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Effect of Long Lasting Insecticide-Treated Net of Roll Back Malaria Programme on Productivity and Income of Farmers in Kogi State

Egwemi, J.O.[1], Usman, F. R.[2], Akubo, D.[3], Musa, S.O.[4], Eyiobami, B.H.[5], Abubakar, U.A.[6]

[1] Department of Agricultural Economics, University of Nigeria, Nsukka, Nigeria

[2,3,4,5,6] Department of Agricultural Technology, Kogi State Polytechnic, Lokoja, Kogi State, Nigeria

ABSTRACT: The effect of insecticide treated net of Roll Back Malaria Programme on Productivity and Income of Farmers in Kogi State, Nigeria was analysed in this study. Sample of 240 respondents was selected using multi-stage sampling procedure. Primary data were used for the study. Data were collected using a structured questionnaire and were analysed using Descriptive Statistics, Ordinary Least Square (OLS) Regression, Multiple Linear Regression and Independent Sample t-test. The results of the analyses showed that 66.39% of the beneficiaries were male and 81.82% of non-beneficiaries were male, mean age of respondents was 45 years, 87.39% of the beneficiaries were married whereas 90.91% of non-beneficiaries were married. The mean household size was 8 persons, mean years of education was 12 years. The average years of farming experience was 12 years and mean annual income was ₦96, 000. Also, farm size (0.001), hired labour (0.004) and quantity of fertilizers (0.002) had significant effect on farm productivity. Factors with positive effect on the production efficiency included age (0.000), educational attainment (0.021), farming experience (0.000), sex (0.002) and access to insecticide treated net (0.020). There was no significant difference in farm income between beneficiaries and non-beneficiaries of long lasting insecticide-treated net of roll back malaria programme. Government should complement the Roll Back Malaria programme with free or low priced malaria treatment since the cost of treating malaria is high.

KEYWORDS: Insecticide, Malaria, Net, Programme, Treated.

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Corresponding Author: Akubo, D.

INTRODUCTION

Malaria is a health problem caused by some parasites called plasmodium. These parasites are spread to people through the bite of infected anopheles mosquitoes called 'malaria vectors'. With about 3.3 billion people at the risk of malaria infection in 2011, the disease is obviously a health challenge in the world today (Abiodun & Abayomi, 2013). There were 20 million cases of malaria in 2012 and an estimated 627, 000 deaths among children in Africa (World Health Organization WHO, 2013). In Nigeria, malaria is the major cause of morbidity and mortality, especially among pregnant women and children below the age of five years (Alaba, 2011). According to WHO (2013), the economic losses due to malaria in Nigeria is in excess of two million U.S. dollars per annum. The Roll Back Malaria (RBM) Programme and the Millennium Development Goal (MDG) partnership was launched in 1998 by the World Health Organization (WHO), United Nations Children Emergency Fund (UNICEF), the United Nation Development Programme (UNDP), and the World Bank (WB). It is a global framework for implementing co-ordinated action against malaria (WHO, 2011). Roll Back Malaria (RBM) is one of the international collaborations that is aimed at achieving 80% use of insecticide treated net (ITN) among pregnant women, and children below five years of age in Africa, especially in rural and semi-urban areas (WHO, 2011). The goal of the Role back malaria (RBM) programme is to reduce malaria burden to half, through interventions that are adopted to local needs through case management using Artemisin based combination therapies, Insecticide Treated Net (ITN) and other vector control measures, providing malaria treatment and Intermittent Preventive Therapy (IPT) for pregnant women and improving malaria epidemic preparedness and responses. These activities were to be facilitated by integration of malaria control activities in Primary Health Care (PHC) and other social activities and strengthening health information systems and research, so as to strengthen community participation (Federal Ministry of Health, 2000; Salaudeen & Jimoh, 2009).

Despite these laudable efforts aimed at ameliorating the menace of malaria, rural dwellers still suffer mostly from the disease. Malaria is still a major public health challenge in Nigeria and it inflicts tremendous social and economic costs, and the effect trickles

down to agriculture. Rural and semi-urban Nigeria are largely agrarian, thus the effects of malaria on agriculture, health and development are wide spread (Babalola, Awoyemi & Awoyinka, 2009). Given the importance of malaria intervention on the economy of Nigeria, it is imperative to boost our understanding of the impact of malaria intervention programme on farming households, especially river flooded areas like Kogi State, where malaria is endemic. Malaria Action Programme for States (MAPS) supported the state to carry out the April 2013 Long Lasting insecticide Net (LLIN) during which households were targeted, two nets per household were distributed (Ogundipe, 2013). There are many ways by which malaria impedes development, including its effects on fertility, population growth, savings and investment, worker productivity, absenteeism, premature death rate and medical cost (Sachs & Malaney, 2010). Losses in productivity and costs arising from malaria infection sometimes pose a great burden to farmers most of whom depend completely on income from their farm work to survive. Roll Back Malaria (RBM) have tried to reduce the prevalence, incidence and mortality rate of malaria through several tools. These tools include the use of long lasting insecticide-treated mosquito nets (LLINS), Artemisinin based combination therapies (ACTS), intermittent preventive treatment (IPT) for pregnant women and babies. Despite these efforts at reducing malaria transmission, malaria remains one of the greatest public health burdens in Nigeria because of its high incidence yearly. This study is therefore important because of the deteriorating malaria situation and the attendant severe economic hardships in Kogi State. This research is aimed at investigating effect of RBM on farming households in Kogi state. The salient research questions were: What are the socio-economic characteristics of farmers in Kogi state? Does insecticide treated net have effect on farm productivity in the area? What is the effect of socio-economic characteristics of the respondents on production efficiency? What is the effect of insecticide treated net on the income of farmers in Kogi State? The broad objective of the study is to assess the effect of insecticide treated net on farming households in Kogi State of Nigeria. The specific objectives of this study were to:

(i) describe the socio-economic characteristics of farming households in the study area;
(ii) analyse the effects of insecticide treated nets on farm productivity in the study area.
(iii) analyse the effects of socio-economic characteristics of farming households on production efficiency in the study area.
(iv) estimate the effect of the use of insecticide treated nets on farm income of farming households in the area

METHODOLOGY

The Study Area

This study was carried out in Kogi State, Nigeria which was created out of Kwara and Benue States on the 27th August 1991. It is located in the North Central Nigeria and found on Latitude 6.33ºN to 8.44ºN and Longitude 5.40ºE and 7.49ºE. Kogi State is made up of 21 Local Government Areas with Lokoja as the state capital. The major ethnic groups are the Igala, Ebira, Okun, Nupe and Bassa. It shares boundaries with Edo State to the South, Niger, Nasarawa and Federal Capital Territory to the North, Benue and Enugu States to the East and Ondo, Ekiti, and Kwara to the West (Kogi ADP 1993). It has a total population of about 3.32 million people (NPC, 2006) and covers a land area of about 75,000 square kilometres. About 70% of the people of Kogi State live in the rural area and are engaged in agriculture. The two largest rivers in Nigeria (River Niger and River Benue flow through the State). The Niger forms a confluence with the Benue at Lokoja the State capital. Eventually, the state is fondly referred to as "Confluence State". Major crops cultivated include Rice, Yam, Maize, Cowpea, Tomatoes, Okra Groundnut and Melon among others. Tree crops, such as oil palm, cocoa, coffee and cashew are commonly grown in the southern and eastern parts of the State.

Sampling Procedure

The population for this study consisted of all farming households in Kogi State. The State is divided into four (4) Agricultural Zones, namely: Zone A (Yagba East, Yagba West, Mopa-muro, Ijumu and Kabba-Bunu). Zone B (Bassa, Dekina, Ankpa and Omala). Zone C (Okehi, Okene, adavi, Ajaokuta, Lokoja, Kogi and Ogori/Mangogo). Zone D (Idah, Ofu, Ibaji, Olamoboro and Igalamela/Odolu). Multi-stage sampling technique was used to select the respondents for this study. The first stage was the random selection of two agricultural zones (B and C) in the State. The second stage involved random selection of two Local Government Areas (LGA) from each of the two Agricultural Zones selected, making total of four LGAs. Stage three involved random selection of two communities from each of the four LGAs to give a total of eight communities. Finally, from each of the communities, 30 respondents were randomly selected giving a total of 240 respondents which were used for the study.

Data Collection Techniques

The data used for this study were primary data. Structured Questionnaire and interview schedule were used to collect data for the study. The questionnaire were administered to the literate farmers while interview method was adopted for the illiterate farmers and their responses were appropriately recorded.

Data Analysis

The specific objective (i) was analysed using descriptive statistics. For specific objective (ii) stochastic frontier production function study was estimated using the Ordinary Least Square (OLS) regression was used to examine the effect of long lasting

insecticidal treated net on farm productivity. Specific objective (iii) was achieved using multiple Linear Regression while specific objective (iv) was achieved using independent t-test

Model Specification:

Stochastic Frontier Production Function:

The stochastic frontier production function that was used to analyse objective (ii) was assumed to be Cobb-Douglas frontier production function specified as follows:

$InQ = {}_0+\beta_1 InX_{1i}+\beta_2 InX_{2i} + \beta_{3i} InX_{3i} + \beta_{4i} InX_{4i} + \beta_{5i} InX_{5i} + V_i - U_i$ (1)

Where:

Q = total value of output of the farmer in naira.

$_i$ = the parameters to be estimated.

X_1 = farm size in hectares.

X_2 = quantity of seed in kg.

X_3 = fertilizer applied per hectare in kg/ha.

X_4 = family labour in man days.

X_5 = hired labour in man days.

V_i = random error that is assumed to be normally distributed with zero mean and constant variance.

U_i = non negative random variable associated with technical inefficiency of production.

Multiple Linear Regression:

The Linear Regression Model is implicitly specified as follows:

$Y= f(X_1, X_2, X_3, X_4, X_5, X_6 \text{ and } X_7)$

It is also stated explicitly as:

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6+ \beta_7X_7+\varepsilon_i$

Y=income of cassava processors (Naira)

b_0 = Constant

b_1 = Age of the respondents (Years)

b_2 = Educational Level of the respondents (No formal education=1, Primary education=2, Secondary education=3, Tertiary education=4)

b_3 = Household size of the respondents (Number of persons)

b_4 = farming experience of the respondents (years)

b_5 = sex of the respondents (Male=1, Female=0)

b_6 = sanitation

b_7 = Access to Long Lasting Insecticidal Treated Nets

t-test model:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where:

$\bar{x}_1$ = mean of frequency of malaria attack on the beneficiaries;

$\bar{x}_2$ = mean of frequency of malaria attack on the non-beneficiaries

n_1 = sample size of the beneficiaries

n_2 = sample size of the non-beneficiaries

S_1^2 = variance or standard deviation (S_1) of the beneficiaries

S_2^2 = variance or standard deviation (S_2) of the non-beneficiaries

Model Specification for objective (vii)

$\bar{x}_1$ = mean income of beneficiaries

$\bar{x}_2$ = mean income of non-beneficiaries

n_1 = Sample size of beneficiaries

n_2 = sample size of non-beneficiaries

S_1^2 = variance or standard deviation (S_1) of beneficiaries

S_2^2 = variance or standard deviation (S_2) of non-beneficiaries

Objective (iv) was achieved using stochastic frontier production function

Measurement of the variables:

Age: age of the household head measured in years.

Sex: measured as a dummy (male = 1, female = 0).

Education: was measured as a number of years spent in acquiring formal education.

Household Size: the number of persons living in the house, who share the same income with one household head.

Farming experience: this is farmers experience in farming measured in years

Sanitation: the process of keeping places free from dirt, infection and disease by removing waste, trash and garbage. This was measured as clean environment = 1, otherwise = 0.

Access to Long Lasting Insecticidal Treated Nets: having the timely use of health services to achieve the best health outcome. This was measured as very far = 4, far = 3, close = 2, very close = 1.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents in the Study Area

The socio-economic characteristics of the respondents considered in this study were: gender, age, household size, educational level, major occupation, farming experience, and annual farm income. The distribution of the respondents according to the socio-economic characteristics is reported in Table1.

Table: 1: Socio-economic Characteristics of the Respondents in the Study Area

Variables	Beneficiaries [119 (49.58%)] Frequency (Percentage)		Non-beneficiaries [121 (50.42%)] Frequency (Percentage)	Mean
Gender				
Male	79	(66.39)	99 (81.82)	
Female	40	(33.61)	22 (18.18)	
Total	119	(100)	121 (100)	
Age				
15-24	-		2 (1.65)	
25-34	6	(5.04)	11 (9.09)	
35-44	22	(18.49)	22 (18.18)	
45-54	55	(46.22)	49 (40.50)	
55 and Above	36	(30.25)	37 (30.58)	
Total	119	(100)	121(100)	
Marital status				
Married	104	(87.39)	110 (90.91)	
Single	7	(5.88)	8 (6.61)	
Divorced	3	(2.52)	-	
Widowed	5	(4.20)	3 (2.48)	
Total	119	(100)	121 (100)	
Household size				
1-5	40	(33.61)	21(17.36)	
6-10	67	(56.30)	84(69.42)	
11-15	2	(1.68)	11(9.09)	
16-20	4	(3.36)	2 (1.65)	
21 and Above	6	(5.05)	3 (2.48)	
Total	119	(100)	121(100)	
Education				
No formal education	14	(11.76)	6 (4.96)	
Primary education	29	(24.37)	33(27.27)	
Secondary education	39	(32.77)	55(45.45)	
Tertiary education	37	(31.09)	27(22.31)	
Total	119	(100)	121(100)	

Farming Experience			
1-5	10	(8.40)	10(8.26)
6-10	25	(21.01)	21(17.36)
11-15	5	(4.20)	16(13.22)
16-20	22	(18.49)	17(14.05)
21 and Above	57	(47.90)	57(47.11)
Total	119	(100)	121(100)
Annual Income			
1,000-100,000	39	(32.77)	42(34.71)
101,000-200,000	36	(30.25)	33(27.27)
201,000-300.000	23	(19.33)	25(20.66)
301,000-400,000	11	(9.24)	17(14.05)
401,000-500,000	9	(7.56)	4(3.31)
500,000 and Above	1	(0.84)	-
Total	119	(119)	121(100)

Source: Field Survey, 2016

It was found that 49.58% of the farm households were beneficiaries of the long lasting insecticide treated net of Roll Back Malaria Programme. Whereas 50.42% were non-beneficiaries. Table 1 showed that 66.39% of the beneficiaries were males while 33.61% were females. Similarly, 81.82% of the non-beneficiaries were males while 18.18% were females. This implies that there were more male farmers than females in Kogi State. This agrees with Enete et al (2010) who reported that male farmers were more able to withstand the rigorous demand of farm work than females. Table 1 also showed that the mean age of the respondents (both beneficiaries and non-beneficiaries) of insecticide treated nets of Roll Back Malaria Programme was 45 years. This implies that farmers in Kogi State were young and possess the physical energy needed to do farm work. This result is similar to the findings of Akoroda et al, (2011) who found that livestock farmers in Bayelsa State, Nigeria had average age of 42 years. Also the mean years of education of both the beneficiaries and non-beneficiaries of insecticide treated net of Roll Back Malaria Programme was 12 years. In other words, the respondents, on the average had secondary education (12 years of schooling). This is in agreement with the findings of Aromolaran et al., (2013) who reported that most poultry farmers in Ibadan, Oyo State, Nigeria were secondary school leavers.

The result in Table 1 also showed that majority (87.39%) and (90.91%) of the respondents were beneficiaries and non-beneficiaries respectively of insecticide treated nets of Roll Back Malaria Programme were married. This implies that majority of the farmers in Kogi State were married and their wives and children could provide labour for farm work. The result also showed that the average household size of the respondents was 8 persons. This is consistent with Ohajiana et al, (2013) who reported an average poultry farming household size of 8 persons in Imo state.

The result on the major occupation of the respondents showed that majority (65.55% and 76.86%) of the beneficiaries and non-beneficiaries of the insecticide treated net of Roll Back Malaria Programme respectively were farmers in terms of major occupation. Table 1 also showed that the mean farming experience of both the beneficiaries and non-beneficiaries of insecticide treated net of Roll Back Malaria Programme was 12 years. Also, the mean farm income of both the beneficiaries and non-beneficiaries of insecticidal treated nets of Roll Back Malaria Programme was ₦96, 000. This implies that the annual income of farmers in the study area is grossly low and cannot cater for the needs of farmers and their households.

Effect of Insecticide-treated Net on farm Productivity of the Respondents

The stochastic frontier production function specified in chapter three of this study was estimated using the Ordinary Least Square (OLS) Regression to examine the effect of insecticide treated net on farm productivity of the respondents. The results were reported in Table 2.

Table 2: OLS estimates of Parameters of the stochastic frontier production function for the measurement of farm productivity

Farm productivity	Coefficient	Stand error	t-ratio	p-value
Quantity of Seed Used (kg/ha)	-0.0417	0 .0523	0.80	0.426
Farm Size (Hectares)	0.2815	0.0864	3.26	0.001
Quantity of Fertilizer (kg/ha)	- 0.4233	0.1369	-3.09	0.002
Family Labour in Man-Days	0.0671	0. 0527	1.27	0.204
Hired Labour in Man-Days	0.1759	0.0607	2.89	0.004
Constant	9.6404	0.7560	12.75	0.000
R-square	0.7826			
F(5, 235)	9.16			
Prob > F	0.0000			
Ramsey RESET F-stat F(3, 231)	2.02 (0.1115)			

Source: Computed from field data, 2016

The result in Table 2 shows that hired labour is a significant determinant of farm productivity. In specific terms, an increase in the number of hired labour leads to 0.18 percent increase in farm productivity. The t-statistics value of 2.89 is significant at 5 percent significance level. The probability value of 0.004 also confirmed that there is insignificant error in rejecting the null hypothesis. As the farmers increased expenditure on hired labour, their productivity will also increase. This is possible because the more the labour hired, the more farm work is done and thus the more the productivity.

Similarly, family labour had positive but insignificant effect on farm productivity. A percentage increase in farmers' family labour leads to an increase in farm productivity by 0.07 percent. However, the t-value of 1.27 showed that the effect is insignificant. Thus the null hypothesis of family labour having no significant effect on farm productivity is accepted at the 5% level of significance. This is also confirmed by the probability value of 0.204. Thus, family labour though had positive effect, is not a significant determinant of farm productivity.

The coefficient of farm size is 0.28. This means that size of farm positively determined farm productivity. Specifically, a unit increase in the size of farm leads to an increase in farm productivity by 0.28 percent. The significant t-statistics value of 3.26 in absolute term indicates the rejection of the null hypothesis that farm size has no significant effect on farm productivity. The probability value of 0.001 also confirms that there is insignificant error in rejecting the null hypothesis.

Both the quantities of seed (kg/hec) and fertilizer applied (kg/hec) had negative effect on farm productivity. An increase in the quantity of seed (kg/hec) leads to decrease in farm productivity by 0.04 percent while an increase in the quantity of fertilizer applied (kg/hec) decreases farm productivity by 0.42 percent. The t-value for the quantity of seed is -0.80 while for the quantity of fertilizer applied is -3.09. The former is insignificant at 5 percent and the latter is significant at 5 percent. Thus, the null hypothesis for the former is accepted while the null hypothesis for the latter is rejected. The probability value of 0.426 indicates that there is a significant error in rejecting the null hypothesis for the former while the probability value of 0.002 confirms that there is an insignificant error in rejecting the null hypothesis for the later.

The coefficient of determination (R^2) value of 0.7826 means that the independent variables in the model jointly explained 78.26 percent variation in farm productivity. The remaining 21.74 percent were explained by other variables that are not included in our model (the error term). F-value of 9.16 with a significant probability value of 0.0000 showed that the variables jointly significantly affected farm productivity. Thus, the hypothesis that the use of long lasting insecticidal treated nets does not have significant effect on farm productivity of farm households is rejected. The use of long lasting insecticidal treated nets has significant effect on farm productivity in Kogi state. The Ramsey RESET F-statistics is 2.02 (0.1115). Since it is not significant at the 5 percent level, we accept the null hypothesis that the model is properly specified. In other words, the Ramsey RESET test for model specification found the model to be properly specified.

Effect of Socio-economic Characteristics of the Respondents on Production Efficiency

The estimate of production efficiency of the respondents is reported in Table 3. It showed that Age of the respondents had a negative coefficient of -0.1691, indicating negative effect on production efficiency. This also means that advancement in age of the respondents reduces production efficiency by 0.17 percent. The t-statistics value is -4.28. Since the t-value is greater than 2 in absolute sense, we reject the null hypothesis at 5 percent level and say that age is a significant determinant of production efficiency of the farmers. This is also confirmed by the significant probability value of 0.000 at 5 percent level. This agreed with the findings of Yusuf et al., (2010) and who found out that both technical efficiency and profit efficiency decrease with age.

Table 3: Effects of the Socio-Economic Characteristics of the Respondents on their Production Efficiency

Production Efficiency	Coeff.	Std error	t-ratio	p-value
Age of Respondents (Years)	-0.1691	0.0394	-4.28	0.000
Educational Attainment (Years)	0.0937	0.0404	2.32	0.021
Household Size	-0.0053	0.0480	-0.11	0.911
Farming Experience (Years)	-0.0053	0.0276	5.54	0.000
Sex of Respondent	-0.2796	0.0904	-3.09	0.002
Sanitation	-0.0466	0.0468	-0.99	0.321
Access to Long Lasting Insecticide- Treated Nets	0.0630	0.0268	2.35	0.020
Constant	0.6342	0.3247	1.95	0.052
R-square	0.8775			
F(7, 233)	8.96			
Prob > F	0.0000			
Ramsey RESET F-stat F(3, 231)	1.81 (0.0602)			

Source: Computed from field data, 2016

The parameter for educational attainment also came out with a sign in line with a priori expectation. It showed a coefficient of 0.0937 with a t-statistics of 2.32. Since the t-value of 2.32 is greater than 2 in absolute sense, we reject the null hypothesis that educational attainment has no significant effect on production efficiency of the farmers at 5 percent level of significance. It implies that, any additional level of education increases production efficiency by 0.09 percent. This is confirmed by the probability value of 0.021 which showed that there is insignificant error in rejecting the null hypothesis. As the level of education of the farmers increases their level of technical inefficiency reduces. This finding agreed with that of Eze, Anyiro and Chukwu (2012).

It was also found that the household size had inverse relationship with production efficiency of the farms in the area. The result showed that when size of the household is increased by 1 person, production efficiency of the farmer reduces by 0.01 percent. This however was found insignificant at the 5 percent level, indicated by the t-statistics value of -0.11. The probability value of 0.911 which is greater than 0.05 also points to significant error in rejecting the null hypothesis. Therefore the null hypothesis as regards household size of the farmers is accepted. This finding implies that as household size increases, production efficiency also increases but as household size continues to increase, diminishing return sets in since land is fixed, and there is underutilization of labour and this leads to production inefficiency.

The sign of the parameter for years of experience in farming as well showed in accordance with our a priori expectation. It is found that any additional year of farming experience will lead to an increase in farm production efficiency of 0.15 percent. The high t-statistics value of 5.54 means significant. Therefore, the null hypothesis of years of experience in farming having no significant effect on production efficiency is rejected at the 5 percent level of significant. The probability value of 0.000 also confirmed that there is an insignificant error in rejecting the null hypothesis.

The result showed a coefficient of sex of respondent of -0.28 with a t-statistics of -3.09. Since the t-value of -3.09 is greater than 2 in absolute sense, we reject the null hypothesis that sex is not a significant determinant of production efficiency in the area. The probability value of 0.002 also confirmed that there is insignificant error in rejecting the null hypothesis.

Sanitation (clean environment) was found not to be a significant determinant of efficiency of production. The result showed that an increase in sanitation insignificantly reduces productivity by 0.05 percent. In other words, the more farmers spent their farming time in sanitation, the lesser their time for farming and thus the lower the level of farm work done and productivity.

The result showed a coefficient of access to long lasting insecticidal treated nets of 0.06 with a t-statistics of 2.35. Since the t value of 2.35 is greater than 2 in absolute sense, we reject the null hypothesis that access to long lasting insecticidal treated nets has no significant effect on production efficiency in the area. In specific terms, any easy and better access to long lasting insecticidal treated nets the farmers had will lead to 0.06 percent increase in production efficiency of the farmers in the area. This is confirmed by the probability value of 0.020 which showed that there is an insignificant error in rejecting the null hypothesis. This agreed with Eyo et al., (2006) reported that farmers' health has significant effect on their capacity to increase output.

The coefficient of determination (R2) was found to be 0.8775. This means that the socio-economic characteristics of the respondents explained 87.75 percent variation in production efficiency of the farmers in the area. 12.25 percent of the change in production efficiency is determined by other factors beside the socio-economic factors represented by the error term. The F-statistics, F (7, 233) of 8.96 with the probability value of 0.0000 indicates significance. Thus, we reject the null hypothesis that the socio-economic characteristics of the respondents have no significant effect on production efficiency. We therefore conclude that the socio-economic characteristics have significant effect on farm production efficiency. The Ramsey RESET F-statistics is 1.81 with a probability value of 0.0602. Since the probability value is greater than 0.05, the null hypothesis that the model is well specified is

therefore accepted. That is, based on the Ramsey RESET test for model specification, we say that the model for this objective is well specified.

Effect of Insecticide-treated Nets on Farm Income of the Respondents

The effect of long lasting insecticidal treated nets on farm income of the beneficiaries in the area was analysed using independent sample t-test. The result is seen in Table 4.

Table 4: Effect of the use of long lasting insecticidal treated nets on farm income among beneficiaries and non-beneficiaries

Variable	Mean	Standard Error	Standard Deviation
Farm Income of Beneficiaries	2.310924	0.1167791	1.27391
Farm Income of non-beneficiaries	2.239669	0.1062929	1.169222
Combined	2.275	0.0787642	1.22021
Difference	0.0712549	0.1577969	
t-statistics	0.4516		
p-value	0.6520		
degree of freedom	238		
95% Confidence interval difference	(-0.24 - 0.38)		

Source: Computed from Field Survey, 2016

The difference in mean between the two samples is 0.0713 with a confidence interval of -0.24, 0.38. The confidence interval crossed zero, suggesting no significant difference in farm income between beneficiaries and non-beneficiaries. The t-statistics for the difference in the sample t-test is 0.4516 (DF=238). The p-value of 0.6520 does not provide strong evidence against the null hypothesis and therefore we cannot conclude that farm incomes of beneficiaries are statistically significantly different on average than those of non-beneficiaries, using the long lasting insecticidal treated nets of the programme. The null hypothesis is therefore accepted.

CONCLUSION

Farm incomes of beneficiaries are not significantly different on average from those of non-beneficiaries. The farmers are producing below the labour efficiency frontier by 18 percent. This could be attributed to frequent malaria incidence amongst the farmers. The farmers in the area are averagely 45 years, and also the average household size of 8 persons. The average farming experience of farmers in the state was 12 years. Malaria incidence is still majorly caused by mosquitoes despite the Roll Back Malaria Programme. Regular malaria sickness, frequent treating of malaria and cost of sanitation are significant determinants of farm productivity and farm income of the farm households. Farmers are producing below the technical efficiency frontier. The technical efficiency of the farmers in the area could be improved by 25 percent through efficient use of available resources and the socio-economic characteristics such as age, level of education, etc. had a significant effect on farm production efficiency.

RECOMMENDATIONS

Based on the findings, the following recommendations were made:

- Awareness campaigns of the economic and health benefits of long lasting insecticidal treated nets should be intensified.
- There is need to intensify the focus on creating demand for long lasting insecticidal treated nets through all available health information channels and farmers should be educated to know that withstanding the inconveniencies of using their long lasting insecticidal treated nets far outweighs the burden of treating malaria
- Government can also complement the Roll Back Malaria programme by providing free or low cost malaria treatment programme since the cost of treating malaria is a significant determinant of productivity and income of farm households.

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