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DETERMINANTS OF PREFERENCE FOR LAND MANAGEMENT PRACTICES AMONG FOOD CROP FARMERS IN NORTH-CENTRAL NIGERIA

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ABSTRACT
The study examines the factors determining the use of land management practices among food crop farmers in North-Central, Nigeria. Data were collected from 345 farmers using multistage sampling technique and analyzed with multinomial logit model. The results showed that both traditional and modern land management practices coexist in the study area. The variables that significantly explained the use of land management practices ($p<0.05$) were age of household heads, levels of education, household size, value of livestock owned, off farm income, security of tenure, farm size, distance of plot to residence, distance of plot to the nearest market and distance of plot to all weathered road. Factors that explained the choice of land management practices in the study area were combinations of human, physical and financial capitals as well as parcel or plot level and institutional factors.

Keywords: Preference, Land Management Practices, Food Crop Farmers, Multinomial logit model, and North-Central Nigeria

Introduction

The population of the world is estimated at seven billion people, with an annual growth rate of 1.9% and it is projected to increase to about nine billion in the next 40 years (Spore, 2012; Sajini, 2013). To this effect, the demand for food and fuel is expected to rise tremendously while this growth rate will worsen the situation of hunger and malnutrition (Efe, 2011). It therefore implies that, meeting the demand for food will require more intensive use of many natural resources especially agricultural land, forest, water and fisheries (Sajini, 2013). Global estimates, reveal that human pressures on land are reaching unprecedented limits (FAO & ITPS, 2015) with land becoming vulnerable to various forms of depletions, such as soil erosion, soil fertility declining, and associated changes in soil physical and chemical properties. Soil erosion by water is the most severe and widespread that occupies 56% (Gelagay & Minale, 2016) or 1094 million hectares of the world's total land area (Walling & Fang, 2003). In Sub-Sahara Africa (SSA), low and declining soil fertility due to net nutrient extraction by crops have been identified to be responsible for low agricultural productivity and food insecurity (Yirga and Hassan, 2010; Nakhumwa and Hassan, 2012). One of the greatest concerns to sustaining crop productivity in Nigeria is the declining fertility of soil caused by the washing away of top-soil brought about by inappropriate land-use practices (Aromolaran, 1998).

The principal factor limiting optimum crop yields is low fertility resulting from land degradation (Tekwa *et. al.*,2010) even with the use of improved seeds. Increasing yield stability in food crops is important in Nigeria, where more than 70% of the population of the country depends largely on small subsistence farming with the productivity of their farming systems being very much limited by soil conditions (Kano Soil Health Project, 2010; Mrabet, 2011). The management of soil fertility is the first condition for sustainable crop production with this posing a great challenge to farmers in Nigeria. It is claimed that productivity of the farming systems could only be maintained or sustained through the efficient management of land (Tarawali, 1998).

Investments in sustainable land management (SLM) are an economically sensible way to address land degradation (Akhtar-Schuster *et al*., 2011; ELD Initiative, 2013). However, available estimates show that the use of SLM practices in sub-Saharan Africa, including Nigeria, is low just on about 3% of total cropland (WB, 2010). Several factors limit the use of SLM in the region, including lack of local-level capacities, knowledge gaps on specific land degradation and SLM issues, inadequate monitoring and evaluation of land degradation and its impacts, inappropriate incentive structure (inappropriate land tenure and user rights), market and infrastructural constraints (increasing input costs, inaccessible markets), and policy and institutional bottlenecks (difficult and costly enforcement of existing laws that favour SLM) (Reed *et al*., 2011; ELD Initiative, 2013).

Against the backdrop of the intensive use of the land for agricultural production, there lies the need for farmers to update their knowledge on the possible soil management practices necessary to check soil overexploitation resulting from land use, other activities of man, and natural occurrences such as climate change. Thus, as farmers are conscious of increasing agricultural production such as crop farming, a concurrent effort is required to be put in place for continuous and proportionate soil conservation measures to sustain agricultural productivity. In Nigeria, productivity of food crop farmers is affected by many factors, including land degradation. Food crop farmers have adopted different Land Management Practices (LMP) to curtail degradation and enhance productivity. However, there is limited empirical evidence on the preference for LMP among food crop farmers in North-Central Nigeria (NCN). Hence, it is not clear which of the adopted LMPs are mainly preferred by farmers and which institutional, farm and farmer characteristics influence the preference of the adopted LMP in the area (Agboola, 2016). Therefore, the study aims at filling this information/knowledge gap by isolating those factors that helps to determine the preference for the different LMP in the study area. This paper will also contribute to a better understanding of policies and strategies that would help to conserve the environment while trying to increase crop productivity.

Analytical tools widely used to assess adoption/use of conservation technologies include binary probit or logit models (Babalola and Olayemi 2014; Moges and Taye 2017**)**, using such bivariate models excludes useful economic information contained in the interdependent and simultaneous adoption decision (Birungi 2007). It is therefore important to treat use of soil conservation measures and soil nutrient enhancing technologies as multiple-choice decisions simultaneously made. In this study, and as adopted by (Miheretu and Yimer 2017) farmers' use of land management practices was modeled using the multinomial logit model (MNL) because of its computational simplicity in calculating the choice probabilities that are expressible in analytical form. This model provides a convenient closed form for underlying choice probabilities, with no need of multivariate integration, making it simple to compute choice situations characterized by many alternatives. The main limitation of the model is the independence of irrelevant alternatives (IIA) property, which states that the ratio of the probabilities of choosing any two alternatives is independent of the attributes of any other alternative in the choice set **(**Ojo *et al.*, 2013**)**.

Miheretu and Yimer (2017) investigated the determinants of farmers' adoption of land management practice in the Gelana sub-watershed, Northern highlands of Ethiopia. Data for the study were collected from 176 randomly selected farming households using a survey questionnaire and was analyzed using multinomial logit model (MNL). Results showed that education, family size, slope of the plot, security of tenure, training, access to farm credit and extension service positively and significantly influence adoption of land management practices while age has a negative and significant influence on adoption. The study recommends improved farmers' education and better access to credit will reduce poverty and increase income, which would enhance better adoption of land management practices.

Moges a and Taye (2017) examined the major determinants of farmers' perception to use and invest in Soil and Water Conservation (SWC) technologies in Ankasha District, north-western highlands of Ethiopia. Data were collected with the aid of questionnaire from 338 randomly selected farming households in two rural villages. Descriptive statistics and logistic regression model were used to analyze the data. The results indicate that educational level of the respondents and their access to trainings were found to have positive and significant association ($P<0.01$) with farmers' perception. Likewise, land ownership, plot size, slope type, and extension contact positively and significantly influenced farmers' perception at 5% level of significance. On the other hand, the influence of respondents' age and plot distance from the homestead was found to be negative and significant ($P<0.05$). Frequent contacts between farmers and extension agents and continuous agricultural trainings were recommended to increase awareness of the impacts of SWC benefits.

Methodology

The Study Area

The study was carried out in North-Central Nigeria which serves as a gateway between the northern and southern part of the Country. The selection of the study area was based on the criterion that the area is prone to nutrient mining as a result of intensive cultivation practices. The zone comprises Kwara, Kogi, Niger, Benue, Nassarawa, Plateau states and the Federal Capital Territory (FCT), representing about 13% of the land mass in the country (Manyong *et al*., 2001), and with an estimated population of 20,266,257 (NPC 2006). The zone is located between latitude 11^0 07^1 and 13^0 22^1 north and longitude 06^0 52^1 and 09^0 22^1 east of the Greenwich meridian. Two seasons can be distinguished – the rainy season from May to September/October and a long dry season from October to May. Temperature during the rainy season is between 27.0 and 34.0^{0}C (maximum) and 18.0 and 21.0^{0}C (minimum), while dry season is from 16^{0}C- 37^{0}C. Soil in the zone has sandy loam to clay loam textured topsoil with a pH of 5 to 7 and an organic carbon content ranging between 0.5 and 1.5%. The soil properties, as described by Norman *et al*., (1982) are leached ferruginous tropical soil and reddish, fine loam clay to sandy loam surface soil. The main activities of the people of the zone are farming, fishing, dyeing, weaving, carving and blacksmithery.

Method of Sampling

The study population comprised food crop farmers in the north-central geopolitical zone from whom data were collected with the aid of questionnaire. A multistage sampling technique was used in the study. The first stage was the random selection of Benue and Kogi states from the states in the zone; the second stage was the random selection of four local government areas from each of the states. The third stage was the random selection of twelve communities/ villages from each of the states, with the number of communities/villages selected from each local government proportionate to the number of communities/villages in each local government. The last stage was the proportionate selection of the farmers from the selected villages/ communities. A total of 400 copies of the questionnaire were administered with only 345 returned with useful information that was used for the analyses as shown in Table 1.

Table 1: Sampling Procedure for the Selection of Farmers

States	LGAs	Communities	Number of questionnaire administered	Number of questionnaire retrieved
Benue	Buruku	Abwa, Biliji, Mbatsaase and Mbaya	66	53
	Oju	Obotu Ororu-Ainu, Okpoma Ainu, Oyinyi Iyeche and Uchuo	66	52
	Otukpo	Otukpo icho and Okete	34	29
	Ushongo	Sati Ikov and Bilaja Ikom	34	27
Kogi	Adavi	Edavi Eba, Inoziogolo and Osara	50	48
	Bassa	Gbokolo, Oguma and Sheria	50	44
	Igalamela	Akpanya, Amaka and Ogboligbo	50	45
	Yagba East	Ilafin Ishanlu, Itedo Ishanlu and Mopo	50	47

Source: Field Survey, 2015

Sources of Data

A well-structured questionnaire was used to collect primary data from the respondents. Data were collected on the socio economic characteristics of the farmers, their levels of education, membership of associations, and participation in government programmes. Data were also collected on plot levels including security of tenure, farm sizes, cropping patterns, crop production, land management practices, distance of plot to residence, to the nearest market and seasonal roads, access to nutrient enhancing inputs, access to extension services, access to rural finance, non-farm income and the value of livestock owned.

Method of Data Analyses

Multinomial logit

In this study, farmers' use of land management practices was modeled using the MNL model following (Miheretu and Yimer, 2017). The different land management practices available to farmers in the study area were; application of organic manure, bush fallowing, crop rotation, application of inorganic fertilizer, alley cropping, cover cropping and mulching were classified as the dependent variables. Categorization under a particular land management practice does not imply that farmers were exclusively looking for a single practice; they were rather looking for integrated land management practices with a different intensity of preferences. Therefore, categorization was based on which of the practices farmers had the highest preference for. It is assumed that the dependent variables Y_{it} can take on one of j categories 1, 2, -----, k (different land management practices).

Use of soil conservation and nutrient enhancing technologies by households can be evaluated on the basis of alternative decision choices, which can easily be linked to utility. According to Greene (2000), the unordered choice model could be motivated by a random utility framework, where the i[th] household is faced with j technology choices. The utility of technology choice j is given as

$$U_{ij} = \beta'_j X_{ij} + \varepsilon_{ij} \quad (1)$$

where U_{ij} is the utility of household *i* derived from technology choice *j*, X_{ij} is a vector of factors that explain the decision made, and β'_j is a set of parameters that reflects the impact of changes in X_{ij} on U_{ij}. The disturbance term ε_{ij} are assumed to be independently and identically distributed. If farmers choose technology *j*, then U_{ij} is the maximum among all possible utilities. This means that

$$U_{ij} > U_{ik}, \ \forall ik \neq j \quad (2)$$

where U_{ik} is the utility to the i[th] farmer of technology k. Equation 2 means that when each technology is thought of as a possible preference decision, farmers will be expected to choose a technology that maximizes their utility, given available alternatives (Birungi, 2007). The choice of *j* depends on X_{ij}, which includes aspects specific to the household and plot, among other factors. Following Greene (2000), if Y_i is a random variable that indicates the choice made, then the Multinomial logit form of the multiple choices problem is given as

$$\text{Prob. } (Y_i=j) \quad \frac{e^{\beta'_j X_{ij}}}{\sum_{j=1}^{j} e^{\beta j' X_{ij}}} . j = 0,1,2 \ldots\ldots\ldots. j \quad (3)$$

Estimating equation 3 provides a set of probabilities for j+1 technology choices for a decision maker with characteristics X_{ij}. The equation can be normalized by assuming that β = 0, in which case the probabilities can be estimated as

$$\text{Prob. } (Y_i= j) = \frac{e^{\beta'_j X_{ij}}}{1+\sum_{k=1}^{j} e^{\beta'_j \ Z_{ij}}} \quad \text{and} \quad (4)$$

$$\text{Prob. } (Y_i = O) = \frac{1}{1+\sum_{j=1}^{j} e^{\beta'_j} X_{ij}} \quad (5)$$

Normalizing on any other probabilities yields the following log-odd ratios

$$\ln\left[\frac{P_{ij}}{P_{ik}}\right] = X'_i(\beta_j-\beta_k) \quad (6)$$

In this case, the dependent variables were the log of one alternative relative to the base/reference alternative. The choice of land management practices is then modeled as a function of social, human, financial and physical capitals, plot level characteristics as well as institutional factors. This can be presented as a general form equation:

$$Z_{it} = f(Xi). \quad (7)$$

where Z_{it} takes on values 1, 2… *k*, if individual, *I*, chooses alternative *j*.

The coefficients in a multinomial logit model are difficult to interpret. So the marginal effects of the explanatory variables on the choice of alternative management strategies are usually derived as in Green (2000):

$$M_j = \frac{\partial P_j}{\partial X_i} = P_j\left[\beta_j - \sum_{k=0}^{j} P_k K_k\right] = P_j\left[\beta_j - \bar{\beta}\right] \quad (8)$$

The sign of these marginal effects may not be the same as the sign of respective coefficients as they depend on the sign and magnitude of all other coefficients. The marginal probabilities measure the expected change in the probability of a particular choice being selected with respect to a unit change in an independent variable (Long, 1997; Greene, 2000). It is also important to note that in a Multinomial logit model, the marginal probabilities resulting from a unit change in an independent variable must sum up to zero, since the expected increase in marginal probabilities for certain options induce a decrease in the other options within a set.

The MNL model is however operationalized empirically with the following equations.

$$Z_{ot} = \alpha_o + \beta_{10}X_1 + \beta_{20}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (9)$$

$$Z_{1t} = \alpha_1 + \beta_{11}X_1 + \beta_{21}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (10)$$

$$Z_{2t} = \alpha_2 + \beta_{12}X_1 + \beta_{22}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (11)$$

$$Z_{3t} = \alpha_3 + \beta_{13}X_1 + \beta_{23}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (12)$$

$$Z_{4t} = \alpha_4 + \beta_{14}X_1 + \beta_{24}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (13)$$

$$Z_{5t} = \alpha_5 + \beta_{15}X_1 + \beta_{25}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (14)$$

$$Z_{6t} = \alpha_6 + \beta_{16}X_1 + \beta_{26}X_2 + \text{--} + \beta_n X_n + \varepsilon_1 \quad (15)$$

$X_i \ldots X_n$ represent the vector of the explanatory variables where n = 1---------17

$\beta_1 \ldots \beta_n$ represent the parameter or coefficients

ε_i represents the independent distributed error term and α_0, α_1, α_2…..shows the intercept or constant term.

The independent variables were selected based on Adeoti and Adewusi (2005), Awoyinka *et al.*, (2005), Kato *et al.*, (2011); Moges and Taye (2017)

Human capital

X_1 = Age (years)

X_2 = Primary education (dummy)

X_3 = Secondary education (dummy)
X_4 = Tertiary education (dummy)
X_5 = Household size (number)
X_6 = Farming experience (years)
Social Capital
X_7 = Membership of production association (1=yes, 0= no)
Physical capital
X_8 = Value of livestock owned (naira)
Financial Capital
X_9 = Access to credit (dummy)
X_{10} = Non-farm income (naira)
Parcel or Plot level factors
X_{11} = Security of Tenure (dummy)
X_{12} = Farm size cultivated (ha)
X_{13} = Perceived nutrient deterioration (dummy)
Institutional factors
X_{14} = Contact with extension agent (dummy)
X_{15} = Distance of plot to residence (Km)
X_{16} = Distance of plot to nearest market (Km)
X_{17} = Distance of plot to all weathered road (Km)

Results and Discussion

Factors Determining Preference for Land Management Practices among Food Crop Farmers in the Study Area

This section presents the multinomial logit regression results for the factors that influence the preference for land management practices among farming household heads in the study area using STATA 11 software. Table 2 shows the results of the Multinomial Logit estimate (marginal effects) in which seven different types of land management practices were used as the dependent variables (organic manure application, bush fallowing, crop rotation, inorganic fertilizer application, alley cropping, cover cropping and mulching) where inorganic fertilizer was selected as reference or base category, as it was the one with the highest frequency. Chi-square distribution was used to test overall model adequacy at specific significant levels. The Likelihood ratio also determines the goodness of fit or whether the multinomial Logit model is preferable to the binomial logit model while the McFadden's Pseudo R^2 also confirms that all the slope coefficients are not equal to zero. In other words, the explanatory variables were collectively significant in explaining the classification of the household by their land management choices. The results of the estimated equations were discussed in terms of the significance and signs of the parameters. However, evidence from the model, as contained in the table, shows that the set of significant explanatory variables varies across the groups in terms of the levels of significance and signs. Twelve of the seventeen variables were found to be significant, though at different levels and signs under different land management practices. The significant variables were age, primary, secondary and tertiary education of household heads, household size, value of livestock owned, off farm income, security of tenure, farm size, distance of plot to residence, distance of plot to market as well as distance of plot to all weathered roads. Age and primary education were found to be negatively significant at 10% in the choice of bush fallowing as a land management device. The result implies that a unit increase in the two variables decreases the probability of using bush fallowing in preference to inorganic fertilizer. This is because as farmers advance in age, the agility or strength to cope with such a labour intensive practice reduces. The negative coefficient is in line with the result of study by Moges and Taye (2017)**.** While higher educational levels are associated with greater information on conservation measures, the productivity consequences of land degradation and higher management expertise.

The secondary education of household heads showed a negative but significant relationship at 5% and 10% respectively, with use of cover cropping and mulching, indicating that an additional year of secondary education of the household heads impacted negatively on the probability of their use of cover cropping category by -.143 and mulching by -.095 in preference to inorganic fertilizer. This implies that better educated households have more access to information and are better able to adapt to new opportunities by the adoption of new technologies. The negative but significant coefficient at 1% in respect of tertiary education to the use of mulching means that a unit increase in the number of years of this variable reduces the probability of making use of mulching as a land management practice, i.e. household heads having tertiary education will prefer using inorganic fertilizer to mulching. The implication of this is that the opportunity cost of labour involving highly educated farming household heads will be higher than that involved in such a labour intensive land management practice as mulching. The negative coefficient of tertiary education is consistent with the result from work of Kato *et al.,* (2011).

Household size was found to be significant (1%) but negatively related to bush fallowing while it was positive and significant at 5% in respect of alley cropping. The negative coefficient indicates that a unit increase in the variable decreases the probability of making use of bush fallowing as against inorganic fertilizer. Specifically, an additional member to the household decreases the likelihood of using bush fallowing by .020. This is because a unit increase in household size leads to land fragmentation which will not support bush fallowing. As a result, they try to maximise short-term benefits and would be less interested in soil conservation measures with long term benefits. The negative coefficient tallies with the findings of Awoyinka *et al.*,(2005). The positive coefficient in the case of alley cropping indicates that a unit increase in household size is strongly associated with its usage. Specifically, an additional member to the household increases the likelihood of using alley cropping by .013. This implies that larger households are likely to be faced with the problem of liquidity constraint which may inform their choice of a management technique that is not capital intensive while the labour required will be supplied by the family members. The positive coefficient in respect of household size tallies with the findings of Miheretu and Yimer (2017).

Value of livestock owned was found to be positive and significant at 1% and 10% in case of organic manure and bush fallowing respectively, meaning that a unit increase in the value of livestock owned increases the likelihood of the household head making use of organic manure and bush fallowing as against the use of inorganic fertilizer. Livestock wealth may ease cash constraints, increase availability of manure and act as a major conduit of nutrient flows on the farms through nutrient re-cycling. However, more specialization in livestock rather than cropping may reduce investment in crops (Martins *et al*., 2010). The effect of the size of livestock holding on land degradation shows that size of livestock holding is an important determinant of farmers' behaviour to improve soil fertility through manuring, fallowing and more capital investment in soil and water conservation (ILRI 2003). On the other hand, value of livestock owned was found to be negative but significant at 10% and 1% respectively in the case of crop rotation and alley cropping, which implies that a unit increase in the value of livestock owned tends to decrease the likelihood of the household using alley cropping. Though, this is contrary to expectation in the case of alley cropping as ownership of livestock and alley cropping are complementary because leguminous shrubs used in alley cropping are harvested as forage crop for feeding livestock.

Off-farm income was negatively significant (10%) in relation to the use of bush fallowing, whereas it was positive and significant at 1% with respect to mulching. Implying that a unit increase in off-farm income will lead to a decrease in the probability of using bush fallowing in preference to inorganic fertilizer, while a unit increase in off farm income will increase the probability of making use of mulching as against the use of inorganic fertilizer. Though, the positive coefficient is contrary to a priori expectation as off-farm investment may make available cash required for the purchase of inorganic fertilizer or crowd out investment resources for land-quality improvement. Also increasing dependence on non-agricultural activities may translate into a shift of interest away from farming. This result agrees with that of Adeoti and Adewusi (2005).

The tenure variable was positively and significantly related with the use of mulching in the study area. A positive coefficient for the tenure variable implies that ownership of land is associated with better use of land management practices, in this case mulching. In other words, the household heads will prefer being in the comparison group to be in the reference category. The positive coefficient is in tandem with findings of Moges and Taye (2017). Distance of plot to all weathered roads was also found to be a positive and significant variable at 5%, i.e. a unit increase in the distance of plot to all weathered road increases the probability of using mulching by .030 as against the application of inorganic fertilizer because of the transportation cost of the latter. Distance of plot to market increased the likelihood of using cover crops. The positive and significant coefficient at 5% in respect of distance of plot to market was observed to be .019 indicating that the farther away the plot is from the market, the better the chance of using cover cropping as against application of inorganic fertilizer because of its associated cost of transportation as an average farmer in Nigeria spent between ₦ 350 to ₦ 450 in transporting a bag of fertilizer to their farms (Liverpool-Tasie *et al*., 2016).

Farm size was found to be negative but significant at 5% in relation to crop rotation. A unit increase in farm size leads to a reduced probability of household heads making use of crop rotation in preference to inorganic fertilizer. The argument is that farm size is often correlated with peasant wealth that may help ease liquidity constraints. Similarly, wealthier farmers are more likely to be able to apply expensive fertilizer on their farms. Besides, large scale farmers generate more income, which provides a better capital base and enhances risk-bearing ability. This is in sharp contrast to the findings of Moges and Taye (2017). Distance of plot to residence was positive and significant at 5% under crop rotation and bush fallowing, meaning that a unit increase in the distance of plot to residence increases the probability of using crop rotation and bush fallowing as against the use of inorganic fertilizer. The positive and significant relationship between distance of plot to residence shows that farmers tend to use crop rotation and bush fallowing on far off plots. This also contradicts the findings of Moges and Taye (2017). Transportation cost of inorganic fertilizer could account for the preference of crop rotation on far off farm while the fact that when farms are closer to the homesteads, there could be competition between the use of land for agricultural purpose and for residential purposes, could be a justification for the positive relationship between bush fallowing and distance from plot to residence.

Conclusion

Result of multinomial logit model reveals variables that significantly explained the preference across different land management practices at different levels of significance. Controlling the increase in the family size should be of priority to address problems of resource degradation. Policy related to family planning, education and other means of reducing family size and dependency ratios will help reduce land degradation and increase crop production and per capita income. Access to feeder roads should be considered as important prerequisites on which the outcome of other agricultural programmes can be based. Negative coefficient in respect of farm size implies that household heads with large farm size could not management their farmland sustainably; hence smaller farm size is hereby advocated for. Negative coefficient in respect of age implies that older household heads might not be able to cope with the labour intensive nature of some land management practices; hence such programme as e-wallet that makes inorganic fertilizer available to farmers should be sustained.

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Table 2: Factors affecting the choice of Land Management Practices in the Study Area (marginal effects)

Variables	Organic manure	Bush fallowing	Crop rotation	Alley cropping	Cover cropping	Mulching
Age	-.004	-.006	.001	.0001	-.0007	.001
	(-1.04)	(-1.85)*	(0.43)	(0.07)	(-0.19)	(0.38)
Priedu	.218	-.073	.034	-.039	.035	-.014
	(1.54)	(-1.73)*	(0.36)	(-1.20)	(0.49)	(-0.25)
Secedu	.196	.039	-.008	-.031	-.143	-.095
	(1.36)	(0.63)	(-0.08)	(-0.88)	(-2.52)**	(-1.81)*
Tertedu	.224	.022	.073	-.039	-.061	-.230
	(1.59)	(0.36)	(0.71)	(-1.07)	(-0.95)	(-4.16) ***
Hhsize	.009	-.020	.004	.013	-.005	-.003
	(1.19)	(-2.72)***	(0.50)	(2.27)**	(-0.63)	(-0.48)
Farmexp	.004	.003	.004	-.001	-.0007	.0007
	(1.09)	(1.12)	(1.06)	(-0.89)	(-0.19)	(0.24)
Mem. Ass.	-.045	-.087	.113	.036	-.034	-.089
	(-0.46)	(-1.12)	(1.52)	(0.98)	(-0.38)	(-1.04)
Lstock	1.14e-06	3.31e-07	-6.01e-07	-1.06e-06	-9.35e-08	-4.39e-08
	(4.70)***	(1.95)*	(-1.92)*	(-4.91)***	(-0.34)	(-0.18)
Crdtacc	.030	.009	.028	-1.06e-06	-.032	.033
	(0.54)	(0.26)	(0.46)	(-0.10)	(-0.65)	(0.70)
Offinc	4.50e-08	-1.83e-07	-1.95e-08	-2.80e-08	-4.44e-08	2.27e-07
	(0.51)	(-1.83)*	(-0.19)	(-0.49)	(-0.46)	(3.15)***
Tensec	-.011	.013	-.032	-.062	-.059	.147
	(-0.20)	(0.39)	(-0.54)	(-1.62)	(-1.17)	(3.15)***
Fmsize	-.043	-.022	-.068	-.019	-.009	-.034
	(-1.41)	(-1.02)	(-2.04)**	(-1.12)	(-0.37)	(-1.38)
Perception	-.034	-.072	.042	.020	.065	-.072
	(-0.41)	(-1.20)	(0.56)	(0.58)	(1.24)	(-1.02)
Extcon	.011	.023	-.006	.029	.048	-.039
	(0.19)	(0.55)	(-0.11)	(0.90)	(0.90)	(-0.72)
Plotdist	-.004	.017	.033	-.011	-.013	-.011
	(-0.30)	(2.06)**	(2.44)**	(-1.21)	(-1.04)	(-0.88)
Mktdist	.008	.000	-.017	-.001	.019	-.010
	(0.96)	(0.07)	(-1.63)	(-0.23)	(2.48)**	(-1.27)
Roaddist	-.018	-.007	.007	.012	-.012	.030
	(-1.23)	(-0.87)	(0.50)	(1.35)	(-0.93)	(2.36)**

Source: Computed from 2015 survey Data, *** Significant at 1%, ** at 5%, * at 10%
The value in parenthesis represents the Z value while those not enclosed in parenthesis are the marginal effects of the different variables

Log likelihood = -477.9972
Observations = 345
LR χ^2 (102) = 376.08
Prob > χ^2 = 0.0000
R^2 = 0.2823