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EFFECTS OF EDUCATION ON THE AGRICULTURAL PRODUCTIVITY OF FARMERS IN THE OFFINSO MUNICIPALITY

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ABSTRACT

The study investigated the effects of education on agricultural productivity of farmers; how the varying kinds of education affect agricultural productivity; to suggest policy interventions that will facilitate the use of education to increase agricultural productivity and how educational level of farmers in the Municipality can be improved. Eight farming communities were involved in the study. They were selected based on their location in the Municipality, predominant economic activity, access to extension services and non- formal education. Data was obtained from 100 farmers in these communities and also from the Municipal Agricultural Development Unit as well as Non- formal Education Section of the Offinso Municipal Educational Directorate. The major finding in the study were that the as educational level increases, output increases with secondary school education having the highest returns on agricultural productivity. Extension service has a greater impact on agricultural productivity than formal education even though coverage is low. The study concluded that education is important to the improvement of agricultural productivity such that formal education opens the mind of the farmer to knowledge, non- formal education gives the farmer hands- on training and better methods of farming and informal education keeps the farmer abreast with changing innovations and ideas and allows farmer to share experience gained. It is recommended the government improves the quality of formal education, extension services and adult literacy classes in the Municipality. Factors that affect productivity such as transportation, access to input and credit facility to farmers should be improved.

INTRODUCTION

There has been numerous studies conducted relating to education and productivity in the agricultural sector which have shown that there is a relationship between education and agricultural productivity (Appleton and Balihuta, 1996; Asadullah and Rahman, 2005; Lockheed, *et al*., 1980; Pudasaini, 1983; Weir, 1999). The type of relationship that exists between education and productivity is a matter of mixed evidence and it may either be positive or negative, substantial or otherwise. In 1992, the World Bank conducted a survey to measure the relationship between farmer's education and their agricultural efficiency in low income countries and found out that farmers with basic education were 8.7% more productive than farmers with no education (Gasperini, 2000).

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It suggests from the finding of the World Bank that there is a positive relationship between educational level of farmer and productivity. In a study conducted in Nepal on the effects of education on agriculture, it was discovered that education enhances agricultural productivity primarily by improving farmers' decision-making ability and secondarily by alleviating their technical efficiency. Technical efficiency used here is the farmer's capability to make better choices in terms of input and make better economically rational decisions (Pudasaini, 1983). Craig, Pardey, and Roseboom (1997) as cited in Reimers and Klasen (2012) noted puzzling negative coefficients for the education variables used in their studies. In an analysis of 37 data sets from different countries by Lockheed *et al* (1980), six data sets turned out to show negative but statistically insignificant effect of education on productivity. Hasnah *et al*. (2004) as cited in Asadullah and Rahman (2005) report a significantly negative impact of education on technical efficiency in West Sumatra-Indonesia.
In addition to the divergence in the type of relationship between education and agriculture, there is mounting evidence

that the type of education used in various studies matter. It is apparent that returns of education on agricultural productivity vary for different educational levels (primary, secondary and tertiary levels of education) with the returns on primary education being the highest (Lockheed *et al*, 1980; Appleton and Balihuta, 1996). In Uganda, it was realized that there are positive externalities from schooling in the form of higher agricultural productivity whereby other farmers benefit by adopting technology and practices used by one educated farmer (Appleton and Balihuta, 1996). A further study in Ethiopia emphasized that formal education does not necessarily affect productivity but non- formal education does in the form of extension services and sharing of information from farmer to farmer which has a greater influence in the adoption of and practice of best technology (Weir, 1999). A multiplicity of research has been conducted in Asia and in some African countries like Kenya, Uganda, Tanzania, Burkina Faso and Ethiopia (Appleton and Balihuta, 1996; Weir, 1999). Some of these studies are crop specific whiles others are general agricultural practice. That notwithstanding, evidence from to be specific Ghana is elusive. The purpose of this research is to ascertain the relationship between education of farmers and agricultural productivity in the Offinso Municipality of Ghana and to find out how education can be used to improve agricultural productivity in Ghana.

Problem Statement

The agricultural sector employs about 50% of the population in Ghana making it the highest employment sector in the country. Despite that, the sector contributes to about a third of the nation's Gross Domestic Product. The sector is dominated by small holder production units which are confronted by challenges such as low productivity, low level of agricultural production among others (National Development Planning Commission, 2010). In terms of education, the human resource of the sector has the lowest level of education with majority having just up to basic education. In a study conducted by the Cocoa Research Institute of Ghana, it was realized that 52% of farmers had up to middle school education whiles 21.5% were illiterates (Aneani, et al., 2012). The percentage of people employed in the agricultural sector is not commensurate with the percentage contribution of agriculture to the Gross Domestic Product (GDP) of Ghana. Why the difference in percentages? Is it that the quality of labour force is minimal to that of other sectors? There is little evidence in Ghana to suggest that the sector's low education level is what affect its contribution to GDP.

Possible causes of this problem could be attributed to the low level of education in the sector. One might argue that this is not the case since as stated earlier there are so many other factors that account for low agricultural productivity such as bad weather condition or changing trends of weather, pests and diseases among others. But education which involves literacy and numeracy is thought to provide people with skills, knowledge and ability to make efficient use of their resources in addition to innovating new ways of doing things. Even though the agricultural sector is faced with various challenges, there may be efficiency advantage for farmers who are better prepared to cope with the uncertainties due to education (Asfaw and Admassie, 2004). The study therefore seeks to identify the effects between education of farmers on agricultural productivity in the Offinso Municipality of Ghana.

Objectives of the Study

The objectives of the study are as follows:

- To examine the relationship between education and productivity in the Offinso Municipality;
- To determine how the differing types of education affect agricultural productivity;
- To propose policy intervention that facilitates the use of education to increase agricultural productivity in Ghana; and
- To recommend ways by which educational level of farmers can be enhanced in the Offinso South Municipality.

Education and Agricultural Productivity

The productive value of education has two main effects on agriculture: "worker effect" and "allocative effect" (Welch, 1970) . Worker effects is described as the situation whereby an educated farmer, given the same number of input can produce a greater output that is a better use of current resources. It is seen as increased output per unit change in education holding all other factors constant. With allocative effect, a worker is able to acquire information about cost and characteristics of inputs and interpret the information to make decisions that will enhance output. Here there may be a change in input and the farmer adopts methods which will otherwise not have been used. In a study conducted in Nepal, India (Pudasaini, 1983), it was discovered that the allocative effect of education on productivity is much greater than the worker effect indicating that a key way that education influences agricultural productivity is by improving the ability of farmers to take decision concerning the selection of input and the combination of input for better output. He stated that there are three main ways that education raises agricultural productivity: Improvement in farmer's skills, enhancement of farmer's ability to obtain, understand and utilize, new input, and improvement in overall managerial ability.

The effect of education of agricultural productivity can also be described as cognitive and non- cognitive as indicated by Appleton and Balihuta, 1996. Cognitive effects of education comprises basic literacy and numeracy that farmers achieve from education. Literacy enables farmers to read and understand instructions on inputs such as chemical fertilizers and pesticides among others. Numeracy allows for calculation of the right proportion of inputs to be combined to get the desired output. In a research conducted on 141 villages consisting of rice farmers within Bangladesh, it was found out that schooling has positive effects on agriculture due to the skills of literacy and numeracy that give the farmers better understanding into agricultural issues (Asadullah & Rahman, 2005). With regards to non- cognitive effects, there is a change in the attitude of farmers who attend school and this is as a result of discipline of formal schooling in terms of punctuality, teamwork, timeliness, adhering to schedules and so on. Nevertheless, non- cognitive effect on agriculture has not been widely studied and the inference of its effect on agricultural productivity are few as it is assumed that change in farmer's behavior as a result of education make them more susceptible to new ideas and modern practices. Education influences agricultural productivity either directly as indicated above or indirectly. Indirectly, with the skills derived from education,

farmers are able to engage in activities in the non- farm sector which serves as alternative source of income for agricultural activities (Appleton and Balihuta, 1996; Weir, 1999). Types of Education and Their Effect on Agricultural Productivity. The returns to education differ with the level of education and the type of education. A regards educational level, there are mixed evidence from literature as to whether primary or secondary education has the most returns to agriculture but despite that it is generally agreed that returns on tertiary education is very minimal or non- existence (Appleton and Balihuta, 1996; Asadullah and Rahman, 2005; Reimers and Klasen, 2012). This necessitates the exploration of the returns on secondary and primary education with respect to agricultural productivity. Lockheed, *et al*. (1980) argue that primary schooling is more crucial to agricultural productivity than secondary schooling because it gives farmer basic literacy and numeracy. It was realized in their research that an additional year of primary schooling increases agricultural productivity by 7.4% which was supported by Appleton and Balihuta (1996) who gathered that four years of primary schooling raised productivity by 7% while completing primary schooling increases crop production by 13%. Pudasaini (1983) also noted that as education level increases, the rate of productivity declines hence there is diminishing marginal productivity with regards to education.

Nevertheless, these statements have been opposed by recent studies conducted by Reimers & Klasen (2012) on a sample of 95 developing and emerging countries from 1961 to 2002, who discovered that returns to secondary education exceeds that of primary education because it is not just the ability to read and write that gives higher agricultural productivity but the ability to do critical thinking in addition to application of knowledge gained. This ability is what is gained in secondary schools. Secondary education can then be said to enhance the allocative effect of education on agricultural productivity in addition to indirectly contributing to productivity by providing a means to obtain non- farm income that can be used in the acquisition of inputs (Weir, 1999). It was realized that generally, an increase in schooling for an additional year increases agricultural productivity by 3.2%. Furthermore, formal and non- formal education can be seen as complementary in terms of enhancing agricutlural productivity (Lockheed, et al., 1980). This means that formal schooling alone will not boost agricultural productivity if it is not combined with extension services and mutual learning and sharing of ideas among farmers necessitating the need for a combination of both to improve productivity.

Kalirajan and Shand (1985) in their study of rice farmers in the Tamil Nadu region alluded that formal schooling does not necessarily increase farmer productivity but rather non- formal schooling. It was explained that an illiterate farmer is able to learn new ideas and modern technology from a neighboring educated farmer and from the mass media like radio and television hence emphasis should be placed on non- formal education like extension services rather than formal schooling. Non- formal education which was measured in terms of understanding, experience and extension visits led rather to significant increase in productivity than the years of formal schooling or educational level of a farmer. Even though their research results cannot be generalized to all the farmers in India, it can be said that non- formal schooling increases agricultural productivity through the mutual learning among farmers and extension service. An uneducated person is also able to apply knowledge gained for increased output and production efficiency. Social and Private Returns to Education on Agricultural Productivity. One major factor used to quantify the amount investment in education is whether the returns to education is private or social. Evidence from literature shows that social returns from education with respect to agricultural productivity far exceeds private benefits (Appleton and Balihuta, 1996; Weir, 1999). In a study conducted in Ethiopia, an additional year of formal schooling on average in the village has a much larger impact upon farm productivity than increasing household educational attainment by one year on average (Weir, 1999). Furthermore in Uganda, Social returns to education exceeded individual returns due to the fact that there was usual mutual learning among farmers. This indicated that an educated neighbor can affect an uneducated farmer through sharing of knowledge and ideas hence positive externalities from schooling lead to a higher agricultural productivity emphasizing the point of government intervention in subsidizing educational cost in rural areas (Appleton and Balihuta, 1996).

Determining the relationship between education and agricultural productivity

The measurement of the relationship between education and productivity has evolved with time with authors criticizing previous works and finding better equations and tests to reduce statistical and data errors to find the actual relationship that exist between these two variables. Factors to note in this measurement include: Sample characteristics, method of analysis, specification of measurement of dependent, independent and other explanatory variables (Lockheed, *et al*., 1980) Studies have shown the use of production function as the basic tool for analyzing the impact of education of agricultural productivity (Lockheed, *et al*., 1980; Appleton and Balihuta, 1996; Reimers and Klasen, 2012). Production function relates the quantity of farm output to the level of input that is the factors that affect production (land, labour, capital and any other factor that seems relevant to the study). The variables used in the production function depends on the objectives of the study as well as the data available. The kinds of production functions that have been commonly used include Cobb- Douglas Production function, linear production function and translog production function.

The Study Area

The geographical scope of this study is the Offinso Municipal Assembly which has a total land size of 600km^2 representing about 2.5% of the total land area of the Ashanti region. It lies within the latitude 7^0 15N and 6^0 95S and longitude 1^0 35W and 1^0 50E. It is located in the extreme North-Western part of Ashanti Region sharing common boundaries with Offinso North District Assembly in the North, Afigya-Kwabre in the East and South, Atwima-Nwabiagya and Ahafo Ano South Municipal Assemblies in the West. The municipality has many rivers that aid agricultural activities. These include the Offin. The municipality experiences Wet Semi- Equatorial climatic conditions with an annual temperature range of between 21ºC and 32ºC. The area experiences double maxima rainfall with an average annual rainfall of 953.40 mm. The major rainy

season is usually from May to June whiles the minor rainy seasons occurs between September and November. This favorable climatic condition enables farming activity which is the predominant agricultural activity in the municipality. The soil in the area are rich in humus, very fertile and well drained which supports the cultivation of both food and cash crops, the main source of livelihood in the municipality.

Education

Education is seen to be every important in the Municipality much care is given to it. There are 74 Pre- schools, 74 Primary schools, 52 Junior High Schools, 3 Senior High Schools, 1 Midwifery Training School and 1 College of Education. The Municipality has about 647 trained teachers and 273 untrained teachers making a total of 932 teachers. The Municipality also has a non- formal education sector that educates school drop-outs and adults for free. Basic literacy and numeracy in both English and Twi are taught for a period of 18 months each after which a student receives a certificate of completion. Classes are either held in the morning or evening in the communities with a minimum of 18 students and a maximum of 30 students

Major Economic Activities in the municipality

The predominant economic activity in the region is agriculture which employs about 62% of the total labour force. Other economic activities include: Commerce- 21%, Services- 15% and Industry- 4%. Since the focus of the study is on the relationship between education and agricultural productivity, much emphasis will be placed on the agricultural sector. The agricultural sector contributes about 55% of the total household income in the Municipality from food crops and 20% from livestock. The major agricultural produce includes food crops, cash crops and livestock. Major food crops include plantain, maize, yam, cocoyam and vegetables such as pepper, garden eggs and tomatoes. The industrial crops produced are cocoa, oil palm and teak. The major method of farming is slash and burn while the main farming practices are bush fallowing and mixed cropping. The average farm size per farmer is 1.0 hectares. Livestock raised in the Municipality include sheep, goat, cattle and poultry. This is usually subsistence based with very few large scale poultry farmers located in Abofour and New Offinso.

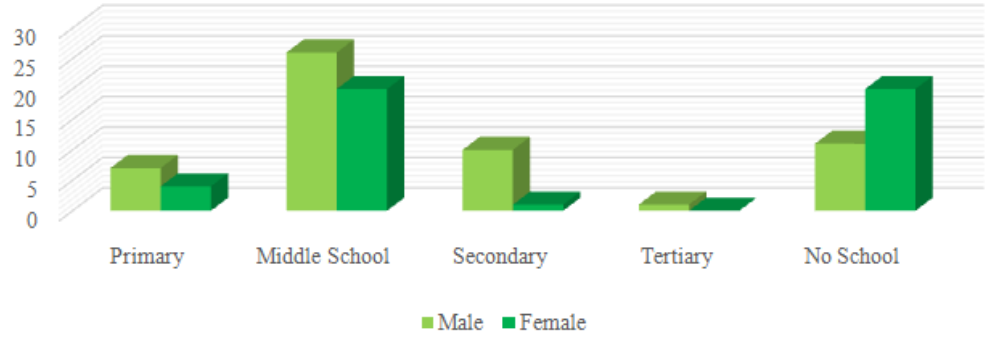
MATERIALS AND METHODS

The research design used was non- experimental design specifically correlation studies. Non- experimental designs do not involve the manipulation of a situation or circumstance but rather it is used to find the relationship between variables and in comparative studies. Simple correlation measures the degree of linear association between two variables without stating whether there is a cause and effect relationship. To explain and effect of the varying types of education on productivity, the mean average output was compared for various level and simple cross tabulations were used to determine the relationships that exists. Due to the uneven distribution of the data gathered Spearman's rank Correlation was used to give a true reflection of the relationship that exists between education and agricultural productivity and harmonic mean was used to reflect the true average output. Agricultural production as stated in the literature review is a combination of several factors such as land, labour, capital and other inputs. And as such to determine the contribution of education on agricultural productivity all the other factors were considered. The 2000 population census indicated that 62% of the people in the Municipality are farmers. Inferring from that using economically active population of 36141, it can be concluded that the total number of farmers in the region is 22,407. Primary data from MADU also indicates that 55%, 25% and 20% of the population are food crop farmers, cash crop farmers and animal producers. Therefore 75% of farmers are into crop production hence a study population of 16,805 farmers. The sample size of 100 farmers was chosen to be interviewed in 8 communities across the Municipality. The 8 communities from which the farmers were selected was done purposively while the simple random sampling technique was used to select farmers from the various communities. Primary data was collected from farmers in the selected communities in the district basically on production level, farm size, farm input and equipment used, educational level and access to extension services. The data was collected using questionnaires which was filled by the interviewer based on the answers given by the farmer. Primary data was also collected from the Municipal Agricultural Development Unit on crop production in the Municipality, extension services and any efforts put in by MADU in the education of farmers. The data collected was coded and analyzed using Statistical Package for Social Scientists (SPSS) and Microsoft Excel. These software were used to generate correlation coefficients, cross tabulation of variables, frequencies, charts and tables to show visibly findings identified.

Characteristic of Respondents

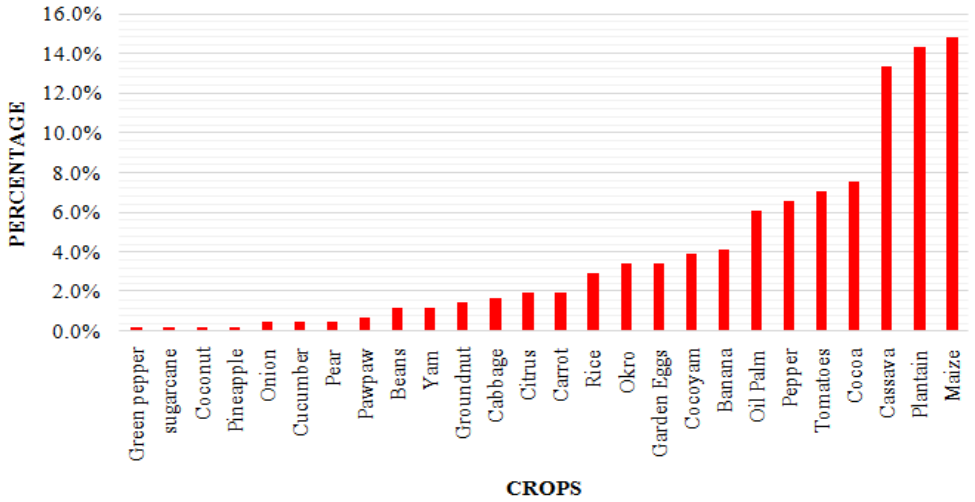
Hundred farmers were interviewed in the Offinso Municipality which consist of 55% male and 45% female farmers. 31% of the farmers have no schooling whiles 69% of farmers have some form of formal schooling. The average age per farm manager is 44 years whiles the average age per adult household members who work on the farm is 48 years. Figure 1 shows the educational level of farmers by gender and it can be seen that the male farmers have better education than the female farmers in the Municipality because in the rural areas, it was seen to be more beneficial to educate males than females. The total land size cultivated is 1345.5 acres in 8 communities with the annual average income per hectare being GH¢530.24. Crops cultivated as shown in Figure 4.2 include food crops (eg. Maize, cassava, yam, etc), cash crops (cocoa and oil palm) and exotic vegetables (cucumber, carrot, cabbage and green pepper).

The type of crops grown is determined by factors such as: regular supply of income, fertility of land, profit generated, and farmer's knowledge of crop and for posterity (cash crops). Farm produce are sold at the farm, in the communities, in the markets within the municipality and at some markets outside the municipality such as Kumasi to get better prices. Since most crops are perishable, they are sold right after harvest and only maize and rice are stored in barns to be sold at a higher price in the lean season. Oil Palm however is processed into palm oil to earn better income. Land cultivated for farming belonged to either family (64.22%) or rented (35.78%). With regards to farm labour used, only few large scale farmers (5%)



Source: Offinso Municipality Field Survey, 2014

Figure 4.1 Educational Level of Farmers by gender



Source: Offinso Municipality Field Survey, 2014

Figure 4.2. Types of Crops grown in Offinso Municipality

have permanently hired labor. On the other hand, farmers with smaller farm sizes (68%) use temporarily hired labour based on the money available whiles 6% of farmers use family labour only and 21% of farmers do not use any labour apart from themselves. Inputs such as fertilizer, chemicals for pest and disease control and seedlings are available in the municipality.

Effects of education on agricultural productivity of farmers in the Offinso Municipality

During the data collection, it was identified that farmers were unable to quantify their yield for the previous year but were only able to give information on income generated from sale of crop. Consequently, output as used in this study means average income generated per acre of land cultivated. To determine the effects of education on agricultural productivity of farmers, a translog Coub Douglas Production function (adapted from Lockheed et al, 1980) was used with value of output as dependent variable. The independent variables include land size cultivated last year, labour (represented by number of adults permanently working on the farm), capital (expenditure on purchased equipment used last year), expenditure of purchased input used last year (fertilizer, seedlings and agro- chemicals) and access to extension service. This is shown below:

$$lnY_i = \alpha_0 + \alpha_1 lnL_i + \alpha_2 lnK_i + \alpha_3 lnA_i + \alpha_4 lnP_i + \alpha_5 lnE_i + \alpha_6 lnExt_i + e_i \quad \ldots\ldots\ldots (1)$$

Where, Y = Value of output (average income generated)

α_0 = intercept (the value of Y when all other independent variables are 0)
L = Labour (number of adults permanently working on the farm)
K = Capital (expenditure on purchased equipment)
A = Land Size Cultivated
P = expenditure of Purchased input
E = Number of years of Schooling
Ext = Access to extension services (dummy variable)
e = Error term

From the equation, **α** (0, 1, 2, 3, 4, 5, 6) represents the coefficients of the various independent variables which shows the degree to which an independent variable affect productivity when all other independent variables are held constant. The regression coefficients was generated using SPSS and is shown below.

$$Y = 5.805 + 0.264L + 0.309K + 0.639A + 0.016P - 0.039E + 0.036Ext \quad \ldots\ldots\ldots (2)$$

$$Y = 5.805 + 0.264L + 0.309K + 0.639A + 0.016P - 0.041E + 0.036Ext \quad \ldots\ldots\ldots (3)$$

Table 1 summarizes the regression equation and tests for the validity of the model used. The multiple regression coefficient (R) shows that the independent variables predict 70.8% of the

dependent variable which is total income generated or output. To check the extent to which the output is explained by the independent variables chosen, the coefficient of determination which is R^2 was calculated and it indicated that 50.1% of output is explained by the independent variable. It was also necessary to check if the model used is suitable for the data gathered, an F-test was conducted which gave a significance of 0 at 95% confidence interval hence the model is a good fit for the data. From equation (2) above, it can be seen that land size cultivated has the highest coefficient of 0.639, meaning that it is the highest factor that determines the agricultural productivity of a farmer. The table 2 below shows the regression coefficient, the standard error and statistical significance of the variables used to predict the output. When the p- value is less than 0.005 it can be said that the variable is significant and any change in the variable will substantially affect productivity. Only the farm equipment used and total land size cultivated have a significant effect on agricultural productivity. Since equipment use is related to type of input used, input use can be said to affect productivity indirectly.

Table 1. Summary of Model and Statistical Significance

Multiple Regression Coefficient (R)	R Square (R^2)	Adjusted R Square (R^2)	F	Sig.
0.708	0.501	0.469	15.558	0

Table 2. Showing results of Multiple Regression

Independent Variables	Regression Coefficient	Std. Error	t	Sig. (p- value)
(Constant)	5.805	0.396	14.667	0
Number of years of schooling	-0.039	0.087	-0.451	0.653
Number of farm workers	0.264	0.178	1.477	0.143
Total cost of equipment	0.309	0.097	3.184	0.002
Total Land size Cultivated	0.639	0.1	6.379	0
Total Cost of purchased input	0.016	0.05	0.313	0.755
Dummy variable for extension	0.036	0.187	0.19	0.85

*Dependent variable is total income generated

To ascertain the effect of education on agricultural productivity of farmers, the education coefficients which is represented by number of years of schooling for formal education and extension service for non- formal education, were critically examined. From table 1, it can be seen that formal education has negative effects on productivity but it is not statistically significant. This means that a 1 year additional increase in the years of schooling leads to a GH¢0.039 which is equivalent to 3.9 pesewas reduction in income generated which is not substantial. This can be attributed to the low level of literacy in the Municipality. Literacy level as used in the analysis is the ability to read and write English. Out of the total number of farmers interviewed 64% cannot read and write English while 36% can read English implying that the number of years of schooling has minimal effect on literacy which is one of the major ways through which education affects productivity. This is evident in equation (3), whereby number of years of schooling is replaced with literacy and the result shows a coefficient of -0.041. Figure 3 below shows the interaction between educational level of farmers and literacy.

From the figure above it can be seen that only 9.09% of farmers who have attained primary school education and 47.83% who have had Middle School or Junior Secondary School education can read and write English. A major effect of education on agriculture is the cognitive effect whereby a farmer acquiring basic literacy and numeracy can read instructions on fertilizer, pesticides and weedicides and can calculate the right mix of input to enhance productivity (Appleton and Balihuta, 1996). Since 57% of farmers interviewed have up to 10 years of education which has not had a significant effect on the literacy of the farmers, majority of farmers are not able to apply lessons learnt in the classroom in their agricultural activity. Although formal education has negative but statistically insignificant effect on agricultural productivity, it can be used to indirectly improve productivity. Education is said to have allocative effect whereby a worker is able to acquire information about cost and characteristics of inputs and interpret the information to make decisions that will enhance output (Welch, 1970).

	Can read and write both English and Twi	Can read and write English only	Can read and write Twi only	Can read Twi only	Cannot read and write English and Twi
Primary	9.09%	0.00%	9.09%	18.18%	63.64%
Middle School/JSS	43.48%	4.35%	15.22%	2.17%	34.78%
Secondary	81.82%	9.09%	9.09%	0.00%	0.00%
Tertiary	100.00%	0.00%	0.00%	0.00%	0.00%
No School	6.45%	0.00%	3.23%	0.00%	90.32%
Total	33.00%	3.00%	10.00%	3.00%	51.00%

Source: Author's Own Construct, 2014

Figure 3. Relationship between Literacy and Educational Level

The type of equipment used which is directly related to the type of input use has a substantial effect on agricultural productivity. Therefore, an improvement in education can enhance agricultural productivity through improvement of farmer's ability to make decisions concerning choice of farm equipment and input to boost output. Conversely, extension service had a coefficient of 0.036 which also implies that access to extension services once a year increase productivity by GH¢0.036 or 3.6 pesewas which is positive but not statistically significant. The level of significance is low because only 36% of farmers interviewed have extension services.

Types of Education and their effect on Agricultural productivity

Formal Education

Formal education has been grouped in to Primary education (1 to 6 years of schooling), Middle School/ JSS (7 to 10 years of schooling), Secondary school (10 to 13 years of schooling) and Tertiary (above 13 years of schooling). About 11 percent of the respondents have attained primary education, 46 percent have middle school educations, another 11 percent have attained secondary education while only one percent has tertiary education. About 31 percent of the respondents have never been to school. According to Welch (1970), the productive value of education has two main effects which is the worker effect (how much one is able to produce more given the same input) and the allocative effect (acquiring knowledge to change combination of inputs to enhance output). The allocative effect of education has already been examined above. To determine the worker effect of formal education on agricultural productivity, the mean outputs of the various educational levels are compared as shown in table 4.

Table 4. Comparing Means of Educational Levels

Education level	*Mean Output per Annum (GH¢)	Frequency	Mean farm size
Primary	568.77	11	7.36
Middle School	503.60	46	4.25
Secondary	829.23	11	5.99
Tertiary	931.00	1	5
No School	487.66	31	6.24

Source: Author's Own Construct, 2014

**Mean used in this study is harmonic mean because the data contains some values that are much higher than the rest and using harmonic mean gives a better representation of the average.*

From table 4 it can be seen that tertiary education has the highest mean average income per hectare with no schooling being the lowest. Taking the individual components of education, it can be seen that the higher the education the higher the output gained. This emphasizes Reimers and Klasen (2012) discovery that returns to secondary education is higher than primary education because secondary education gives the farmers better ability to think critically and take decisions that have positive effect on productivity in the face of other agricultural challenges such as changing seasons and inadequate funds for input and hired labour. Primary school output is higher than that of Middle school because about 52% of farmers with the highest level of education being Middle school/ JSS cannot read and write English. The overall effect of the various levels of education is determined by using no schooling as control group and replacing the number of years of schooling with dummy variables for primary, middle school, secondary and tertiary education. The equation is shown below.

$$lnY_i = \alpha_0 + \alpha_1 lnL_i + \alpha_2 lnK_i + \alpha_3 lnA_i + \alpha_4 lnP_i + (\alpha_5 lnPrim_i + \alpha_6 lnMid_i + \alpha_7 lnSec_i + \alpha_8 lnTer_i) + \alpha_9 lnExt_i + e_i \quad \ldots\ldots\ldots (3)$$

$$Y = 5.805 + 0.264L + 0.309K + 0.639A + 0.016P + (0.014Prim + 0.033Mid + 0.284Sec - 0.226Ter) + 0.036Ext \ldots\ldots\ldots (4)$$

Where,

Prim = 1 to 6 years of schooling
Mid = 7 to 10 years of schooling
Sec = 11 to 13 years of schooling
Ter = above 13 years of schooling

Looking at equation (4), it can be seen that an additional year of primary, middle school and secondary education leads to increases productivity with secondary education giving the highest returns to education. This finding matches that of Reimers and Klasen (2012) who also discovered that returns to secondary education is higher than primary education because the ability of farmers to make better decisions and choices about combinations of inputs to obtain maximum output is developed. Another reason for secondary schooling yielding the highest returns is that about 50% of these farmers studied Agriculture which gives them better knowledge than other farmers. However an additional year of tertiary schooling has a negative effect on productivity. This confirms findings made by Pudasaini (1983) which that as education level increases beyond a certain, the rate of productivity declines hence there is diminishing marginal productivity with regards to education. Interaction between educational level of farmers and other variables. To determine the interaction between the educational level of farmers and the other variables used to predict productivity (Land, Labour, Purchased input and equipment), educational level of famers is cross tabulated with land size cultivated, type of equipment used, and type of input used and utilization of input.

Land Size

Relating educational level to average land size cultivated shows primary school leavers having the largest land size among the others. It was found out in the studies that highest educational level attained does not affect the size of land cultivated but rather factors such as tribe, resources availability and age rather determine the size of land cultivated.

Type of equipment and farm input used

Farmers in the Municipality still use the traditional tools which are cutlass and hoe for farming. However, about 88% use the Knapsack sprayer with weedicides, herbicides and other insecticides to control weeds, pests and diseases on their farms. Only 18% of farmers use pumps for irrigation purposes and this only applies to farmers who grow vegetables such as tomatoes, pepper, okro, garden eggs and the exotic vegetables like carrot, cabbage and cucumber. About 41% use fertilizer either organic or inorganic fertilizer purchased from chemical

shops on their farms. Currently, the choice of input or equipment is not determined by one's educational level because about 57% of farmers without schooling also use these input and equipment.

Utilization of farm input

Educational level has minimal effect on how farm inputs such as fertilizer and agrochemicals are used. This is because 18.9% of farmers use inputs based on instructions from extension officers; 11.3% of farmers use inputs based on knowledge gained from friends and colleague farmers; 19.3% of farmers use inputs based on farmer's own discretion; 5.2 % of farmers use inputs based on instructions from chemical shop and 0.9% of farmers use inputs based on read instructions. These reasons cut across the various educational levels.

Savings and Access to credit

The different levels of education also do not have any significant relationship with savings and access to credit facilities. This is because 63% of farmers save of which 20% have had no schooling. In addition, 70% of those who save and have had no schooling save in the bank. Access to credit facilities from this study is determined by one joining an FBO, saving at a bank, and from the relationship one has with friends and family not one's educational level.

Alternative occupation

Education level of farmers can have an indirect relationship with productivity through provision of alternate source of income to fund agricultural activities. This was examined by Appleton and Balihuta (1996) and Weir (1999) who stated that with the skills derived from education, farmers are able to engage in activities in the non- farm sector to gain alternative source of income for agricultural activities. It was discovered in the Offinso Municipality that 42% of farmers have alternative source of income with Trade being the main source. Out of this 6% have primary education, 17% have Middle School/ JHS, 5% have secondary schooling and 14% have no schooling. The average income obtained from the farms of those who have alternative occupation is much lesser than that of those whose sole occupation is agriculture and this can be ascribed to small farm sizes as well as inadequate time to pay attention to farming activities. An interesting finding was that farmers with secondary schooling who have other occupations have the highest average output of GH¢1289.40. Therefore, education which enables farmers with skills to work in the non- farm sector also has minimal effect on agricultural productivity for low levels of education but with secondary education, one is able to better manage time and other resources to improve productivity.

Non- formal Education

Non- formal education will take into consideration extension services and adult literacy classes. 2 out of the 100 farmers educated had 1 year of adult literacy classes had the ability to read and write only Twi. The effect of adult literacy classes on agricultural productivity cannot be examined because it has had no effect on the farming activities of the farmers interviewed. The focus in this section is on extension services. About 36% of the farmers interviewed have access to extension services in the Offinso Municipality. According to the farmers some of the services delivered include the provision on knowledge on: row planting, pests and disease control, farm management, fertilizer application, harvesting, good farming practices, How to Save; and provision of input such as fertilizer, seedlings and chemicals for pests and disease control. Comparing the mean annual income per acre of farmers with extension services (GH¢ 540.28) to that of farmers without extension services (GH¢524.76), it was discovered that farmers who have extension services have output that is 10% higher than that of those with no extension services implying that extension service helps improve agricultural productivity. This is as a result of the services provided by extension officers listed above. An interesting finding on the field was that some farmers even though receive extension service have some perceptions on the use of weedicides and fertilizer on the land. Such farmers who constituted about 10% for weedicide use and 13% for fertilizer application, explained that application of fertilizer reduces the fertility of the land in the long run and after about 10 years, the land will no longer be able to produce on its own but will be completely reliant on fertilizer and output will be low. To remedy this situation some farmers use poultry droppings, cow dung and urea.

How inputs are utilized is also very crucial to the allocative effect of education (Welch, 1970). About 32% of farmers use inputs as learnt from extension officers, 12 percent use as learnt from other farmers, 34% use inputs based on own knowledge, 10% inquire from chemical shop and 1percent read instructions on the container. This shows that when farmers are given information on the right methods of utilization of input, they will take decisions about how to combine the inputs in other to get an increase in output. About 72% of farmers that have extension services save while 58% of farmers without extension services save. Among the things taught by extension officers are the importance of saving and where to access credit facilities from. This implies that farmers with extension services save and have greater chance of getting access to credit facilities as well as opportunity for reinvestment.

Some farmers are in Farmer- based Organizations whereby they meet and learn together concerning crop production, growing of seedlings, joint harvesting, and joint weeding among others. About 50% of farmers who have extension services are in FBO's and these are mainly made up of cocoa farmers. These farmers attend meetings and are taught how to nurse and transplant cocoa seedlings, pruning, pests and disease control, harvesting and drying of cocoa. There are also some crop specific FBO's which include Rice Growers Association, Exotic Vegetable Growers Association and Maize Growers Association. Extension services provided in the Municipality has a stronger effect on the productivity of farmers in terms of savings, utilization of inputs and sharing of knowledge among farmers than formal education.

Informal Education

Informal education used in this study describes the "neighbourhood effect" of education whereby farmers share ideas among each other concerning crop production. 62% of

farmers share ideas with other farmers while 38% do not. Of the total number of farmers, 28% do not have access to extension services, are not members of FBO's and do not share ideas with other farmers. Their average output is GH¢475 which is much lesser than the general average of GH¢530. It can be seen that, the sharing of knowledge among farmers has contributed greatly to the utilization of farm input such as fertilizer, weedicide and chemicals for pests and disease control. The low coverage of extension service offered in the Municipality also contributes to the increase in the sharing of knowledge among farmers because that is the readily available source of knowledge in the communities. Farmers share knowledge on how to control pests and diseases, types and quality of seeds to use for planting, farming practices, harvesting, marketing among others.

Recommendations

The following recommendations have been suggested to help improve upon education and agricultural productivity in the Offinso Municipality.

Strengthening of extension services in the Municipality

Since extension services contribute more to agricultural productivity, government investment in agriculture should be channeled towards the provision of better extension services. The Ministry of Food and Agriculture should transfer more extension officers to the Municipality and provide them with motorbikes to facilitate easy movement among communities most especially to the hinterlands. Some farmers also refuse to patronize the extension services provided but have problems with pests and disease management on their farms. Extension officers should be trained to practice evidence- based teaching whereby things taught will be practiced on a sample farm with community members monitoring progress so that when other farmers see the results, they will change their perceptions and apply the lessons taught. Also individuals in communities who are respected and acknowledged by community members can be trained and used as advisors to farmers so that they can be a link between other farmers and extension officers.

Government investment in other sectors that affect agriculture

For productivity to increase in agriculture, there need for a right mix of all the factors that affect productivity and the government in investing in agriculture must consider this. The Ministry of Agriculture should consider subsidization of input and equipment used for agricultural purposes. The Municipal Assembly should make sure that roads leading to farming areas are frequently graded and bridges built over streams to enable easy movement of produce from the farms to the markets.

Enhancing the quality of formal schooling

From the data analyzed above, it was realized that 90.91% of the farmers who have had Primary schooling cannot read or write English whiles 52.17% who have had up to Middle School or JSS education cannot read and write English. This is a very serious situation which raises concerns about the quality of education in the Offinso Municipality in times past and indicates that the returns (both private and social returns) to education is very low. Supervision at the primary and JHS level has to be strengthened by the Municipal Educational Directorate to ensure that resources are not being wasted and that students are understanding and are able to apply what they have been taught and teachers are teaching properly. Also, the curriculum in basic school already has agriculture incorporated into it but the link between literacy and agriculture as well as the how education can enhance agriculture should be made known to students so that should they pursue agriculture as an occupation, they can apply knowledge gained in school.

Ways by which educational level of farmers can be improved

The literacy level of farmers in the Municipality is very low even with 57% of farmers having obtained basic education which necessitates the improvement of the educational level of farmers in the Municipality to reap the benefits that education has on agricultural productivity. The channel through which this can be done is through adult literacy classes. It was found out during the study that only five communities in the Municipality have access to adult literacy classes; two of which are in the Municipal Capital, New Offinso. The locations are changed every 2 to 4 years which is the duration of the study. Adult literacy classes is a great channel that can be exploited because enhanced literacy gives farmers confidence in decision making and enables them read instructions, gives a better understanding of issues confronting agriculture. The Non- formal section of the Educational Directorate can train basic school teachers and other literates in the communities to hold the classes and teach the illiterates so that more farmers will learn basic literacy and numeracy to enhance their agricultural activities.

Conclusion

Education is said to be one of the factors that affect agricultural productivity. After the study in the Offinso Municipality, it was unraveled that education indeed has an effect on agricultural productivity but this effect has been minimized due to the low literacy level, low educational level of farmers in the Municipality as well as low level of provision of extension services. Also, the farmers faced other factors that magnify the effects of education such as transportation, resources availability and cost of farm equipment and input which minimized the effect of education on agricultural productivity of farmers.

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