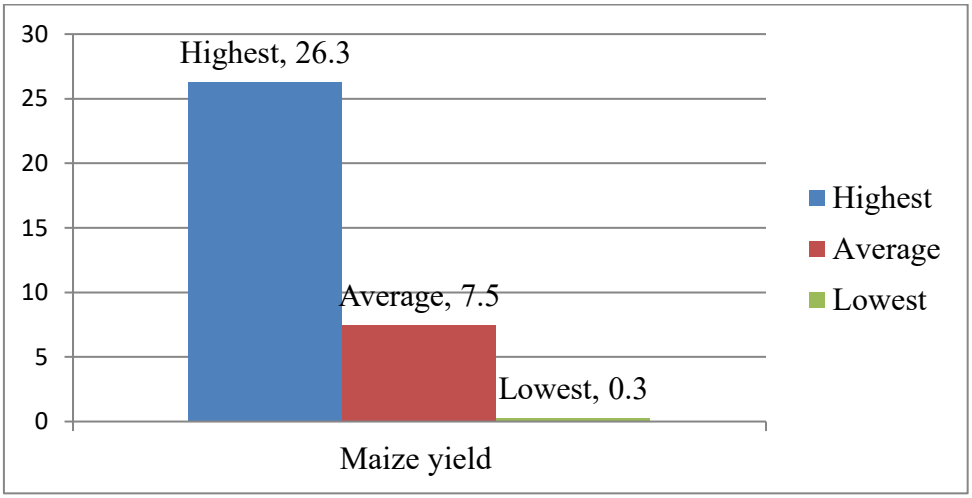

Figure 1: Average Maize Yields

The mean output was 7.9 (90 kg) bags per acre. On average, farmers used 6.7kgs/acre of certified seeds and 29.8kgs/acre of chemical fertilizer. They hired on average 50.7-man hours and on average spend KES 2260.9 on mechanization as in Table. The mean output agrees with the findings of Ali-Olubandwa (Ali-Olubandwa *et al.*, 2011) and means that the level of maize productivity has not changed in the county since and is still comparatively low.

Table I: Production Data

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Yield	322	.30	45.00	7.8849	6.07986
Labour	322	.00	1250.00	50.6630	101.19693
mechanization	322	.00	22000.00	2260.8789	2943.40786
Seed	322	.00	50.00	6.7246	6.01693
Fertilizer (chemical)	322	.00	150.00	29.7517	25.78468

Model estimation

Table II: Stochastic frontier and Inefficiency Models

Stochastic production model			
Variable	**parameter**	**coefficient**	**standard-error**
Constatnt	β_0	2.089444	0.19306656
Lnlabour	β_1	-0.0014898**	0.029453714
Lnmchanization	β_2	0.0184989**	0.01077944
Lnseed	β_3	0.2027262***	0.056223089
Lnfertilizer	β_4	0.079305463	0.03037021
Variance parameters			
Sigma-squared δ^2		0.96790469	0.24792797
Gamma Υ		0.84552911	
log likelihood function		-353.74646	
***p<0.001, ** p<0.05			

1. Fertilizer was positively correlated with yield though not significantly (p=0.207). Increased use of fertilizer improved maize yields. Out of the 322 firms that responded, 76% or 245 farmers were found to use inorganic or synthetic fertilizer in differing amounts. The amount of synthetic fertilizer input per acre ranged from 150 kg to 0.5 kg; with an average of 29.8 kg per acre. Most farmers substituted hired labour for fertilizer and so their hired labour input levels were greater than that of the most efficient producers. These were also the ones with the low non-farm income. This could point to inability to buy fertilizer as the reason for substitution of hired labour for fertilizer

2. There was no statistically significant relationship between the quantity of certified seed used and maize yields. Use of certified seeds was positively and significantly correlated with yield (p<0.001). At 0.5% level, use of certified seeds was positively correlated with yield. This means that if more certified seed were to be planted by farmers in Busia County, there would be an increase in the level of the yield. 80% of the 322 responding firms planted certified seed. The highest amount of certified seed input per acre was 50 kg while 2 kg was the lowest. The average amount was 6.7kg. However, given that most firms used inputs below the recommended rates, the amount of fertilizer used by the most farmers was slightly below the recommended rate of 120 Kg per acre (Faidaseeds, 2014).

3. There was no statistically significant relationship between hired labour hours and maize yields. From the findings, at 5% level, labour was negatively correlated with yield (p=0.027). At 5% level, labour was negatively correlated with yield. Hiring more labour actually reduces yield. 267 firms used hired labour. This represents 83% of the 322 firms. The average number of hours of hired labour input by a firm was 50.7 hours per year. The highest of these was 1250 hours, while the lowest was 2 hours.

4. There was no statistically significant relationship between the level of mechanization and maize yields. Similarly, mechanization was significantly and positively correlated with yield (p=0.022). The only type of machinery found to have been used was tractors which were used for preparing the land for planting. No machines were used during the planting, weeding or harvesting of maize. Tractors were made available by the Busia County government for the farmers to hire for ploughing in the year 2014. The County government fixed the hiring charge at an average of 3250 Ksh. per acre (Buluma, 2014). This made it possible to infer that the higher the expenditure on machine/tractor hire per acre, the higher the intensity of machinery use per acre. The use of machinery ought to be encouraged because at 5% level, mechanization was positively correlated with yield. The number of firms that used

machines to prepare their land for planting was 151(47%) out of the 322 respondents. The firms spent an average of 2260.9 Kenyan shillings to hire machinery for the production of maize. It was observed that firms spent between Ksh.333 and Ksh.11,500 per acre on the hire tractors.

CONCLUSIONS AND RECOMMENDATIONS

Results show that more certified seed input, more use of tractors for land preparation and less use of hired labour have significant and positive relationship with the level of maize output. The findings of this study seem to be in agreement with Schultz's assertion that small scale farmers in developing countries were poor due to lack of inputs but not due to inappropriately allocating the inputs to production (Ball & Pounder, 1996). Increased use of the farm inputs will help improve maize production which is the main food in Busia County. In this regard then, efforts should be made to make machines more available to the farmers either through hire, or through direct purchasing. Subsidizing machine hire/purchase costs could help. While most farmers are aware about the recommended levels of fertilizer and seed to us, they do not live up to these recommendations mainly because they cannot afford the said inputs. There is need again to make seed and fertilizer more affordable. Facilitation of credit would be a good way of financing such farm inputs.

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