GENDER GAPS AND ADOPTION OF CLIMATE SMART PRACTICES AMONG CEREAL FARM HOUSEHOLDS IN NIGERIA

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ABSTRACT
Women are more active as economic agents in Africa than anywhere else in the world and perform the majority of agricultural activities in some countries. However, they are plagued with persistent obstacles and economic constraints limiting adoption of new technologies in addition to societal norms/beliefs affecting access to resources and decision making process in agricultural production and climate change. This results in male and female farmers having different vulnerabilities and coping strategies to the impact of climate change in developing countries. Gender gap therefore, is a measure of inequality to socio-cultural determinants in all sphere of life. This paper documented the effect of gender gaps on adoption of climate smart practices in Nigeria. Primary data were collected through a well structured questionnaire using a multistage random technique from a cross section of 1,747 rice and maize farmers interviewed across 141 farming communities spread across 16 States and six agro ecological zones in Nigeria. Data were analyzed using descriptive statistics and multivariate Probit regression. The descriptive results revealed that women farmers had less access to land than male farmers with differences in years of formal education, access to credit and household size between male-and female-headed households. The coefficient estimates from multivariate Probit model indicated that female plot managers have a higher probability of adopting green manure and agro-forestry, while male plot managers were more likely to adopt crop rotation and retain residue relative to their female counterparts. The results of this analysis show that the adoptions of CSPs are strongly influenced by gender of the plot manager as well as plot characteristics and household factors, suggesting that provision of credit facilities would significantly increase adoption of crop rotation and zero tillage. Also, efforts to promote green manure and agro-forestry should target female farmers who would warmly welcome the complimentary role these practices played in a plot where they are adopted.
KEYWORDS: Gender gaps, climate smart, farm households, multivariate Probit, Nigeria.

INTRODUCTION
Climate-smart agriculture has the potential to provide a range of benefits for women if they are able to take advantage of them. Studies have shown that when women have access to information, training and services, they are likely to adopt new practices as their male counterparts (World Bank, FAO, IFAD, 2015). However, ensuring that the potential benefits of Climate Smart Practices (CSPs) also extend to women farmers involves recognizing gender differences in priorities and capacities for agriculture. As a result of the gender division of labour and household responsibilities, women and men usually have different preferences for crops and other agricultural activities (FAO, 2015). Men tend to prefer crops with increase market value such as yield, appearance, and market demand, while women prefer varieties that are more nutritious, better tasting, and easier to cook (Nyasimi and Huyer, 2017).

Different societal norms and beliefs interact with access to resources and decision-making to influence how men and women respond to the impacts of climate change. As a result, women and men farmers in developing countries have different vulnerabilities and capacities to deal with the impact of climate change on agriculture (Huyer *et al*, 2015; Kristjanson *et al*, 2016). Evidence suggests that farmers are adopting CSPs that show small incremental changes rather than large transformative ones (World Bank, FAO and IFAD, 2015). This is because farmers, especially women farmers, lack access to and use of productive resources and information. The introduction of CSPs will therefore need to respond to both the effects of climate change and gender inequalities to ensure that the "needs, priorities, and realities of men and women are recognized and adequately addressed so that both men and women can equally benefit" (World Bank, FAO and IFAD, 2015).

A gender-responsive climate smart agriculture approach takes into account the socially differentiated roles, responsibilities, priorities and resources of producers at the community and household levels. Overcoming gender-based constraints in order to adapt to CSPs requires paying greater attention to the ways in which men and women in the same households interact in agricultural production, which will go beyond simplistic designation of the primary decision-maker (Johnson *et al.*, 2016). Closing the gender asset gap is allowing women to own and control productive assets, increases both their productivity and self-esteem. A woman who is empowered to make decisions regarding what to plant and inputs to apply on her plot will be more productive (FAO, 2011).

This study addressed the knowledge gap in farm households by assessing the effect of gender gaps on adoption of CSPs in Nigeria. Specifically, the adoption of selected climate smart practices which was disaggregated by gender was analysed using descriptive statistics; the Multivariate Probit method to assess the influence of gender gaps on the adoption of selected CSPs using some selected socioeconomic variables as determinants. This article will contribute to the literature by providing empirical evidence on the relationship of gender gaps and adoption of CSPs among cereal farmers in Nigeria.

RESEARCH METHODOLOGY

Description of the Study Area

The study was conducted in some selected farming communities reputed for maize and rice production across the six geopolitical zones covering five of the seven Agro-ecological zones (AEZs) of Nigeria. Nigeria is situated in the West African region and lies between longitudes $3^{\circ}$and 14° and latitudes 4° and14° with a land mass of 923,768 sq.km. Nigeria shares land border with the Republic of Benin in the west, Chad and Cameroon in the east, and Niger in the north. Its coast lies on the Gulf of Guinea in the south and it borders the Lake Chad to the northeast.

Data Collection and Sampling Procedure

The respondents were drawn in a multi-stage sampling process. The first stage was a purposive selection of two States/AEZ, which are those reputed as the leading producers of rice and/or maize in Nigeria, the second stage was by purposive selection of three (3) Agricultural Blocks per crop and two (2) Extension Cells per block - that is, 12 Cells across six Blocks. The final stage was by random selection of five – 15 members of the Rice/Maize farmers' groups in each of the selected cells. This process yielded a total of 1,747 rice and maize farmers interviewed across 141 farming communities that were spread across 16 States and six (6) of the seven AEZs in Nigeria. Data were collected on the farmers' personal, household, farm and community characteristics, production and plot characteristics, resource use, output/yields and prices for the 2016/17 farming season in addition to A-WEAI and their livelihood assets.

Analytical Technique

This study used descriptive statistics like means, frequency tables and percentages in summarising the results while multivariate Probit was used to analyse the effect of women empowerment on adoption of CSPs in the study area.

Gender gap

Aggregate gender gap index (AGGI) was obtained as AGGI= 1- Empowerment score.

Household were grouped into 3 based on AGGI following the standard normal distribution curve. The normal distribution is useful because of the central limit theorem which establishes that, if a sample is obtained from a large number of observations which is randomly generated, the arithmetic average that is computed will be distributed according to a normal distribution.

a. $< \overline{AGGI} - \sigma_{AGGI}$ (Severe)
b. $\overline{AGGI} - \sigma_{AGGI} \leq \overline{AGGI} \leq \overline{AGGI} + \sigma_{AGGI}$(Moderate)
c. $> \overline{AGGI} + \sigma_{AGGI}$ (Low)

The **empowerment score**, which measures achievement of empowerment, was based on 6 weighted indicators of the AWEAI documented in Alkire *et al.* (2013). It was computed by assigning a value of one if an individual achieved adequacy according to cut-offs defined by Alkire *et al.* (2013) or zero otherwise. An empowerment score was then generated for her (or him), in which the weights of those indicators in which she (or he) enjoys adequacy are summed to create a score that lies between 0% and 100% (Seymour, 2017). According to Alkire *et al.*, (2013), an individual is empowered in 5DE if she or he has adequate achievements in four of the five domains or is empowered in some combination of the weighted indicators that reflect 80% total adequacy or more.

Modelling the Adoption Decision

This study assumes that each plot manager (i.e. individual family members) compares the CSPs with the traditional technology and adopts it if he/she perceives that the expected utility from adoption exceeds the utility of the traditional technology (Awotide *et al.*, 2016). Furthermore, it was assumed that farmers make multiple adoption decisions at the same time, and attempting to model adoption of single technologies separately using a Probit or Logit model ignores the potential correlation among the unobserved disturbances in the adoption equations, thus leading to inefficient estimates and thereby wrong inference (Theriault *et al.*, 2017). Also univariate modelling (the estimates of separate Probit or Logit equations) excludes useful economic information contained in interdependence and simultaneous adoption decisions (Dorfamn ,1996). Hence, the Multivariate Probit estimator corrects for this problems by allowing for non-zero covariance in adoption across technologies (Marenya and Barrett, 2007). Thus, this study utilized the multivariate Probit model and a set of explanatory variables on each of the different CSPs by estimating a set of binary Probit models simultaneously, while allowing the error terms in those models to be correlated (Greene, 2008). The MVP model for multivariate choice decision problems can be represented by two systems of equations. First, a system of equations with latent (unobservable) dependent variables are described by a linear function of a set of observed household (*h*) and plot (*p*) characteristics (Xhp) and multivariate normally distributed stochastic terms (εhp). The second equation described the observable dichotomous choice variables. The basic model is specified as:

$$Y^*_{npk} = X_{hp}\beta_k + \varepsilon_{hp} \,.......(1)$$

$$Y_{npk} = \int_0^1 {}_{otherwise}^{if\ Y^*_{npk}>0} \,......(2).$$

Where Y^*_{npk}; denotes the latent dependent variables which can be represented by the level of expected benefit and/or utility derived from adoption of green manuring (G), agroforestry (A), organic manure (O), crop rotation (C), zero/minimum tillage (Z) , retain residue(R)

ε = Error term h = Household characteristics p = Plot characteristics

Table 1: Definition of independent variables

Variable	Description
Household characteristics	
Age	Age of the plot manager in years
Gender	If plot manager is female = 1, otherwise = 0
Marital Status	If the plot manager is married = 0; Otherwise = 1
Years of Schooling	Years of formal education of the plot manager
Dependency Ratio	Ratio of non-working members to working members of the plot manager's household
Gender gap	Weighted sum of plot manager's achievement of empowerment across 6 indicators comprising the A-WEAI subtracted from 1
Use of credit	If the plot manager uses credit = 1; Otherwise = 0
Native	If plot manager is a native of the community = 1; Otherwise = 0
Plot characteristics	
Land Ownership Status	If plot manager owns the plot = 1; Otherwise = 0
Farm Size (Ha)	Size of the plot being cultivated by plot manager in hectares
Land type	If plot is upland = 0; Otherwise = 1
Extension Contact	Number of visits by an agricultural extension agent to the plot manager or by the plot manager to an extension service office during last 1 year
Plot Trekking distance	Number of minutes used in trekking to the plot from home

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

The descriptive analysis of the socioeconomic characteristics of households' members was shown in Table 2. A typical cereal crop farmer in Nigeria is about 45 years old with mean years of schooling of 8 years. The mean household size and land holdings were 8people and 3.4Ha respectively. The average age (45 years) of members of the sampled households in the study area indicates that a higher proportion of the members sampled were in their active and productive years with an average of 7 years of formal education.

The gender gap result which was obtained from one of the metrics of the AWEAI presented in Table 3 and was disaggregated by agro ecological zones and gender. It shows that majority (85%) of male headed households have low gender gap index compared to female (14.3%) in the study area. Also households in the rain forest have a low gender gap index (44.6%) compared to the other agro ecological zones. The implication of this is that male farmers generally have access to productive resources than female in the study areas because the closer the gender gaps index to 1 the lesser the severity of the gender gap. This is consistent with literature (Quisumbing and Pandolfelli, 2010), who reported that men are generally advantaged in owning assets due to gender norms compared to women.

The distribution of adoption of climate smart practices which was disaggregated by gender and agro ecological zones (Table 4) revealed that female farmers adopted agro forestry more in the derived savannah (78%), northern guinea savannah (79%) and rain forest (64%) compared to their male counterparts. Male farmers generally adopted use of organic compost, crop rotation (28%) in derived savannah, zero or minimum tillage (52%) in northern guinea savannah and retain residue (53%) in southern guinea savannah compared to female farmers.

Table 2: Socioeconomic Characteristics of Respondents

	Male		Female		Total	
Characteristics	**Freq**	**Percent**	**Freq**	**Percent**	**Freq**	**Percent**
Age(years)						
≤30	182	13.3	29	21.3	211	14.1
31-40	370	27.1	29	21.3	399	26.6
41-50	419	30.7	42	30.9	461	30.7
51-60	276	20.2	22	16.2	298	19.9
>60	117	8.6	14	10.3	131	8.7
Mean	45.1		43.9		45.07	
Marital status						
Married	1311	96.1	91	66.9	1402	93.5
Single	53	3.9	7	5.1	60	4
Widow	0	0	38	27.9	38	2.5
Educational Status						
No formal education	354	26	45	33.1	399	26.6
Arabic	97	7.1	6	4.4	103	6.9
Primary education	252	18.5	44	32.4	296	19.7
Secondary education	334	24.5	26	19.1	360	24
Tertiary Education	327	24	15	11	342	22.8
Mean years of formal education	7.8		5.9		7.6	
Native						
No	162	11.9	23	16.9	185	12.3
Yes	1202	88.1	113	83.1	1315	87.7
Land size(Ha)						
<2	755	55.4	98	72.1	853	56.9
2-5	363	26.6	22	16.2	385	25.7
>5	246	18	16	11.8	262	17.5
Mean land size	3.4		2.7		3.3	
Access to Credit						
No	503	36.9	51	37.5	554	36.9
Yes	861	63.1	85	62.5	946	63.1
Household size						
1-5	531	38.9	65	47.8	596	39.7
6-10	559	41	44	32.4	603	40.2
11-15	175	12.8	19	14	194	12.9
>15	99	7.3	8	5.9	107	7.1
Mean	8		7		8	

Source: Computed from Field survey; 2017

Table 3: Gender Gaps Disaggregated by Agro ecological zone and Gender

	Aggregate gender gap							
	Severe		Moderate		Low		Total	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
AEZ								
Derived Savannah	14	3.6	33	4.6	38	9.7	85	5.7
Northern Guinea	29	7.4	76	10.6	37	9.4	142	9.5
Rain forest	139	35.5	229	32.0	175	44.6	543	36.2
Sahel Savannah	47	12.0	69	9.6	12	3.1	128	8.5
Southern Guinea	107	27.3	135	18.9	75	19.1	317	21.1
Sudan savannah	56	14.3	174	24.3	55	14.0	285	19.0
Mean (SD)	0.63(0.33)							
Gender								
Male	326	83.2	702	98.0	336	85.7	1364	90.9
Female	66	16.8	14	2.0	56	14.3	136	9.1

Source: Computed from Field survey; 2017

Table 4: Distribution of Household Head by Adoption of Climate Smart Practices by Gender and Agro ecological zone

AEZ		Green manure	Agro-forestry	Organic Compost	Zero or minimum tillage	Retain residue	Crop rotation
Derived Savannah	Male	0.16(0.37)	0.57(0.50)	0.41(0.49)	0.43(0.499)	0.43(0.499)	0.28(0.45)
	Female	0.22(0.44)	0.78(0.44)	0.44(0.53)	0.56(0.527)	0.55(0.527)	0(0)
	Total	0.16(0.37)	0.59(0.50)	0.41(0.50)	0.44(0.500)	0.44(0.500)	0.25(0.43)
Northern Guinea	Male	0.11(0.31)	0.71(0.46)	0.43(0.50)	0.52(0.501)	0.52(0.501)	0.20(0.40)
	Female	0.21(0.43)	0.79(0.43)	0.43(0.51)	0.28(0.489)	0.28(0.489)	0.36(0.50)
	Total	0.12(0.33)	0.72(0.45)	0.43(0.50)	0.50(0.502)	0.50(0.502)	0.22(0.41)
Rain forest	Male	0.20(0.40)	0.61(0.49)	0.35(0.48)	0.43(0.496)	0.430(0.496)	0.23(0.42)
	Female	0.16(0.37)	0.64(0.48)	0.43(0.50)	0.32(0.473)	0.32(0.473)	0.16(0.37)
	Total	0.19(0.40)	0.62(0.49)	0.36(0.48)	0.41(0.493)	0.41(0.493)	0.22(0.41)
Sahel Savannah	Male	0.09(0.28)	0.53(0.50)	0.28(0.45)	0.29(0.457)	0.29(0.457)	0.23(0.42)
	Female	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.71)
	Total	0.09(0.28)	0.52(0.50)	0.27(0.45)	0.28(0.455)	0.28(0.455)	0.23(0.43)
Southern Guinea	Male	0.15(0.36)	0.70(0.46)	0.38(0.49)	0.53(0.499)	0.53(0.499)	0.24(0.43)
	Female	0.13(0.34)	0.65(0.49)	0.39(0.50)	0.47(0.511)	0.47(0.511)	0.13(0.34)
	Total	0.15(0.36)	0.70(0.46)	0.38(0.49)	0.53(0.500)	0.53(0.500)	0.24(0.43)
Sudan savannah	Male	0.18(0.38)	0.52(0.50)	0.45(0.50)	0.54(0.499)	0.54(0.499)	0.18(0.38)
	Female	0.42(0.51)	0.50(0.52)	0.67(0.49)	0.33(0.492)	0.33(0.492)	0(0)
	Total	0.19(0.39)	0.52(0.50)	0.46(0.50)	0.53(0.50)	0.57(0.50)	0.17(0.38)
Total	Male	0.16(0.37)	0.61(0.49)	0.38(0.49)	0.47(0.499)	0.47(0.499)	0.22(0.42)
	Female	0.18(0.39)	0.65(0.48)	0.44(0.50)	0.36(0.48)	0.36(0.48)	0.15(0.36)
	Total	0.17(0.37)	0.62(0.49)	0.39(0.49)	0.46(0.499)	0.46(0.499)	0.22(0.41)

Source: Computed from Field survey; 2017

Estimates of the Multivariate Probit Model

The MVP regression results are presented in Table 5 and 6. Some of the Climate smart practices under consideration have positive correlations meaning that the CSPs under study complement each other in a plot where they are adopted and the negative correlations meant that the practices are substitutes. The results indicated that female plot managers have a higher probability of adopting green manure ($P<0.05$) and agro-forestry ($P< 0.01$), while male plot managers were more likely to adopt retain residue ($p<0.10$) and crop rotation ($P<0.01$) relative to their female counterparts. This may be because male plot managers have access to more land, can afford to rotate crops among their multiple plots and also involved themselves in rigorous activities that revolve round residue management while their female counterparts utilized the limited plot available for them, and still produce staple food items for family consumption. Evidence from literature has also revealed that women are often allocated marginal lands (Amigun *et al.,* 2011), which are closer to the homestead, which may account for women's higher likelihood of adopting soil restoring practices such as application of green manure in a bid to replenish the fertility of the plot available for their use. Furthermore, with the exception of use of organic compost ($P<0.05$), the gender gap classification of the plot managers did not significantly influence the adoption of other CSPs in this study. Table 5 showed that the likelihood of adopting the use of organic compost increased with plot managers in the moderate gender gap index compared to those in the low gender gap level. Also, plot managers that use credit are more likely to adopt crop rotation ($P<0.05$) and zero tillage ($P<0.01$) while the likelihood of adoption of agro forestry ($P<0.10$) increases with the number of visit of the extension agents.

Plot characteristics are highly significant variable in determining the choice of agricultural technologies. As the plot size increases farmers are less likely to adopt zero or minimum tillage ($P<0.10$). Plot managers that owned land have the likelihood of adopting zero or minimum tillage ($P<0.01$) and agro-forestry ($P<0.01$), while use of organic compost ($P< 0.05$) is more likely to be adopted by managers that does not own the land. Also the likelihood to adopt practices such as retain residue ($P<0.01$), use of organic compost ($P<0.10$) and crop rotation ($P< 0.10$) was mostly among the plot managers that used upland type for rice or maize cultivation in the study areas.

Table 5: Multivariate Probit Model Results

	Coef.	Std. Err.	P-value
rho21	-0.1967	0.05575	-3.53
rho31	0.13903	0.05723	2.43
rho41	0.00692	0.06219	0.11
rho51	-0.0351	0.0568	-0.62
rho61	-0.0459	0.05638	-0.81
rho32	-0.129	0.04869	-2.65
rho42	-0.0595	0.05188	-1.15
rho52	0.09621	0.04693	2.05
rho62	0.30055	0.04571	6.57
rho43	0.07721	0.05544	1.39
rho53	0.04358	0.04953	0.88
rho63	-0.0572	0.04919	-1.16
rho54	-0.199	0.04998	-3.98
rho64	-0.0716	0.05366	-1.33
rho65	0.08507	0.04855	1.75
Prob>chi2	0		
chi2(15)	90.52		

Likelihood ratio test of rho21 = rho31 = rho41 = rho51 = rho61 = rho32 = rho42 = rho52 = rho62 = rho43 = rho53 = rho63 = rho54 = rho64 = rho65= 0.
Source: Computed from Field survey; 2017

Table 6: Multivariate Probit Model Results – Individual Plots

	Green manure		Retain residue		Organic compost		Crop rotation		Zero/min tillage		Agro forestry	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z
Age	0.0035	0.88	-0.0018	-0.53	0.0037	1.05	-0.00305	-0.84	0.0016	0.49	-0.0024	-0.73
Sex	0.387**	2.37	-0.261*	-1.89	0.2007	1.42	-0.526***	-2.94	0.0996	0.71	0.531***	3.65
Marital status	-0.7118	-2.31	0.0620	0.36	-0.0057	-0.03	-0.1848	-0.84	-0.222	-1.24	-0.053	-0.3
Years of formal education	0.020**	2.33	-0.0056	-0.77	-0.0099	-1.34	-0.0121	-1.51	0.0081	1.09	0.0028	0.38
Dependency ratio	0.010	0.36	-0.0296	-1.3	0.0267	1.18	-0.0011	-0.04	-0.0276	-1.11	-0.03**	-1.71
Use of credit	0.0740	0.7	0.051	0.6	0.091	1.04	0.209**	2.21	0.149**	1.72	-0.0322	-0.38
Severe dummy	0.0925	0.68	-0.0589	-0.53	0.114589	0.99	-0.024	-0.2	0.119	1.05	0.0806	0.71
Moderate dummy	0.0184	0.15	-0.13445	-1.36	0.205**	2.04	-0.027	-0.25	0.1203	1.21	-0.0392	-0.4
Native	-0.129	-0.92	0.201*	1.73	-0.248**	-2.11	0.298**	2.15	0.011	0.1	0.353***	2.88
Landownership	0.0411	0.38	0.0318	0.37	-0.178**	-2.03	-0.0631	-0.66	0.507***	5.63	0.506***	5.76
Farmsize(ha)	-0.009	-0.94	-0.0048	-0.71	0.0028	0.45	0.0035	0.52	-0.011*	-1.81	-0.00018	-0.03
Land type	0.120	1.2	-0.529***	-6.38	-0.166*	-1.96	0.1674*	1.84	0.1246	1.5	-0.096	-1.16
Extension contact	0.0003	0.29	0.0005	0.55	0.0007	0.79	0.00011	0.11	-0.0008	-0.86	0.0014*	1.68
Trekking distance(min)	-0.0004	-0.51	0.0001	0.18	-0.00037	-0.54	0.0006	0.81	0.00025	0.37	0.0006	0.97
Derived savannah	0.628*	1.78	0.331	1.51	0.0034	0.02	-0.133	-0.58	-0.094	-0.44	0.401*	1.89
Northern guinea	0.5349	1.51	0.590***	2.73	0.1704	0.8	0.0504	0.22	-0.0307	-0.15	0.141	0.67
Rainforest	0.828**	2.56	0.443**	2.3	0.0093	0.05	0.1480	0.74	-0.035	-0.19	0.303	1.62
Southern guinea	0.4267	1.28	0.664***	3.36	-0.0163	-0.08	0.114	0.56	0.0419	0.22	0.569**	2.96
Sudan savannah	0.932***	2.85	0.536**	2.72	0.285	1.5	-0.140***	-0.68	-0.159	-0.83	0.142	0.75
Constant	-2.252***	-5.27	0.220	0.7	-0.232	-0.74	-1.138***	-3.38	-0.963***	-3.19	-0.622**	-2.04
Wald chi2(114)	378.60											
Prob> chi(2)	0.00											
Pseudolikelihood	-3559.36											

***, **, and * denote significance at 1%, 5% and 10%

CONCLUSION AND RECOMMENDATIONS

This paper explores gender gaps and adoption of climate smart practices among cereal farm households in Nigeria. A total sample of 1747 cereal farm households was selected and 1500 plots were used for the gender gap and adoption of climate smart practices analysis. The descriptive results revealed that women farmers had less access to land than male farmers with differences in years of formal education, access to credit and household size between male-and female-headed households. The econometric results suggested that some of the climate smart practices under consideration have positive correlations meaning that the agricultural technologies under study complement each other in a plot where they are adopted while the ones that are negatively correlated are substitutes. The analysis further shows that gender differentials in some climate practices adoption do exist. Women plot managers are more likely to adopt green manure and agro-forestry but are less likely to adopt retain residue and crop rotation relative to male managed plots. However, there were no gender differences for adoption of organic compost and zero or minimum tillage in the study areas.

We find out that the adoptions of CSPs are strongly influenced by gender of the plot manager as well as plot characteristics and household factors, suggesting that equitable distribution of assets between male and female farmers will enhance the adoption of these CSPs. Also, efforts to promote green manure and agro-forestry should target female farmers who would warmly welcome the complimentary role these practices played in a plot where they are adopted. Furthermore, provision and availability of credit facilities to farmers would significantly increase adoption of crop rotation and zero tillage. Also, farmers who had access to extension officers have strong preference for the adoption of agro forestry indicating a need for further sensitisation of the benefits of CSPs among farmers.

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