Analysis of Agroforestry Practices Among Small-Scale Farmers in Southern Guinea Savannah Zone of Nigeria

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Abstract:

Agroforestry has been identified to help tackle climate change for increased agricultural productivity, food security and sustainable development. This study therefore assesses the choice of agroforestry practices among small-scale farmers in Nigeria. A total of three hundred and fifteen farmers (315) were interviewed through the use of structured questionnaire and interviews. The data were analyzed using descriptive statistics and multinomial logit regression model. The result shows that about 66 percent of the small-scale farmers adopted agroforestry practices. The significant variables that influenced the choice of agroforestry practices by the farmers were their age, farm size, land tenure, membership in agricultural related group, amount of hired labour used and access to planting materials. It is recommended that government policies that would facilitate improved dissemination programmes on agroforestry should be made. This will bring about increase in productivity for food security.

Keywords: Agroforestry practices; multinomial logit model; Nigeria; Small-scale farmers

1. Introduction

In recent times, resilience, mitigation and adaptation to climate change are important issues in the current sustainability discourse among many developing countries. At the core of the Sustainable Development Goals (SDGs) lies Sustainable food system [1]. A sustainable food system (SFS) is defined as a "food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" [1]. Therefore, building food system resilience is critical as food systems must mitigate and adapt to local and regional climatic change in order to maintain environmental, social, and economic sustainability. However, a major challenge is to identify and develop resilient agricultural systems where ecosystem function is maintained [2-3].

The Nigerian agriculture, like other countries in West Africa is highly vulnerable to the impacts of climate change due to the dependence on rain-fed agriculture [4]. Consequently, this has resulted in reduced productivity which threatens food production with adverse effect on food security and on-farm income among the rural households in the country [5-6]. There are an increasing number of people experiencing food insecurity in the country. According to [7] the population of undernourished people in Nigeria grew from 10 million in 2010 to about 14 million in 2016 [8] and the number is expected to increase further. Despite the efforts of the government and international donors in tackling food insecurity in the country, Nigeria holds the 40th position out of the 79 countries on the Global Hunger

Index list [9]. Food security is expected to be increasingly affected by future climate change in the country [1]. Generating food and income needed to ensure food security under adverse effects of climate change requires significant increase of investment in climate change adaptation and mitigation strategies [10]. This is in order to improve on the current level of productivity among small-scale farmers.

Agroforestry, the purposeful integration of trees onto farms, is one potential solution [11]. Agroforestry has been identified as one of the strategies for effective mitigation or adaptation to climate change [12-15]. It offers multiple benefits such as being both climate and drought-smart land management practices which offers opportunities for mitigating the effects of drought while increasing the resilience of people and ecosystems to drought [16]. In addition, agroforestry's has been identified to enhance food security not only by providing food directly, but also increase soil fertility and provide cash to purchase food [17]. The ecosystem services, carbon sequestration and increased water table ability and microclimate modification amongst other attribute and benefits of agroforestry shows the potential of the land use system in adaptation to and mitigation of climate change [18]. It is therefore imperative to employ, agroforestry, a land use system which encourages increased productivity, food security as well as environmental stability

There are several types of agroforestry practices, ranging from traditional to modern technologies. However, the effectiveness of any agroforestry practice depends on the structure and function of different components of each agroforestry practice [5] as well as the number of agroforestry practices adopted. The small-scale farmer do have farm plots at different location and the fact that a different agroforestry practice can be adopted on the plots, enables them to make a choice on the number of agroforestry practices to be adopted. In addition several studies [19-25] have been conducted on adoption of agroforestry however there are limited studies [5] on factors affecting the choice of agroforestry practices among farmers. Against these backdrops, the study seeks to: identify the types of agroforestry practices adopted by the farmers and determine the choice of agroforestry practices among farm households in Nigeria.

2. Materials and Methods

2.1 Study Area

The study was conducted in Kogi, Niger and Kwara states of Nigeria. These states are located in the Southern Guinea Savanna Zone of Nigeria. The region has temperature fluctuating between 180C – 370C in the year and rainfall of 1000mm to 1500mm annually. The climatic cover of the region is tropical, divisible into two major seasons: the dry season and the wet season. The vegetation cover is a mix of forest and grass belt. Farming is the predominant occupation of the people.

2.2 Sampling Procedure

A multi-stage sampling technique was used to select 315 farmers. The first stage was a purposive selection of three agricultural zones: Zone D in Kwara state, Zone I in Niger and Zone A in Kogi state as indicated by the Kwara, Niger and Kogi's Agricultural Development Programme. The purposive selection was based on the fact that there is an established tree planting programme and presence of tree-rich savanna in the selected zones. The third stage was a random selection of fifteen (15) villages across each zone, while the fourth stage involved the random selection of 7 respondents per community. A total of three hundred and fifteen households (315) were selected and used for the study.

Primary data were used for the study. The primary data were collected through the use of structured questionnaire, interviews with the heads of the household.

2.3 Analytical Technique

To achieve the stated specific objectives of the study, the descriptive statistics (frequency, percentage and mean) and multinomial logit regression were the tools used for data analysis.

2.3.1 Multinomial logit (MNL)

The Multinomial Logit (MNL) model was used to analyze the factors influencing choice of agroforestry practices among farmers in Nigeria. The model was preferred because it permits the analysis of decisions across more than two categories in the dependent variable; hence it becomes possible to determine choice probabilities for the different agroforestry practices [27]. The dependent variable was based on the choice of agroforestry practice of the farmer. The explanatory variables were chosen based on literatures [4, 27-28]. Therefore, the empirical specification for examining the influence of explanatory variables on the choice of agroforestry (Y) is given as follows:

$$Yi = 0,1,2 = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + \beta 10X10 + \beta 11X11 + \beta 12X12 + \mathscr{E} \quad (1)$$

Where Yi= Choice of agroforestry practice (0 = No adoption, 1 =adopted single practice, 2 = adopted more than one agroforestry practice)

X1 = Age (years); X2 = Gender (Dummy 1 = Male, 0 = Female); X3= Education (years); X4= Farming Experience (years); X5= Household size; X6= Farm size (Hectares); X7= Extension contacts (Number of contacts); X8= Membership in agricultural related group (Dummy 1 = Yes, 0 = Otherwise); X9= Land ownership (Dummy 1 = Yes, 0 = Otherwise); X10= Farmers innovativeness (Number of innovations implemented by the farmer within 20 years) ; X11= Access to improved planting materials (Dummy 1 = Yes, 0 = Otherwise); X12= Amount of hired labour used (mandays)

$\mathscr{E}$ = error term.

3. Results

1. 3.1 Socio-Economic Characteristics of Farmers

2. The result in Table 1, shows that, majority of the farmers (79%) were male while only 21 percent were female. This implies that farming in the study area is male dominated. The modal age group was between 41 and 50 years with the mean age of 49years. Only 30 percent of the farmers had no formal education. About 22 and 23 percent of the farmers had primary and secondary education respectively. Only 13 percent had tertiary education. This finding is similar to that of [29]. This implies that the farmers in the study have low level of education. The modal household size for the study area was between 6 and 10 with a minimum household size of zero and a maximum household size of 17 members. The significance of the large household size may be that the farmers may have a large family labour supply. In small-scale agriculture, the average farmer make use of family labour and will usually first exhaust all sources of family labour before looking out for hire labour..

Table 1: Distribution of farmers by socio-economic characteristics

Characteristics	Category	Frequency (n = 315)	Percentage	Mean
Age	≤ 30	14	4.5	
	31 – 40	40	12.7	49years
	41 – 50	137	43.5	
	51 – 60	82	26.0	
	> 60	42	13.3	
Gender	Male	249	79.0	

	Female	66	21.0	
Education	No formal education	97	30.8	
	Adult education	34	10.8	
	Primary education	71	22.5	
	Secondary education	73	23.2	
	Tertiary education	40	12.7	
Household size	≤ 5	102	32.4	
	6 – 10	136	43.2	7members
	11 – 15	74	23.4	
	>15	3	1.0	
Farming experience	≤10	54	16.8	
	11 – 20	75	23.8	26years
	21 – 30	93	29.8	
	>30	93	29.6	

Characteristics	**Category**	**Frequency (n = 315)**	**Percentage**	**Mean**
Farm size	≤ 1	101	32.7	
	1.01 – 2.0	77	24.4	
	2.01 – 3.0	31	10.5	2.6hectare
	3.01 – 4.0	45	14.3	
	4.01 – 5.0	26	8.6	
	>5	30	9.5	
Land Ownership	Inherited	156	49.5	
	Family land	87	27.6	
	Communal	15	4.7	
	Rented	27	8.6	
	Government owned	9	2.9	
	Gift	9	2.9	
	Purchased	12	3.8	
Membership in Agric. group	Yes	146	46.3	
	No	169	53.7	
Extension Contacts	0	102	32.4	
	1 – 5	95	30.2	4 contacts
	6 – 10	71	22.5	
	>10	47	14.9	
Number of participations in On-farm Demonstration	0	230	73.0	
	1 – 3	70	22.2	
	>3	15	4.8	
		315	100.0	

About 33 percent of the farmers had farm size of less or exactly 1 hectare with a mean of 2.6 hectares in the study area. The most common mode of land ownership in the study area was through the customary land tenure of inheritance (50%) followed by family land (27%). This implies that the farmers had some control over their farmland. 54 percent of the farmers do not belong to any agricultural related group. Only 32 percent of the farmers had no contacts with extension workers. On the average the farmers had 4 contacts with the extension agents in a year. About 73 percent of the farmers had not participated in any on-farm demonstration of agroforestry practices. This implies that the farmer lacked the technical know-how of making use of improved agroforestry practices on their farm land. Access to planting materials especially tree seedling is important to help boost adoption of agroforestry practices. The result shows that about 61 percent of the farmers had access to planting materials while 39 percent did not have access to planting materials in the study area. This implies that there is a low level of access to planting materials which may have reduced the adoption rate of agroforestry practices in the study area.

3.2 Choice of Agroforestry Practices

Table 2, presents the distribution of farmers according to the number of agroforestry practices adopted in the study area. This includes the percentages and count of farmers making use of agroforestry practices.

Table 2: Distribution of farmers by the number of agroforestry practices adopted in the study area.

Number of Agroforestry practice	Frequency	Percentage
Single practice	184	58.4
Multiple practice	22	7.0
No adoption	109	34.6
Total	315	100.0

Source: Field survey

The result shows that about 34 percent of the farmers did not adopt agroforestry practices. While 7 percent of the farmers made use of more than one agroforestry practice in different combination and 58 percent of the farmers made use of just a single agroforestry practice. This implies that about 66 percent of the farmers adopted agroforestry practices. This result agrees with the findings of [24]. Most of the adopters had trees on their farm to either provide shade, improve soil fertility and for economic benefit. The farmers also adopted agroforestry practices to combat land degradation through wind erosion and help reduce environmental degradation.

3.3 Determinants of Choice of Agroforestry Practices

The factors that influence the choice of agroforestry practice adopted by the farmers were assessed using the multinomial logit model. The results of the analysis are presented in Tables 3, and 4 showing the multinomial regression estimates and the marginal effect of the multinomial estimate respectively.

The result in Table 3 showed that the estimated model has explanatory power as shown by the likelihood ratio which was significant at the 1% level. The results of the coefficients of the multinomial logit model, the relative risk ratio (RRR) and the marginal effects were computed. However, the result of the marginal effect was explained. This is because the marginal effects are used to measure the expected change in probability of the number of agroforestry practice being chosen with respect to a unit change in an independent variable from the mean [30]. The result of the marginal effect of the multinomial model in Table 5, showed that eight (8) out of the eleven (11) variables included in the model were statistically significant in determining the variation in the choice of agroforestry practice adopted by the farmers. The significant variables include; age, farm size, Land ownership, number of extension contact,

membership in agricultural related group and farmers' innovativeness, access to planting material, use of hired labour. The Standard interpretation of the marginal effect result for this study is that for a unit change in the predictor variable, the probability of choosing a practice is expected to change by a factor of the respective parameter estimate given all other variables in the model are held constant.

Single agroforestry practice

For the single practice, the variable age was significant (10%) and negative. This implies that an increase in age by one year reduces the probability of choosing a single agroforestry practice by 0.005. This means that the probability of choosing a single agroforestry practice is about five percentage points lower for older farmers than for younger farmers with the other variables in the model held constant. This further implies that as the farmers grows older it decrease the probability of adopting agroforestry practice. Young household heads are more interested in engaging in new agricultural practices because of their risk taking character unlike the older farmers. This result is in tandem with the findings of [23, 31-32].

Table 3: Result of the multinomial logistic regression of the determinant of farmers choice of agroforestry practices

Choice/variables	Coefficient	Relative Risk Ratio	z
1. No practice	**Base category**		
2.Single practice			
Age	-0.041(0.0166725)**	0.960(0.0160061)**	-2.45
Gender	0.063(0.3498573)	1.063(0.371961)	0.18
Education	-0.017(0.0226447)	0.983(0.0222586)	-0.76
Experience	0.025(0.0134253)**	1.027(0.014)**	1.97
Household Size	0.008(0.0510595)	1.009(0.0515204)	0.18
Farm size	-0.266(0.0865438)***	0.765(0.0662196)***	-3.09
Extension Contact	0.020(0.0365472)	1.019(0.0372338)	0.51
Membership	0.508(0.3073248)*	1.662(0.5109074)*	1.65
Land Ownership	-0.688(0.3623187)*	0.489(0.1770854)**	-1.98
Innovativeness	0.109(0.049552)**	1.113(0.0551376)**	2.16
Access to Planting material	1.690(0.3053919)***	5.325(1.626225)***	5.48
Hired labour Used	-1.600(0.8007453)**	0.205(0.1639442)**	-1.98
Constant	3.138(1.103484)**	23.228(25.63224)***	2.85
3. Multiple practices			
Age	-0.071(0.0316541)**	0.927(0.0293551)**	-2.38
Gender	1.063(0.8303485)	2.899(2.407226)	1.28
Education	-0.026(0.0436036)	0.974(0.0424629)	-0.61
Experience	0.036(0.0271324)	1.043(0.028289)	1.54
Household Size	-0.003(0.0906733)	0.999(0.0905413)	-0.02
Farm size	-0.207(0.1644307)	0.810(0.1331566)	-1.28
Extension Contact	0.148(0.065573)**	1.160(0.0760509)**	2.26
Membership	0.508(0.5491868)	1.956(1.074361)	1.22
Land Ownership	1.317(1.094398)	3.349(3.665554)	1.10
Innovativeness	0.100(0.0845868)	1.104(0.0933483)	1.17
Access to Improved Planting material	1.109(0.5709625)*	2.934(1.675121)*	1.89
Hired labour Used	-1.754(1.089604)	0.179(0.1945856)	-1.58
Constant	-0.742(2.022178)	0.591(1.194858)	-0.26
LR chi2(24)	91.54***		
Log likelihood	-227.04797		
Number of obs	120		
Pseudo R^2	0.1688		

Source: Field survey. Note; Figures in parenthesis are standard error, *, **, ***, indicate significant levels of 10%, 5% and 1% respectively.

Table 4: Marginal effect of the determinant of farmers choice of agroforestry practices based on the number of practices adopted

Variables	Single Practice		Multiple practice		No practice	
	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat
Age	-0.007(0.004)*	-1.94	-0.002(0.001)*	-1.70	0.009(0.004)***	2.63
Gender	-0.014(0.077)	-0.18	0.040(0.025)	1.63	-0.026(0.076)	-0.35
Education	-0.003(0.005)	-0.63	-0.001(0.002)	-0.37	0.004(0.005)	0.80
Experience	0.005(0.003)	1.62	0.001(0.001)	0.96	-0.006(0.003)**	-2.08
Household Size	0.002(0.011)	0.19	-0.001(0.004)	-0.09	-0.002(0.011)	-0.16
Farm size	-0.055(0.019)***	-2.96	-0.002(0.008)	-0.21	0.057(0.018)***	3.10
Extension Contact	-0.001(0.008)	-0.08	0.007(0.003)**	2.30	-0.006(0.008)	-0.79
Group Membership	0.094(0.065)	1.45	0.016(0.026)	0.64	-0.111(0.063)*	-1.75
Land Ownership	-0.179(0.066)***	-2.69	0.057(0.023)**	2.46	0.122(0.064)*	1.90
Farmers' Innovativeness	0.021(0.010)**	2.05	0.001(0.004)	0.36	-0.023(0.011)**	-2.17
Access to improved planting material	0.354(0.062)***	5.69	0.002(0.025)	0.06	-0.355(0.062)***	-5.73
Use of Hired labour	-0.216(0.089)**	-2.41	-0.027(0.058)	-0.48	0.243(0.073)***	3.32

Source: Field survey, Note; figures in parenthesis are standard error

The choice of adopting a single agroforestry practice was significantly influenced by the size of farm at 1 percent level of significance and has a negative estimate. This implies that an increase in farm size by one hectare decreased the probability of choosing single agroforestry practice by 4.4 percent. This may be as a result of the fact that agroforestry practices are targeted towards the small-scale farmers and the practice works well on small land holding.

Land ownership has been identified to play a significant role in adoption of agroforestry since it involves tree planting. However the results showed that land ownership negatively influenced choice of single agroforestry practice at 5 percent significance level. This means that the probability of choosing a single agroforestry is on average about 3 percent lower for land owners than for non-land owners. This could be as a result of the fact that most of the farmers (81%) owned their farm land and the fact that those who did not adopt agroforestry practices also had some rights to their farm land due to the customary land tenure system used in the study area. In addition some of the farmers meet the trees on their farm land and do not have the right to cut them down since they do not own the land. This result is against the findings of [19, 33] who found that rural household' investments in agroforestry increase with increase in land ownership.

Farmers innovativeness based on the number of technologies adopted in the past 20years by the farmer had positive significant effect on the choice of single agroforestry practices at 5 percent level of significance. This implies that when farmers are innovative in their production they adopt more innovation. This result is in tandem with [34] finding that the degree of innovativeness of individual farmers affects adoption of agroforestry practices.

Access to improved planting material (tree seedling) was significant (10%) and positive for single agroforestry practice at 1 percent level of significance. This result implies that when additional access to planting materials such as seedlings is gained by the farmers, this will encourage adoption of agroforestry technologies among the farmer. This result is in accord with [35-36] who found out that lack of planting materials (seed and seedlings) constrained establishment of agroforestry.

The use of hired labour was negative and significantly influenced the choice of single agroforestry practices at 10 percent level of significance. This implies that the probability of choosing a single agroforestry practice is on average about 21 percentage points lower for farmers who used more hired labour than those who do not. This could be as a result of the fact that the adopters of agroforestry practices had smaller farm size than those who did not adopt. Consequently, the small-scale farmers (adopters) made use of more of family labour than hired labour to save cost.

Multiple practices

The result of the marginal effect on the choice of multiple agroforestry practices showed that the variable age was significant (1%) and negative. This implies that an increase in age of the farmers by one year reduces the probability of choosing multiple agroforestry practice by 0.002. This means that the probability of choosing multiple agroforestry practice is on average about 0.2 percent points lower for older farmers than for younger farmers with the other variables in the model are held constant. This also implies that as the farmers grows older it decrease the probability of adopting agroforestry practice.

The number of extension contacts with farmers was positive and significantly influenced the choice of multiple agroforestry practices. This implies that an increase in extension contacts by one visit increased the probability of choosing multiple agroforestry practices by 0.8 percent. Agricultural extension agents provide different information and alternatives depending on prevailing activities which impacts farmers differently and they are expected to choose an option that suits them best [37]. The number of contacts with extension officers is a proxy measure for access to agricultural information and this positively contributes to awareness and subsequent adoption of new technologies [38-39]. [20, 22, 25] found a positive relationship between extension contact and adoption of agroforestry practices. However, a study by [27] contrasts this result where agricultural extension services were more focused on intensifying crop and livestock production at the expense of tree planting.

Land ownership positively influenced choice of multiple agroforestry practice at 5 percent significance level. Land ownership increased the probability of choosing multiple agroforestry practices by 5.7 percent. This means that the probability of choosing multiple agroforestry is about 5.7 percent higher for land owners than for non-land owners. This also implies that when farmers have rights on their farm land they can take up agroforestry practices while those who do not have rights on their farm land cannot take up or adopt agroforestry practices. Unlike the single agroforestry practice, this result may be due to the fact that those who adopted multiple agroforestry were actual owners of their farm and have the right to plant trees. In addition tenant farmers are not usually allowed to plant trees as such they cannot adopt agroforestry practice because it involves tree planting. This result is in tandem with the findings of [24, 33]. [40] noted that, immigrant settlers in the rural areas of south western Nigeria have problems in acquiring land for cultivation, and they do so only on a temporary basis which hinders the large scale adoption of agroforestry in the area.

No agroforestry practice

For the no practice option, the result of the marginal effect on the choice of no agroforestry practices showed that the variable age was significant (1%) and positive. This implies that an increase in age of the farmers by one year increases the probability of choosing no agroforestry practice by 0.009 for older farmers than for younger farmers with the other variables in the model held constant. This also implies that as the farmers grows older it increase the probability of not adopting agroforestry practice. This may be due to the fact that agroforestry practices requires energy and strength and older farmers have less strength to take up the practice unlike the younger farmers.

The results also showed that farming experience had a significant negative effect on the choice of no adoption at 5 percent level of significance. This implies that as the farmers gain additional years of experience in farming it reduces their probability of choosing not to adopt agroforestry practices. This means that the more experienced the farmer the higher their probability of adopting agroforestry practices.

The no practice option was significantly (1%) influenced by the farm size and was positive. This implies that an increase in farm size by one hectare increased the probability of choosing no practice option by 5.7 percent. This implies that as the farmers' farm increases in size, the farmers do not make use of agroforestry practices. Small land holding hinders the usage of technologies other than agroforestry compared to large land holding. A large farm size allows a farmer to experiment new technologies on a portion of land without worrying about compromising the family food security [27].

Group membership had a negative influence on the choice of no practice at 10 percent level of significance. This implies that membership in agricultural related group reduces the probability of choosing no practice option by about 11 percent. This also implies that membership in farmers group encourages the use of agroforestry practices. Members in a farmer group may influence one another to choose and adopt better technologies. Membership in groups exposes farmers to a wide range of ideas and sometimes gives farmers the opportunity to have better access to information, through training and extension services, which may positively change their attitude toward an innovation [41].

The results showed that land ownership positively influenced the probability of choosing no practice at 5 percent significance level. Land ownership increases the probability of choosing no agroforestry practices by 12 percent. This implies that as the farmers gain more rights on their farm land they tend not to adopt agroforestry practices. This result is true for the farmers that have rights to their farm land but did not adopt agroforestry practices.

Farmers' innovativeness had a negatively significant effect on the choice of no agroforestry practices at 5 percent level of significance. This implies that farmers' innovativeness reduces the probability of choosing not to adopt agroforestry practice by about 2 percent. This implies that a farmer that adopts innovations will tend to adopt more than those who rarely adopt innovation. When farmers are innovative in their production they adopt more agroforestry practices.

Access to improved planting material was significant (1%) and negative for no agroforestry practice. This implies that access to planting material reduces the probability of choosing no practice option by about 2 percent. This result implies that when farmers gain more access to planting materials such as tree seedlings, this will discourage choosing not to adopt agroforestry practices. One of the major problems identified in the study area is the inadequate access to planting material. When farmers have access to tree seedlings this encourages adoption of agroforestry technologies among the farmer.

The use of hired labour significantly influenced the choice of no agroforestry practice and was positive at 5 percent level of significance. This implies that an additional use of hired labour increases the probability of choosing no agroforestry option. This could be as a result of the fact that farmers that did not adopt agroforestry practices had bigger farm size than those who adopt. This necessitates employing more labour on the farm. [42] Indicated that large farms seek to hire more labour to maximise output and yield.

5. Conclusions

The study examined the choice of agroforestry practice among farming households in Nigeria. Most of the farmers adopted single agroforestry practice. The significant variables that influenced the choice of agroforestry practices by the farmers were their age, farming experience, farm size, extension contacts, land tenure, membership in agricultural related group, farmer's innovativeness, amount of hired labour used and access to planting materials. Therefore, it is recommended that farmers should be encouraged to become members of agricultural related group. In addition, policies affecting farmers' access to improved planting material (tree seedlings) and extension services should be encouraged for a wider adoption and use of the agroforestry practice. Through being members of agricultural related group and increased access to extension services, farmers can get more market information especially information on outlets to get improved tree seedlings. Establishment of agroforestry farms too should be re-enforced for farmers to achieve the maximum benefits of agroforestry. These will help reduce some of the challenges militating against food security and improve the farmers' adaptation to the vagaries of weather.

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