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IMPACT OF ACCESS TO CREDIT ON FARM OUTPUT AMONG AGROFORESTRY FARMERS IN OYO STATE, NIGERIA

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Abstract
Agroforestry contributes to food and income security, and improvement of crop productivity. Access to agricultural credit is crucial to the enhancement of agricultural growth and development. The study examined the impact of access to credit on the output of agroforestry farmers in Oyo State, Nigeria. A multi-stage sampling technique was used to select the respondents from the study area. Descriptive (frequencies and percentages) and inferential statistics (Propensity Score Matching-PSM) were used in the study. The results show propensity score distribution and common support for propensity score estimation from the covariate balancing tests both before and after matching in which the treatment (credit access) and comparison (non-access to credit) groups are said to be balanced. Meanwhile, the result of the impact of access to credit facilities on farmers' output in the study from the PSM analysis shows that access to credit had a positive and significant impact on the farmers output. Therefore, the study concludes that improving access to agricultural credit facilities could be a potential source of poverty reduction among farmers in the study area through the enhancement of farmers' output and by extension improving their income. In view of this, farmers' access to credit facilities needs to be enhanced through the development and encouragement of farm-level policies that ensure easy access to financial credit among rural farmers.

Keywords: Agroforestry Technology, Food Production, Food Security, Propensity Score Matching (PSM), and Oyo State

Introduction

In 1977, the Federal Government of Nigeria (FGN) established credit schemes such as the Agricultural Credit Guarantee Scheme (ACGS) and the Agricultural Credit Support Scheme (ACSS) to ensure farmers' access to agricultural credit. The ACGS was formed for the singular aim of providing a guarantee in respect of loans granted by any bank for agricultural purposes (CBN, 1990). According to Nwosu *et al*. (2010), ACGSF was set up with the main objective of encouraging financial institutions to lend funds to those engaged in agricultural production and agro-processing activities with the aim of enhancing export capacity of the nation and for local consumption. This was exclusively in favour of large-scale farming as smallholder farmers rarely obtain credit from formal credit sources. Farmers' inability to access credit can be a function of both demand and supply. On the supply side, banks may find it very risky and expensive to provide credit to rural smallholders, thus rationing the supply of credit or making available contracts that may be too expensive or too demanding on collateral. On the demand side, apart from the situations where farmers may not have adequate collateral, even in situations where credit is available, farmers may find it too risky to borrow (Boucher *et al*., 2008).

Carter and Weibe (1990) suggested that farmers need both ex-ante and ex-post access to capital. According to them, ex-ante capital access is required in order to finance vital production costs such as labour and purchase inputs which needed to be paid ex-ante, that is, prior to the actual realization of production. On the other hands, access to capital after the realization of the production process, that is ex-post capital access, is of particular importance when there is no insurance as it's often the case in low income agrarian economies. Thus, in case of annual fluctuation in production, ex-post access to capital is highly essential for the stabilization of households' consumption from year to year. The implication of this is that access to credit may not have a direct impact on productivity, but it could have a positive and significant indirect impact through its positive influence on agricultural technologies adoption, increased capital for farm investment, hired labor, and improved household welfare through

improved health care and better nutrition. Furthermore, Feder *et al*.(1990) indicated that credit allows farmers to satisfy the cash needs induced by the production cycle which characterize agriculture; land preparation, planting, cultivation, and harvesting are typically done over a period of several months in which very little cash revenue is earned, while expenditure on materials, purchased inputs, and consumption need to be made in cash. Thus, access to credit may affect farm productivity because farmers facing binding capital constraints would tend to use lower levels of inputs in their production activities compared to those not constrained (Petrick, 2004).

Ahma (2010) indicated that access to credit enables poor rural farmers to venture into new areas of economic activities, broaden their sources of capital and manage shocks and stress that are bound to occur. He further stated that poor farming households majority of who are impoverished need to develop the habit of saving, obtaining loans for production and transferring cash. Generally, credit allocation to agriculture is low and as such, remained a major challenge to agricultural investment (FAO, 2015). Meyer (2007) argued that micro finance services should be integrated into crop production since it has the potential of increasing crop production and improving the lives of farmers. In the Upper East region of Ghana, for instance, Quaye (2008) reported that only 19% of the households have access to credit. Nonetheless, various empirical studies such as Asres *et al* (2013) noted that credit has a positive impact in reducing inefficiencies through the alleviation of capital constraint and enable farmers to procure inputs on time.

Agroforestry has been defined as a land use system in which woody perennials are grown with food crops and/or livestock leading to many beneficial, ecological and economic interactions between trees and non-tree components. The International Council for Research in Agroforestry (ICRAF) now World Agroforestry Centre defined agroforestry as a "dynamic ecologically based natural resources management system that through interactions of trees on farm and in the agricultural landscape diversifies and sustains production, enhancing social, economic and environmental benefits for land users at all levels". Garrity and Stapleton (2011) noted that agroforestry is one of mankind best hopes to create a climate-smart agriculture, increase food security, alleviate rural poverty, and achieve a truly sustainable development. Agroforestry also contributes to food and income security, amelioration of environmental hazards, improvement of crop productivity and mitigation of climate change (Ajayi and Catacutan, 2012; Mutua*et al*., 2014 and Kennedy *et al*., 2016).

According to Maren and Carolyn (2011), agroforestry affects the socio-economic livelihood of rural farmers by enhancing income earning potentials and overall food and nutritional security and provision of fuel wood, fodder for animal consumption and employment. Earlier, Kandji *et al.* (2006) pointed out that agroforestry systems improve the microclimate which in turn improves the adaptive capacity of land owners to climate change. Thus, they suggested that the presence of trees in agricultural croplands can provide producers with an additional source of income that helps to strengthen their socio-economic resilience. Integrating trees into systems where they can be planted close to each other and pruned or browsed intensively can help increase economic benefits. Therefore, agroforestry farmers, in the context of this study, refer to farmers who deliberately spare trees on their farms. This category of farmers are said to practice traditional form of agroforestry. The trees are deliberately left by the farmers on their farms to serve as cover for their arable crops and to also replenish soil nutrients. These trees (especially the fruit trees) also provide additional source of income to farmers.

Quite a number of empirical studies have been conducted to study the relationship between access to credit and agricultural productivity. In their studies to establish the relationship between access to credit and agricultural productivity in Ghana, Baffoe *et al*. (2015) analyzed responses from 109 farm households (borrowers and non-borrowers) and concluded that the difference in productivity was significant. The increase in productivity was attributed to the technical efficiency of borrowers. In his analysis of the "Impact of agricultural credit on farm productivity" using the quintile regression and Stochastic Frontier Analysis techniques and responses from 654 farmers sampled from Mekong Delta region of Pakistan, Duy (2012) revealed that the rice yield and technical efficiency of farmers increased tremendously because of access to credit, educational levels of farmers and high level of technology. His study also showed that rice production was positively affected by the use of formal credit rather than informal credit

Furthermore, studies have also been carried out to establish that agroforestry practices enhance farmers' income, food security and improve poverty status of the farming households. Tiwari *et al.* (2017) in their review on Agroforestry for Sustainable Rural Livelihood ascertained that Agroforestry has the potential to provide food security and help to reduce poverty along with its contribution to environment security. They affirmed that traditional farming and their management such as agroforestry practices may potentially provide options to enhance livelihoods through simultaneous production of food, fodder and firewood and reduce the impact of climate change. However, none of the aforementioned studies assessed the contribution of credit facility to the productivity of agroforestry farmers. This study therefore attempts to address the gaps in the previous studies by assessing the impact of access to credit facilities on the output of agroforestry farmers in Oyo State, Nigeria.

Methodology

Study Area

The study was carried out in Oyo State, Nigeria, located in the South-West Zone of Nigeria. The state consists of thirty-three (33) Local Government Areas (LGA) and covers an area of 28,454 square kilometers. Agriculture is the main occupation of the people and small-scale traditional farming system predominates in the area. The bulk of the produce come from annually cultivated rain-fed farms The State has four Agricultural Development Programme (ADP) zones, namely; Ibadan/Ibarapa, Oyo, Saki and Ogbomoso (see Fig.1),

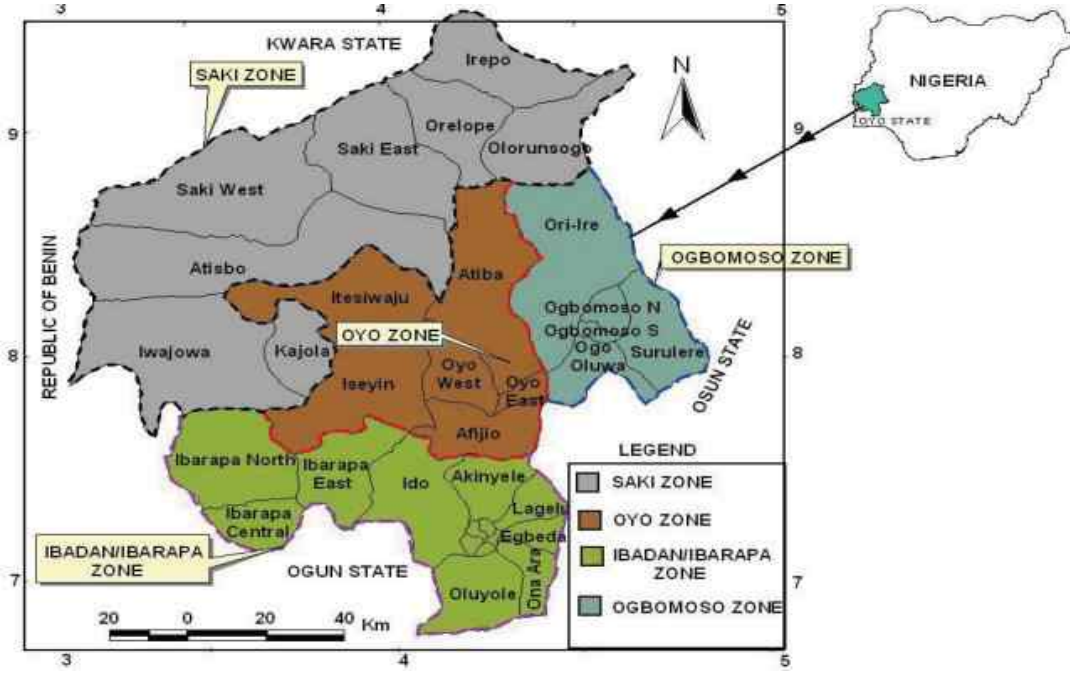

Fig .1: Map showing the Four ADP zones in Oyo State, Nigeria.
Source: Cartographic Laboratory, IFSERAR, FUNAAB, 2016

Sampling Procedure

Multi-stage sampling technique was used to select the respondents from the study area. The first stage was the random selection of two Agricultural Development Project (ADP) zones out of the four agro-ecological or ADP zones in Oyo State. The selected zones were Ibadan/Ibarapa and Saki. The second stage was the random selection of LGAs also known as ADP Blocks from the selected zones. Six LGAs were selected from Ibadan/Ibarapa zone, while four were selected from Saki. The selection was done based on the proportion of number of LGAs in each of the selected zones. The third stage was the random selection of two communities in each LGA, making a total of twenty communities in all. The fourth stage was the purposive selection of five (5) agroforestry farmers in each LGA, making a total of one hundred (100) respondents. However, only 94 copies of the questionnaire were eventually utilized for the analysis..

Method of Data Analysis

Propensity score analysis (PSA) is a useful tool to account for imbalance in covariates between treated and comparison groups. The goal of creating a propensity score is to balance covariates between individuals who did and did not receive a treatment, making it easier to isolate the impact of a treatment. A propensity score (π) for an individual (i) is defined in Rosenbaum and Rubin (1983) as the conditional probability (P) of assigning a participant to a particular treatment or comparison group (T) given a set of covariates (X), expressed thus;

$$\pi_i = (T_i=1|X_i) \ldots\ldots\ldots\ldots (1)$$

Theoretically, relevant pre-treatment variables are used to derive probabilities of group membership which are then used to match participants in treatment and comparison groups such that both groups have equal means or likelihoods of receiving treatment. Once matched, any differences between these groups should be more reflective of the true treatment effects in the population, and analogous to the interpretation of randomized designs. Therefore, theoretically relevant covariates likely to predict group membership should be identified and included in the estimation of the propensity score. There are no limits to the number of covariates that may be used in this estimation process.Once covariates have been identified, the probabilities of group membership or propensity scores are calculated for all participants. Logistic regression is the most commonly used estimation technique (Guo and Fraser, 2010; Thoemmes and Kim, 2011) and is relatively easy to interpret given that the predicted probabilities (P) of group membership (T) are the propensity scores (π) for a given set of covariates (X).

$$\pi_i(X_i) = (T_i=1|X_i) = \frac{1}{1+e^{-xibi}} \quad \ldots\ldots\ldots (2)$$

Once propensity scores have been estimated for all individuals, a conditioning strategy is used to produce groups with similar means and distributions of propensity scores (Rosenbaum and Rubin, 1983). Three primary methods exist for obtaining statistically equal likelihoods of group assignment. These methods include: matching, regression adjustment, and stratification (D'Agostino, 1998). The matching method controls for covariates by pairing participants across groups. This may be accomplished by either (a) matching a participant on the nearest possible propensity score, (b) matching within a caliper, (c) Mahalanobis metric matching, or (d) Mahalanobis metric matching on a specified caliper based on the average of the variances within the group. Alternatively, researchers may use an adjustment in the regression analysis, achieved by either subtracting the effect of covariates from the treatment effect or by adding the propensity score as a variable in the regression equation when estimating treatment effects. Lastly, stratification (also called sub-classification) may be used to place participants into sub-populations (groups / strata) so that participants can be compared based on the groups or strata they are assigned.

This study therefore adopted the use of Propensity Score Matching model to analyze the impact of credit access on the output of agroforestry farmers in the study area The ideal comparison group is selected such that it matches the treatment group using a comprehensive baseline, either survey or time invariant characteristics. The matches are selected based on similarities in observed characteristics. This assumes no selection bias based on unobserved characteristics.

Therefore, let P(X) = Pr (z = 1|x) represent the probability of access to credit by an agroforestry farmer, that is the propensity score. Propensity Score Matching (PSM) will then construct a statistical comparison group by matching observations on the agroforestry farmers who have access to credit, and those with no access to credit for similar values of propensity score. Rather than create a match for each access to credit with exactly the same value of X, we can therefore match the probability of access to credit.

Therefore, to evaluate the impact of access to credit on the productivity of agroforestry farmers, a measure of the impact was used to compare the outcome of those who had access to credit and those who did not have access.

Let Y_1 = Agroforestry farmers with access to credit

Y_0 = Agroforestry farmers with no access to credit.

The impact of credit access will therefore be the change in the mean outcome caused by accessing credit.

$\bar{Y} = Y_1 - Y_0$ ..... (3)

Since it may not be possible to estimate individual treatment effects in equation 1 directly, the evaluation parameter, which is the Average impact of the treatment on the treated (ATT), was introduced thus:

$Y_{ATT} = ATT\ (Y|X; Z=1) = E\ (Y_1 - Y_0|, Z=1) = E(Y1/Z=1) - E(Y_0|, Z=1)$ ..... (4)

Where Z is an indicator variable, showing whether a respondent actually had access to credit or not. It is equal to 1 if respondent had access to credit and 0 if otherwise. X denotes a vector of control variables. STATA 12 Version was used for this analysis.

Results and Discussion

The socio-economic characteristics of the farmers are presented in Table 1. Results show that about 60% of the agroforestry farmers with access to credit were between 40 and 59 years of age, while 68.51% of those without access to credit were within the same age range. Many (40%) with access to credit had secondary education, while 35.19% with no access to credit attained tertiary level of education. Furthermore, majority (72.50%) with access to credit had farm size of 8ha and below, while 83.33% of without credit access had equivalent land holdings. This is an indication that majority of the farm households in the study area are small scale farmers. According to Ozowa (2005), farm households with less than 10ha of farmland are regarded as small-scale farmers. This is according to international standards measurement for farm sizes. It was also observed that agroforestry farmers with access to credit had larger household size than their counterparts with no access. About 72.5% with access to credit had household size range of 6 to 15 persons, while 62.96% without credit access had same. This may not be unconnected to the fact that agroforestry farmers with access to credit and larger household sizes had more people to cater for, hence the need to acquire loan and invest more on arable and tree crops, particularly, multipurpose and fruit trees, in their farming activities for more output and additional sources of income to cater for family needs.

Table1: Socio-economic Characteristics of Respondents

	Credit Access (N=40)		No Access (N=54)	
Variable	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Age (Years)				
≤ 39	02	5.0	05	9.26
40-49	10	25	16	29.62
50-59	14	35	21	38.89
60-69	09	22.5	10	18.52
>70	05	12.5	02	3.70
Gender				
Male	36	90	48	88.89
Female	04	10	06	11.11
Educational Status				
No Formal	02	5	04	7.41
Primary	10	25	07	12.96
Secondary	16	40	17	31.48
Tertiary	10	25	19	35.19
Vocational	02	5	07	12.96
Farm Size (Ha)				
≤2	08	20	12	22.22
2.1 – 5.0	15	37.5	28	51.85
5.1 – 8.0	06	15	5	9.26
≥8.1	11	27.5	09	16.67
Household Size				
≤ 5	9	22.5	18	33.33
6-10	24	60	32	59.26
11-15	05	12.5	02	3.70
≥16	02	5	02	3.70
Marital Status				
Single	01	2.5	02	3.70
Married	36	90	49	90.74
Widowed	02	5	02	3.70
Divorced/Separated	01	2.5	01	1.85
Farming Experience Years)				
≤ 10	05	12.5	05	9.26
11-20	17	42.5	25	46.29
21-30	10	25	12	22.22
≥31	08	20	12	22.22
Access to Extension				
Yes	23	57.5	35	64.81
No	17	42.5	19	35.19

Source: Field Survey, 2019

Several agroforestry farmers in the study area were aware of the advantages of agroforestry practices. They were much aware of the economic benefits of agroforestry practices. As shown in Fig. 1, 87 agroforestry farmers (representing 92.55%) believed agroforestry increased their farm outputs, while 76.6% were of the opinion that agroforestry helps in the enrichment of soil fertility. They further affirmed that sparing trees on their farmland enabled them to meet their basic needs such as fuel wood, fruits, fodder, timber, vegetables etc. About Sixty two farmers further indicated that agroforestry provides them the opportunity to generate additional income from sale of fuel wood, fruits, timber and other non timber forest products (NTFPs).

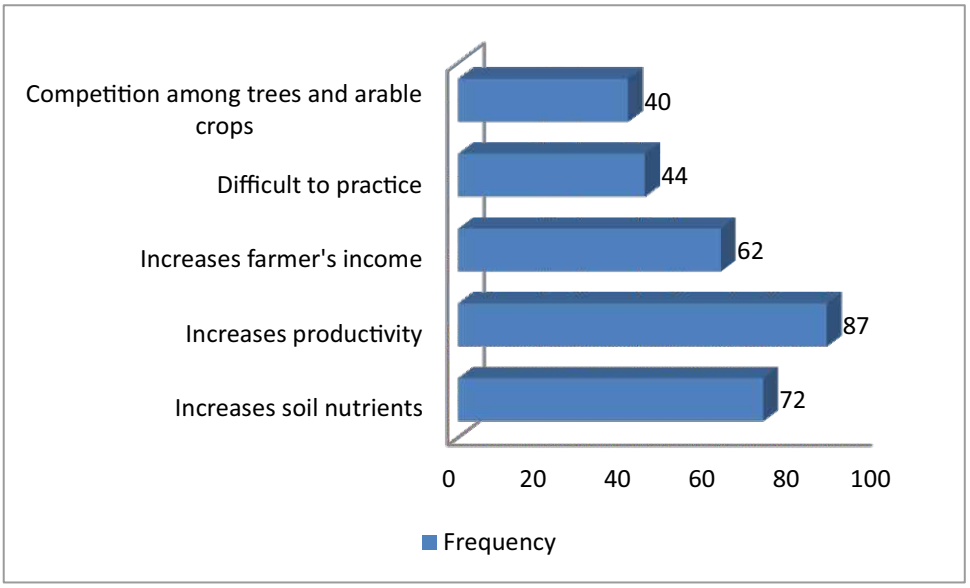

Fig.1: Farmers Perception about Agroforestry Practices

Some of the agroforestry trees the farmers deliberately spared on their farmlands include *Dacryodes edulis, Afzelia Africana ,Irvingia gabonensis, Chrysophyllum albidum, Cola nitida,Ceiba pethandra,, Gliricidia sepium, Milicia excelsa, Mangifera indica, Treculia Africana, Khaya ivorensis, Parkia biglobosa, etc.*

Fig. 2 shows propensity score distribution and common support for propensity score estimation. The "treated" in the figure shows the observations in the adopters group that have a suitable comparison. The balancing test was thereafter applied to find out if the differences in the covariates of the two categories in the matched sample have been eliminated, in which case, the matched comparison group can be considered a plausible counterfactual (Ali and Abdulai, 2010).

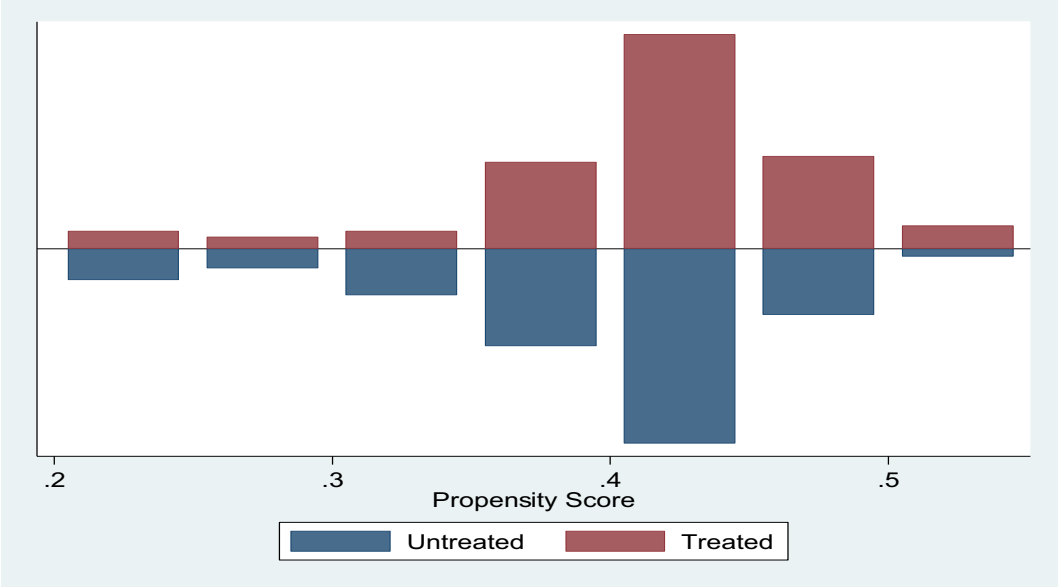

Fig. 2: Propensity Score Match among Agroforestry Farmers with access to credit and those without access to credit facility

Table 2 shows the results from the covariate balancing tests both before and after matching. The standardized mean difference of 10.1% before matching decreased to about 6.9% after matching. Therefore, it can be concluded that the matching process decreased the total bias.

Table 2: Matching Quality Indicator (Before and After Matching)

Sample	Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	%Var
Unmatched	0.014	3.85	0.697	10.1	9.5	28.4*	0.83	33
Matched	0.003	0.69	0.995	6.9	7.5	13.1	0.91	33

Source: STATA 12 Output of results

Impact of Credit Access on Output of Agroforestry Farmers

Table 3 reveals the result of the impact of access to credit on agroforestry farmers' output in the study area. The result from the Propensity Score Matching Analysis shows that credit access had a positive and significant impact on the farmers' output. The Average Treatment Effect (ATE) of the treatment on a farmer drawn from the total population at random is 254,538kg of food production per year. This implies that access to credit increased the farmers' farm output by 254,538kg, and increased the output of the sampled farmers who had access to credit facility by 363,954kg per year. This is in agreement with *a priori* expectation in which access to credit facilities is expected to enhance farmers' output. This corroborates study by Duy (2012) who noted that rice yield and technical efficiency of farmers increased tremendously because of access to credit, educational level of farmers and high level of technology. It is also supported by Baffoe *et al*. (2015), where they concluded that the difference in productivity of borrowers (those who had access to credit) and non-borrowers (those with no access to credit) was statistically significant. This implies that farmers with credit facilities had better productivity than those that had no access to credit facilities.

Table 3: Impact of the Adoption of Agroforestry Technology on Income of Rural Farmers

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Farm Income	Unmatched	660649.614	377720.364	282929.250	82927.9376	3.18*
	ATT	660649.614	296695.337	363954.277	98048.9746	3.53*
	ATU	377720.364	534305.977	156585.613		
	ATE			254538.351		

Source: STATA 12 Output of results

Constraints faced by Agroforestry Farmers

There are many constraints militating against agroforestry farmers in the study area. This study therefore highlighted some of the problems, as stated by the farmers in the study area. Some of the problems examined include; insufficient land for tree planting, illegal felling of trees, long gestation period of trees, lack of technical assistance, lack of planting materials, lack of knowledge and skills and competition among trees and arable crops on farmland. Results show that majority (82.98%) of the respondents indicated lack of knowledge and required skills on agroforestry was a constraint to their adoption of agroforestry and this ranked highest among the constraints, as shown in Table 4. This possibly explains why agroforestry farmers in the study area could not efficiently explore the potentials of agroforestry technology. Furthermore, ranking second highest constraints is the gestation period of agroforestry trees (67.02%). In addition, 62.77% of the respondents stated insufficient land as a constraint to the adoption of agroforestry. This is where expertise of the extension agents and some subject matter specialists are needed to train and enlighten the farmers on how to make effective use of their land to accommodate both their tree and arable crops. This finding is therefore in line with the study by Amonum and Bada (2019) where lack of land, lack of tree seedlings and inadequate extension personnel were stated as some of the constraints affecting the adoption of agroforestry in Katsina State of Nigeria.

Table 4: Constraints militating against the Adoption of Agroforestry in the Study Area

Constraint	*Frequency	Percentage	Rank
Insufficient land for tree planting	59	62.77	3RD
Illegal felling of trees	37	39.36	7TH
Long gestation period of trees	63	67.02	2ND
Lack of technical assistance	40	42.55	5TH
Lack of planting materials	44	46.81	4TH
Lack of knowledge and skills	78	82.98	1ST
Competition among trees and arable crops on farmland	39	41.49	6TH

***Multiple Responses**
Source: Field Survey, 2019

Conclusion

This study assessed the impact of credit access on the output of agroforestry farmers in Oyo State, Nigeria. It also explored the constraints faced by the agroforestry farmers. Result shows that credit access had a positive and significant impact on the farmers' productivity. It can therefore be concluded that access to credit facilities enhanced the productivity of the farmers. Therefore, efforts should be geared towards making credit facilities available and accessible to agroforestry farmers in order to boost their productive capacities and by extension enhance their output. Farmers should also be provided with necessary and early-maturing tree seedling to encourage and motivate them to adopt agroforestry technology.

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