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Land Use Intensity, Crop Diversification and Productivity of Farmers in Akinyele Local Government Area of Oyo State, Nigeria

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ABSTRACT

This study examined the relationship between land use intensity, crop diversification and productivity of farmers in Akinyele Local Government Area, Oyo State, Nigeria. A total of 200 respondents were selected proportionate to size from four communities and structured questionnaire was used to collect data. Data were analyzed using Descriptive Statistics, Ruthenberg index, Herfindahl index, Total Factor productivity and Tobit regression analysis. The mean age of farmers was found to be 50.9years (±15.2), 93.0% were male, 88.0% were married, having an average of 6 persons per household, and 71.5% had formal education. Also, farmers had an average of 25 years of experience in farming, majority (86.5%) were primarily into farming, and 19.5% were members of farmers' association. Majority (79.5%) used hired labour for their farming activities and 25.5% had access to other sources of income asides farm income, 2.0% had access to credit, while 9.0% had access to extension services. Most (51.0%) of the farmers got their land through inheritance while 12.0% rented theirs. The study showed that only 30.0% of the respondents practiced bush fallow, and mean land use intensity of 0.9(±0.2) indicates that land is intensively used in the study area. Majority (72.5%) of the respondents practiced mixed cropping, planted an average of 2 crops, and cultivated an average farm size of 4.6ha. The results of Herfindahl index showed a mean of 0.7(±0.3) which implies that farmers practiced crop diversification while 27.5% practiced specialization (planting only 1 crop). More than half (59.5%) of the farmers had TFP<1 which indicates low productivity. Tobit regression results show that Herfindahl index was found to be positively related to productivity at 1%, implying that crop diversification reduces the level of productivity. At 5% level of significance, age had negative significant effect (-0.01) while access to credit had positive significant effect (01.26) on the level of productivity. Land use intensity was however found to influence productivity positively, though not significantly. It was concluded that crop specialization increases the level of productivity. Crop specialization should be encouraged among farmers with good land management practices to help reduce the negative effect that high land use intensity might cause in the future.

Keywords: Land Use Intensity, Crop Diversification, Total Factor Productivity

1.0 INTRODUCTION

Land is an important input in agricultural production process (Raufu, 2010). Characteristics such as availability, accessibility and quality aid its usefulness for agricultural production. Agricultural land refers to the share of land area that is suitable for cultivation of crops, livestock production, pastures, forestry, and other agricultural uses. In Nigerian agriculture, land quality determines land productivity due to the problems associated with finding unnatural solutions that can boost land productivity, especially by rural farmers that dominate food crop production of the country (Ogundare, 2016).

The Food and Agriculture Organization (FAO) of the United Nations (2011) emphasized that land is the major asset rural dwellers have for supporting farm production and provision of basic livelihood. The

European Commission also pointed out that agriculture depends on how natural resources such as land, soil, water, and nutrients are being managed. Continuous increase in population in Nigeria has led to higher demand for agricultural products, but available arable lands are gradually decreasing, which leads to intensive use of available land for agricultural production, especially crop farming. Udoh *et al.* (2011) affirmed that increasing demand for agricultural products is as a result of ever increasing population.

Different agricultural programmes and policies which aimed at increasing crop production serve as encouragement for farmers to expand their production, and these have led many crop farmers to increase the frequency of cropping and change crop combinations so as to maximize the use of land, and to reduce risks and uncertainties in crop production (Udoh *et al.,* 2011). Agricultural land use intensity (ALUI) constitutes the leading aspect of land use. Higher ALUI is regarded as a convincing option to achieve higher productivity and food security in those countries that have very limited arable lands (Dahal *et al.*, 2009). Land use intensification refers to the extent to which land is put to use and how available resources have been used to achieve desired goal. Intensification may cause conversions of marginal lands such as grasslands or rangeland to cultivation of crops (Li *et al.*, 2013). In addition to land use intensification, farmers practice crop diversification to reduce risks and uncertainties in crop production

Farmers practice crop diversification to maximize the use of land and other resources (Ojo *et al.*, 2014) by planting varieties of crops on their farmland. In agriculture, diversification is also practiced to avoid the risk of monoculture and to minimize the uncertainty of climatic and biological vagaries (Saraswati *et al.*, 2011). Diversification of crops serves as a major option to increasing and stabilizing income flow, and also, a source of employment. Besides, in several circumstances, diversification serves the purpose of restoring the degraded natural resource base. In several instances, diversification of cropping system and/or introduction of new cropping systems have been used to retain or to enhance the value of natural resources, principally land and water (Ojo *et al.*, 2014). However, specialization in crop production (production of one crop instead of many crops) avails farmers the benefits of producing large scale and become more efficient in the crops they produce to increase their incomes. Nevertheless, when farmers depend on rain-fed agriculture, the production risks become higher.

According to Saari (2011), productivity is the total output per unit input. It refers to the relative performance of the processes used in the transformation of inputs into outputs (Egli, 2006). To examine productivity, it may be viewed collectively (across the economy) or viewed industry by industry to find the trend in labour growth, wage levels and improvement in technology (Osuji and Henri-Ukoha, 2018). Obamiro (2008) stated that as the country's population increases, it leads to a concurrent increase in food production. Despite this, food production in Nigeria no longer meets the increasing population, thus creating a wide gap between the demand and supply of food (Abdulrahaman, 2013), there is a definite need for improved management of the nation's agricultural resources. FAO (2018) found that through crop diversification, farming household can spread productivity and income risk over a wider range of crops, thus reducing their vulnerability to weather or market shocks. It also found that crop diversification can produce agronomic benefits and help to increase productivity.

Consequently, farmers always have to determine the methods of production to use and the types of technologies that suit a particular environment and system of farming. For instance, decisions on the types of seed to be planted and desired time of maturity depend on whether double or single cropping is followed and the same apply to the optimal time of planting (Okoruwa *et al.,* 2011). They explained that these observations portray a complex of interacting factors that could affect the country's quest for the much needed growth in the food sub-sector through increased intensity either negatively or positively

According to Shanta *et al.* (2017), although higher agricultural land use intensity has negative implication on the environment, it was found to affect socio-economic aspect of farmers' livelihood positively. One of the prominent limiting factors to the manifestation of the full potential of crop varieties is the declining condition of the resource base, especially in the face of increasing pressure on land and declining capabilities of the dominant smallholder farmers to access and procure inorganic fertilizer (Okoruwa *et al.*, 2006).

The productivity of farmers has been studied in relation to the intensification of land use and crop diversification separately. Thus, this study combined the effects of land intensification and crop diversification on farmers' productivity. Continuous use of land and diversification in crop seem like the best utilization of land to increase food production in Nigeria. However, higher land use intensity with no plan for better management of the soil to restore the nutrients could be detrimental to the national agricultural development goals of self-food sufficiency in the long run (Udoh et al., 2011). Also, specialization in crop production, rather than crop diversification, might be a better way for large scale crop production and improved productivity in Nigeria. Therefore, it is pertinent to examine the relationship between land use intensity, crop diversification and productivity of crop farmers.

The paper achieved the following objectives:

i. Analysed the extent of agricultural land use by farmers.
ii. Measured the extent of crop diversification by farmers.
iii. Estimated the productivity of farmers.
iv. Assessed the effects of land use intensity and crop diversification on farmers' productivity.

2.0 RESEARCH METHODOLOGY

2.1 The Study Area and Sampling Procedure

The study was conducted in Akinyele Local Government Area (LGA) of Oyo state, Nigeria. Oyo state is one of the 36 states in Nigeria; it is located in southwest geopolitical zone of the country. Oyo state covers 28,454 square kilometers. The climate is equatorial, notably with dry and wet seasons with relatively high humidity. The targeted population for the study consisted of both males and females that are actively involved in crop farming in Akinyele LGA. Four villages were selected from the rural part of Akinyele LGA; Atan, Iware, Camp and Ijaye. Atan is considerably bigger than the other villages, therefore, the samples from each village were collected proportionate to size; 80 respondents from Atan and 40 from others; Iware, Camp and Ijaye to make a sample of 200 respondents for the study. The respondents from each village were selected at random. Primary data were generated from a survey of the 200 male and female crop farmers. Structured questionnaire was constructed and used to access information on land-use intensity, crop diversification and productivity of farmers.

2.2 Analytical techniques

Descriptive analysis, Land-use intensity (Ruthenberg index), Herfindahl index, Total Factor Productivity (TFP) estimation and Tobit regression were used for data analysis.

Descriptive statistics

Descriptive statistics were used to profile the socio-economic characteristics of farmers.

Ruthenberg Index

Land use intensity (LUI) model by Ruthenberg (1980) was used to determine the extent of land use by farmers in the study area (objective 1):

$$R = \frac{C}{L}$$

Where,

R = Ruthenberg index

C = Cropping years

L = length of cycle of land cultivation (cropping years plus fallow period)

The range for this unitless index of land use intensity is from 0 to 1. It is specified that higher values imply higher land intensification. Hypothetical value of 1 means complete land use intensification while 0 means no intensification. The closer the R is to 1, the higher the land use intensity of farmers.

Herfindahl index (H.I.)

The Herfindahl index was used to measure crop diversification among farmers (objective 2). According to Swades and Shyamal (2012), Herfindahl index was computed by taking sum of squares of acreage proportion of each crop in the total cropped area. Mathematically, the index is given as:

$$HI = \sum_{i=l}^{N} P_i^2$$

Where N is the total number of crops and P_i represents area proportion of the *i*th crop in total cropped area. With increase in diversification, Herfindahl Index would decrease. This index takes a value of 1 when there is complete

concentration (crop specialization where farmer produces or concentrates on one crop) and takes a value of 0 when diversification is 'perfect'. Thus, the Herfindahl Index is bounded by zero and one.

Total Factor Productivity Estimation

Total factor productivity was used to estimate the productivity of farmers (objective 3). Following Key and Mcbride (2003), TFP can be measured as the inverse of unit variable cost. This is so since TFP is the ratio of the output to the Total Variable Cost (TVC) as shown below

$$TFP = \frac{Y}{TVC} = \frac{Y}{\sum P_i X_i}$$

But since

$$AVC = \frac{TVC}{Y}, then\ TFP = \frac{Y}{TVC} = \frac{1}{AVC}$$

Where,

Y = Quantity of output (₦)

P_i = Unit price of the *i*th variable input (₦)

X_i = Quantity of *i*th variable input

AVC = Average variable cost

TVC = Total variable cost

TFP = 1 indicates the central tendency of TFP, values above 1 indicate a high productivity relative to other farmers whereas values below 1 indicate low productivity.

Tobit Regression Model

Tobit regression model was used to assess the effects of land-use intensity and crop diversification on productivity of farmers (objective 4). The model is such that TFP estimate is the dependent variable and was regressed on various independent variables where Ruthenberg index stands for land-use intensity and Herfindahl index stands for crop diversification as shown below

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e_i$$

Where,

Y = Productivity (TFP estimate)

X_1 = Ruthenberg index (0-1)

X_2 = Herfindahl index (0-1)

X_3= Age (years)

X_4 = Household size (number)

X_5= Primary occupation (1= farming, 0= non-farm)

X_6 = Membership of association (1= yes, 0= no)

X_7 = Other sources of income (1= yes, 0= no)

X_8 = Credit access (1= access, 0= no access)

β_0= Constant term

$\beta_1 - \beta_8 =$ Parameters to be estimated

$e_i =$ Error term

3.0 RESULTS AND DISCUSSIONS

3.1 Socio-economic Characteristics of Farmers

Results in Table 1 show that more than half (59.5%) of the farmers fell between 31 and 60years. The mean age was 50.9years (±15.2years), implying that most of the farmers are matured adults and ageing, 93.0% were male, and majority (71.5%) had formal education. Majority (88.0%) of the farmers were married, having mean household size of 5.9(±2.6). Results further show that majority (86.5%) of the respondents were primarily into farming and 78.5% had farming experience of more than 10years. Less than one-quarter (19.5%) of the respondents were members of farmers' associations, about one-quarter (25.5%) had other sources of income aside from farm income and 2.0% had access to credit. Also, about half (51.0%) of the farmers got their land through inheritance and those that got access

through lease from government were 19.5%. Majority (79.5%) used hired labour on their farms and only 9.0% of the farmers had access to extension agents.

Table 1: Socio-economic Characteristics of Respondents

Variables	**Frequency n=200**	**Percentage**	Mean
Age			
≤ 30	25	12.5	50.9 (± 15.2)
31 – 60	119	59.5	
> 60	56	28.0	
Sex			
Female	14	7.0	
Male	186	93.0	
Marital status			
Single	12	6.0	
Married	176	88.0	
Widowed	9	4.5	
Divorced	3	1.5	
Household size			
≤ 5	84	42.0	5.9 (± 2.6)
6 – 10	111	55.5	
> 10	5	2.5	
Educational level			
No formal education	57	28.5	
Primary	66	33.0	
Secondary	65	32.5	
Tertiary	12	6.0	
Farming experience			
≤ 10	43	21.5	25.5 (±15.1)
11 – 20	59	29.5	
21 – 30	36	18.0	
> 30	62	31.0	
Primary occupation			
Non-farm	27	13.5	
Farming	173	86.5	
Farmers' association	39	19.5	
Other sources of income	51	25.5	
Access to credit	4	2.0	
Labour used			
Family	41	20.5	
Hired	159	79.5	
Method of land acquisition			
Inheritance	102	51.0	
Purchase	35	17.5	
Rent	24	12.0	
Lease of government	39	19.5	
Access to extension agents	18	9.0	

Source: Field Survey, 2019.

3.2 Extent of Agricultural Land Use by Farmers

3.2.1 Land Use Practices by Farmers

Land use practices by farmers are presented in Table 2. Results show that 70.0% of the respondents did not practice bush fallow while 30.0% did. This shows that 70.0% of the farmers practiced continuous cropping which may be because the land in the study area is still moderately fertile. Of the 60 farmers that practiced bush fallow, more than half (55.0%) cropped for 3-5years. The mean of cropping years was 5.9 (±2.2), which shows that farmers in the study area cropped on a piece of land for longer period before they allow it to fallow which maybe because they already have land management techniques used on the farm plots over the years, which makes it possible for them to get perceived satisfactory outputs for longer period. Also, most (58.3%) of the farmers allow their land to fallow for more than 2years which maybe because they have access to other plots of land to use for cultivation within that period. The mean fallow years was found to be 2.88 (±1.1). This agrees with Okoruwa *et al.* (2011), who found the average length of fallow among farmers to be 3years.

Table 2: Land Use Practices by Farmers

Land Use Practice	Frequency	Percentage
Bush fallowing		
No	140	70.0
Yes	60	30.0
Total	200	100.0
Cropping years		
3-5	33	55.0
6-8	17	28.3
9-10	10	16.7
Total	60	100.0
Minimum = 3, Maximum = 5		
Mean = 5.9 (±2.2)		
Fallow years		
1-2	25	41.7
3-4	26	43.3
5-6	9	15.0
Total	60	100.0
Minimum =1, Maximum= 6		
Mean = 2.8 (±1.1)		

Source: Field Survey, 2019.

3.2.2 Land Use Intensity by Farmers

As shown in Table 3, the results of land use intensity by farmers, calculated using Ruthenberg index, show that majority (70.0%) of the farmers had index of 1 which means complete land intensification (continuous cropping on the same piece of land every year). The mean index of 0.9 (± 0.2) showed that land is intensively used in the area. This may be as a result of farmers trying to increase their output with the only asset (land) they have as their family size increases. Okoruwa *et al.* (2011) also found that 79.0% of farmers used land intensively.

Table 3: Land Use Intensity by Farmers

Ruthenberg index	Frequency (n=200)	Percentage
0.4-0.6	13	6.5
0.6001-0.8	45	22.5
0.8001-0.9	2	1.0
1.00	140	70.0
Total	200	100.0
Minimum = 0.4, Maximum = 1.0		
Mean = 0.9 (± 0.2)		

Source: Data Analysis, 2019.

3.3 Extent of Crop Diversification by Farmers

3.3.1 Cropping System by farmers

Based on the choice of cropping system by farmers, results in Table 4 show that 27.5% of the farmers practiced sole cropping while 72.5% practiced mixed cropping. This shows that majority of the farmers planted more than one crop. This may be because farmers are trying to protect themselves against potential risk of monoculture. This agrees with Okoruwa *et al.* (2011) who found that 67% of farmers engaged in mixed cropping. Results also show that 45.0% planted 2 crops, 22.5% planted 3 crops, 3.5% planted 4 crops and 1.5% planted 5 crops on each plot of land. Further, the distribution of farmers based on farm size indicates that most (60.5%) of farmers cultivated within 5hectares of land. The mean land holding of 4.6ha (±3.7) may be due to farmers in the study area having access to land holdings by lease from government. This is contrary to Osuji and Henri-Ukoha (2018) who found the mean farm size of farmers as 1.0ha.

Table 4: Cropping System practiced by Farmers

Cropping system	Frequency (n=200)	Percentage
Sole cropping	55	27.5
Mixed cropping	145	72.5
Number of crops planted		
1	55	27.5
2	90	45.0
3	45	22.5
4	7	3.5
5	3	1.5
Mean = 2.1 (± 0.9)		
Farm size/ha		
≤ 5	121	60.5
5.001-10	68	34.0
> 10	11	5.5
Mean = 4.6 (± 3.7)		

Source: Field Survey, 2019.

3.3.2 Crop Combinations by Farmers

Results of crop combinations by farmers in Table 5 show that of all the farmers that planted one crop, most (13.5%) of them planted cocoa which may be because, being a cash crop, the revenue from cocoa is more. Of those that planted two crops on a plot, most (18.0%) combined cocoa and plantain and 15.5% combined maize and cassava. These show that maize and cassava are the common food crops grown in the study area. Results also show that most (13.0%) of those that combined three crops planted maize, yam and cassava, which agrees with Okoruwa *et al.* (2011) who found that about 12% of farmers intercropped maize, yam and cassava. Meanwhile, few (5.0%) of the farmers combined 4-5 crops on a piece of land.

Table 5: Crop Combinations by Farmers

Crop Combination	Frequency (n=200)	Percentage (%=100)
One Crop		
Cassava	17	8.5
Cocoa	27	13.5
Maize	3	1.5
Palm	1	0.5
Plantain	6	3.0
Yam	1	0.5
Two crops combinations		
Yam/cassava	4	2.0
Maize/yam	2	1.0
Maize/palm	2	1.0
Maize/plantain	1	0.5
Cassava/plantain	3	1.5
Cocoa/yam	2	1.0
Maize/cassava	31	15.5
Cocoa/cassava	4	2.0
Cocoa/palm	5	2.5
Cocoa/plantain	36	18.0
Three crops combinations		
Cassava/cocoa/plantain	9	4.5
Cassava/yam/cocoa	1	0.5
Cocoa/plantain/palm	5	2.5
Maize/cassava/cocoa	3	1.5
Maize/cocoa/plantain	1	0.5
Maize/cassava /yam	26	13.0
Four crops combinations		
Maize/cassava/cocoa/plantain	2	1.0
Maize/cassava/plantain/palm	1	0.5
Maize/cassava/yam/cocoa	1	0.5
Maize/cassava/yam/plantain	2	1.0
Cassava/yam/cocoa/plantain	1	0.5
Five crops combinations		
Maize/yam/cassava/cocoa/plantain	2	1.0
Maize/cassava/cocoa /palm/plantain	1	0.5

Source: Field Survey, 2019.

3.3.3 Crop Diversification by farmers

From the results of crop diversification by farmers, calculated with Herfindahl index, Table 6 shows that 27.5% of the farmers engaged in crop specialization (mono-cropping) while majority (72.5%) diversified. Diversification in the study area is not very high as only (1.0%) of them had indices below 0.25 and the mean index was 0.7 (±0.3). Udoh *et al.* (2011) also found a mean Herfindahl index 0.64 among farmers.

Table 6: Crop Diversification by farmers

Herfindahl index	Frequency	Percentage
≤ 0.25	2	1.0
0.25001-0.5	72	36.0
0.5001-0.75	59	29.5
0.75001- 0.99	12	6.0
1.00	55	27.5
Total	200	100.0
Maximum = 1.0, Minimum = 0.2, Mean = 0.7 (± 0.3)		

Source Data Analysis, 2019.

3.4 Productivity of Farmers

3.4.1 Cost of Inputs

The mean amounts spent on various crop production activities during the planting season are shown in Table 7. Some of the farmers in the study area hired labour to do all the activities and paid them per annum, they spent ₦403,000.00 on the average for the labour service per year. It has the highest mean value which shows that more money is spent on labour and this is because it pays for all farm activities for that year. Others hired labourers for different activities; land clearing, ridging, planting, weeding, chemical application and harvesting. The mean amounts spent on these activities are also shown in Table 7. Chemical application had the minimum mean of ₦18,052.75 (± 14,906.69) which shows that farmers spent the least on this activity probably due to the use of family labour to help reduce their costs.

Table 7: Cost of Inputs

Amount spent on input	Mean (₦)	Minimum (₦)	Maximum (₦)
Labour	403,000.00 (± 286,892.9)	132,000.00	960,000.00
Land clearing	100,071.40 (± 81,092.5)	8,000.00	360,000.00
Ridging	72,583.30 (± 59,928.9)	12,000.00	220,000.00
Planting	42,216.20 (±33,132.5)	1,000.00	140,000.00
Weeding	26,500.00 (± 21,207.3)	7,000.00	80,000.00
Chemical	68,472.00 (± 62,552.1)	2,600.00	264,000.00
Chemical application	18,052.80 (± 14,906.7)	2,000.00	68,000.00
Harvesting	56,071.90 (± 65,771.9)	2,000.00	375,000.00

Source: Data Analysis, 2019.

3.4.2 Crop Outputs of Farmers

Table 8 shows the mean outputs of respondents from the selected crops. It shows that respondents got an average of 16.6tonnes from maize per year, 11.9tonnes from yam, 48.2tonnes from cassava, 3946.1kg of

cocoa, 21.9dozens of plantain, and 1698.3litres of palm oil. When translated in monetary terms, the mean total output of farmers was found to be ₦2,031,504.00

Table 8: Crop Output of Farmers

Crops	Unit of measurement	Mean	Standard deviation	Minimum	Maximum
Maize	Ton	16.6	16.9	1	72
Yam	Ton	11.9	14.9	1	60
Cassava	Ton	48.2	46.3	1	234
Plantain	Dozen	21.9	20.3	4	90
Palm	Litre	1698.3	4875.5	75	19250
Cocoa	Kilogram	3946.1	5803.4	75	47250
Total output	Naira	2,031,504.00	3,146,888.00	18,000.00	28,800,000.00

Source: Data Analysis, 2019.

3.4.3 Total Factor Productivity of farmers

According to Ibitola *et al.* (2019), total factor productivity (TFP) below 1 indicates low productivity, TFP of 1 indicates break-even, and TFP above 1 indicates high productivity. The productivity levels of farmers, calculated with TFP, are shown in Table 9. The results show that few (1.5%) of the farmers were at break-even (TFP=1) while 39.0% had TFP greater than 1. The implication of the group with TFP >1 is that they have extra output which can help in expanding their production capacity, thereby increasing their income and also giving them opportunity to save for the future. However, more than half (59.5%) of the farmers had TFP below 1, that is, low productivity. This may be because they used traditional mode of crop production which affects their ability to take advantage of the available land to increase productivity. This agrees with Ibitola *et al.* (2019), who found that productivity is low for more than half of smallholder farmers in Oyo state.

Table 9: Productivity of Farmers

Productivity	Frequency	Percentage
< 1.0	119	59.5
1.0	3	1.5
> 1.0	78	39.0
Total	200	100.0
Maximum = 3.9		
Minimum = 0.1		
Mean = 1.2 (± 1.1)		

Source: Data Analysis, 2019.

3.5 Effects of Land Use Intensity and Crop Diversification on Productivity of Farmers

Results of Tobit regression analysis assessing the effects of land use intensity and crop diversification on farmers' productivity are presented in Table 10. Land use intensity (Ruthenberg) was positively related to productivity of farmers but not significant. Since land use intensity was found to be high, productivity of farmers was supposed to increase as the land use intensity increases. This is the evidence that farmers increase their output by higher land use intensity in the study area. Farmers in this area probably have specific land management methods used to complement the intensive use of land, which makes the high land use intensity not to reflect negatively on their productivity.

However, crop diversification (Herfindahl Index) was positively related to productivity. A unit increase in Herfindahl index, which implies tending more towards crop specialization, will lead to an increase in productivity by 1.09 and was significant at 1%. This implies that productivity of farmers in the study area can be improved if they focus more on crop specialization rather than diversification. This is in agreement with Alphonse *et al.* (2013) who concluded that policy makers aiming at food security and agricultural

growth should enhance crop specialization for rural farmers. Other variables found to have significant effect on productivity were age of farmers and access to credit.

Age of farmers was found to be negatively related to productivity and was significant at 5%. One year increase in farmer' age will lead to productivity decreasing by 0.01. This implies that farmers that are already leaving their active age will not be as productive as youths. Therefore, involving youths in the production process will help to increase the productivity of farmers in that area. This agrees with Oladeebo and Adekilekun (2013) who found that farmers that are still in their active age will help to increase efficiency in food crops production and in the process productivity increases.

Also, productivity of farmers with access to credit will increase by 1.26 compared to those that do not have access to credit and this was significant at 5%. Access to credit will help farmers to improve their productivity through increased capital for farm investment, hired labour, and adoption of new technologies, among others. This is in agreement with Awotide *et al.* (2015) who found that farmers who obtain credit have higher productivity levels than those without credit.

Table 10: Tobit regression results showing the effect of land use intensity and crop diversification on farmers' productivity

Variables	Marginal Effect	Coefficient	Standard Error	t	P>|t|
Ruthenberg index	0.467192	0.467192	0.489722	0.95	0.341
Herfindahl index	1.085357***	1.085357	0.3297089	3.29	0.001
Age	-0.011772**	-0.011772	0.0055377	-2.13	0.035
Household size	-0.008586	-0.008586	0.0326158	-0.26	0.793
Primary occupation (Farming)	-0.098689	-0.098689	0.3080232	-0.32	0.749
Association (yes)	0.056198	0.056198	0.1934269	0.29	0.772
Other sources of income (yes)	-0.098967	-0.098967	0.2448988	-0.40	0.687
Credit access (yes)	1.255280**	1.255280	0.5525745	2.27	0.024
Constant		0.759177	0.6337453	1.20	0.232

Source: Data Analysis, 2019.

n = 200, Log likelihood = -295.7138, Pseudo R^2 *= 0.0389,*

LR chi^2 *(8) = 23.94, Prob >* chi^2 *= 0.0023*

*** Significant at 5%, *** Significant at 1%*

4.0 CONCLUSION

Land is intensively used in the study area and majority do not practice bush fallow because they cannot afford to leave the land for some years since they do not have other means of increasing their output. Also, in avoiding the risk of monoculture, farmers engaged in crop diversification. However, productivity was low for most of the farmers due to common practice of crop diversification which affects their productivity.

To boost productivity, the crop farmers should be encouraged to practice crop specialization, which will make them best at what they produce and enhance large scale production of preferred crops. Also, youths should be educated and encouraged to take part in production so that more active players are involved rather than only ageing farmers. In order to sustain crop production and have increased productivity,

farmers should aid land use with other land management practices such as mulching and crop rotation to avoid land depletion or degradation.

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