WILLINGNESS TO ACCEPT INCENTIVES FOR A SHIFT TO CLIMATE-SMART AGRICULTURE AMONG LOWLAND RICE FARMERS IN NIGERIA

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Abstract
Climate change threatens agriculture and food systems in sub-Saharan Africa (SSA). Hence, shifting to agricultural practices that are climate-friendly is crucial in building resilience and reducing greenhouse gas (GHG) emissions in the pursuit of Sustainable Development Goal two (2) in SSA. This study aims to assess the preferences for shifting to agricultural practices with CSA potentials (AP-CSAPs) and to estimate the trade-off with respect to price and other attributes among lowland rice farmers in Nigeria. We used choice experiment data collected from 462 farmers in five geopolitical zones in Nigeria. Our result revealed that farmers significantly ($p<0.01$) showed strong preference for rice varieties that have early and medium maturing as against that of late maturing varieties. Similarly, preference was given to farmers that practiced intermittently flooding and rain-fed relative to continuously flooding the rice farm. Likewise, exporting straw from the farm to feed livestock was significantly ($p<0.01$) preferred to incorporating the straw into the soil for more than 30 days before cultivation as against straw incorporation less than 30 days. The study concludes that lowland rice farmers are willing to accept incentives to shift to AP-CSAPs provided the policy actions that will facilitate the implementation of all the hypothetical attributes and incentives are put in place by the government and relevant stakeholders.

Keywords: Willingness to accept incentives; Climate-smart agriculture; Lowland rice; Nigeria

Introduction

Agriculture is at a crossroad given the global challenge which changing climate poses to sustainable food production in the face of rising human population, especially in sub-Saharan Africa (SSA). The direct effect of these challenges is on human lives and the future of the world (IPCC, 2014). The impact of climate change which manifests in the form of rising ambient temperature, rising sea levels, change in rainfall patterns, and emergence of new pests and diseases, among others, is felt all over the world and pose new risks to agriculture and food systems (Vermeulen *et al*., 2013; Brida *et al*., 2013). Growing evidence (Gornall *et al*., 2010; Wang *et al*., 2018) suggests that climate change will lead to a decrease in the efficiency and resilience of global agricultural production. This will occur alongside the increasing demand for food from a growing population.

Driving climate change are anthropogenic activities emitting greenhouse gases (GHGs) like carbon dioxide, methane, nitrous oxide and fluorinated gases which absorb heat in the atmosphere. As noted by Grewer *et al*., (2017) as well as the Food and Agriculture Organization of the United Nations (FAO, 2018), agricultural sector is the largest producer of anthropogenic GHG emissions, especially methane (CH_4) from enteric fermentation of ruminant animals, manure decomposition, lowland rice fields and wetlands, and nitrous oxide (N_2O) from production of fertilizer, fertilised soils, and fish farming systems. Agriculture is therefore, not just a victim of climate change; it is a leading driver of GHG emissions leading to climate change. There is, therefore, needs for a significant improvement in smallholder agricultural system to withstand the emerging challenges of climate change (Ravallion & Chen, 2007).

Farmers can significantly reduce the impacts of climate change globally by shifting to agricultural practices that reduce GHG emissions or store carbon, that is, carbon-sequestration. These production systems, which are also known to help farming systems to build resilience to climate change while also enhancing productivity and income, is what is tagged – Climate-Smart Agriculture (CSA) (Nyasimi *et al.,* 2014). According to FAO (2013), CSA is neither a new agricultural system nor a set of practices. Rather, it is a new approach to address simultaneously and holistically, the multiple challenges facing agriculture and food systems, and which helps to avoid unproductive policies. CSA is premised on three core principles, which are to sustainably increase agricultural productivity and income, adapt and build resilience to climate change, as well as reduce and/or remove greenhouse gas emissions where possible. Climate-smart agricultural practices include inter-cropping, crop rotation, zero tillage, green manuring, application of farmyard manure, integrated soil fertility management, and agroforestry as well as alternate wet and dry lowland rice production systems among others (Bernier *et al*., 2015).

For SSA and most developing countries, the need for a shift to CSA cannot be overemphasised. Close to 80% of food produced in developing countries are coming from the smallholder agriculture, which is known to be the most vulnerable to climate change (Grainger-Jones, 2011), and at the same time, characterised with huge GHG emissions due to over-reliance on unsustainable farm practices such as bush burning, excessive use of fertilizer, mono-cropping among others.

The case of lowland rice production systems is particularly deserving of attention, as these are known to be significant anthropogenic sources of CH_4 and N_2O (Smith *et al.,* 2008), which have been a long-known problem in many developing countries and the world at large (Zschornack, *et al*., 2011; Boateng *et al*., 2017). This research addresses this problem by promoting Alternate Wetting and Drying (AWD) technology during flowering and grain filling rather than continuous flooding as well as application of organic manure. As reported by Neate (2013), AWD has the capacity to reduce the emission of methane from rice paddies by up to 50% while at the same time reducing the water quantity farmers must apply to their fields by up to 40%, thus, making the AWD GHGs reducing as well as water-saving technology. Available evidence in the literature shows that the adoption of CSA practices is generally low in SSA (Liniger *et al*., 2011; FAO, 2013; Byamugisha, 2013). This can possibly be due to the fact that implementing agricultural practices with CSA potentials (AP-CSAPs) often involves upfront investments that take time to bring about gains in productivity. Worthy of note, also, is the fact that present markets do not accurately account for the value of the environmental benefits that CSA delivers. To overcome this challenge, various incentives such as transition funds, payment for ecological services (PES), carbon pricing in form of the carbon dioxide tax, among others have been proposed (Wollenberg *et al*., 2012; FAO, 2013) to encourage more farmers to adopt CSA practices. Yet very little is known on how smallholder farmers in SSA, particularly Nigeria, may respond to such incentives.

Arising from the foregoing, this study has two key goals: first, is to assess the preferences for AP-CSAPs among smallholder, lowland rice farmers in Nigeria. Second, is to estimate trade-off, both with respect to price and other attributes of a hypothetical PES scheme, among lowland rice farmers in Nigeria. This paper presents results of a choice experiment based study that assessed farmers' Willingness to Accept (WTA) incentives to enrol in a hypothetical, publicly funded, 30years, PES scheme by which farmers would be rewarded for carbon that they may be able to sequester for embracing CSA practices. PES is generally implemented to correct market failures in recognition of the value of ecosystem services, and thus provide incentives to ecosystem services providers (Shittu *et al*., 2018; Nyongesa *et al*., 2016; Zander *et al*., 2013; Pagiola *et al*., 2007).

We conceptualised the hypothetical PES scheme as one funded from the federation account[1] through annual budgetary provisions as well as with the funding support of international development and donor agencies. Possible local sources of funds for the scheme include the imposition of emission taxes/levies on GHGs emitting companies, transport services providers, and large-scale farms, among others (Shittu *et al*., 2018). The potentials and sustainability of these revenue sources shall be subject to further research.

This paper uses a choice experiment to assess the preferences for shifting to climate-smart practices (CSPs) among lowland rice farmers in Nigeria using an un-labelled choice experiment with 462 farming households. The choice experiment is a type of stated preference method in which the total economic value (use and non-use value as well as option value) can be measured (Kjaer, 2005). It is designed to value both hypothetical goods and interventions, hence the appropriate methodology for this study.

Emerging evidence in the literature suggests that choice experiments have been used to: examine how the land tenure and property rights influence farmers' willingness to accept incentives to embrace climate-smart agriculture in Nigeria (Shittu *et al.*, 2018); explore the willingness of pastoralists and graziers to sign up to voluntary biodiversity conservation contracts in Australia (Greiner, 2016); explore farmers' prospective responses to the "greening" of the common agricultural policy in Germany (Latacz-Lohmann *et al*., 2014); examine farmers' preferences for drought tolerance traits in rural Bihar, India (Ward *et al.*, 2013). Many studies have also used contingent valuation method (CVM) to determine the willingness to pay for environmental and non-environmental goods (Cawley, 2008 and Rodriguez *et al*., 2008). However, based on the aforementioned advantage of choice experiment over CVM and since to the best of our understanding no study has been carried out on willingness to accept incentive with respect to lowland rice farmers. This study, therefore, seeks to fill this gap.

In the next section, we outline the theoretical and econometric framework underpinning choice modelling as well as random parameter logit. In section three we describe the methods in which we have the study area, discrete choice experiment design, and method of data analysis. In section four we describe and discuss our results. We conclude with the implications of our findings in a final section.

Discrete Choice Modelling Experimental Design:
Analysis of discrete choice experiment (DCE) data entails the design of an experiment to examine the influence of various attributes of the alternatives on the preferred choice (or dependent variable). According to Louviere *et al*., (2000) and Hensher *et al*., (2005), the choice experiment design process begins with identifying the problem and defining the objectives the experiment is set to achieve. Having a clear understanding of the problem can be achieved by providing answers to the following questions:

a. What are the possible alternatives i.e., other options the respondents could have considered instead in making their choice?

b. What are the characteristics of those existing alternatives?

c. What are the likely factors that may influence the demand for such alternatives? and

d. Who are the target population?

[1] The federation account serves as the central pocket through which Nigeria governments – Federal, State, and Local Government – fund developmental projects as well as maintain their respective work force.

Following Louviere *et al.,* (2000) and Hensher *et al*., (2005), we developed our choice experiments without naming the alternatives, hence, the alternatives have no utility beyond the characteristics attributed to them in the experiment. We asked the respondents to consider two alternatives that vary in terms of the levels at which the attributes are presented with a status quo option to be exhaustive. The alternatives have generic names (options A, B and C). Evidence from literature (Bennett & Blamey, 2001; Bateman *et al*., 2002) suggests that there is no standard method for selecting attributes, but the attributes should be pertinent to policy makers and meaningful to the respondents. In choosing attributes and deciding on the list of attributes for our study we rely on literature reviews, direct questioning, interviews with key stakeholders such as crop specialist, extension agents, among others. The carbon price was included as part of the attribute to allow for the estimation of willingness to accept/pay.

As noted by Kjaer, (2005), there are no hard-and-fast rules to the number of attributes to be included in DCE, we ensured the inclusion of a smaller number of attributes as the required sample size increased rapidly with the number of attributes while at the same time striking a balance not to exclude relevant attribute(s) as this may result in biased estimates and incorrect welfare measures.

In view of the above discrete choice design, we conducted DCEs along with the interviews which were aimed at assessing the farmers' land use preference, trade-offs and Willingness to Accept (WTA) incentives to shift from current farming system to one of a set of context-specific AP-CSAPs. These AP-CSAPs are those that have the potentials to sequester carbon, in addition to the relevance of restoring/conserving soil health, helping farmers to build resilience to climate change and raising productivity. The AP-CSAPs options presented include varieties that are short gestation or early maturing (< 90 - 100 days), medium maturing (100 - 120 days) and late maturing (> 120 days) as well as adoption of water management such as intermittently flooding, rain-fed, and straw management which includes straw burnt, straw incorporated more than 30 days and straw exported to feed livestock or to produce compost.

We estimated the carbon sequestration potentials of a shift to a CSA option as against maintaining a prior state of not using any climate-smart agriculture with CSA potentials, under various climate and soil conditions in Nigeria, using FAO Ex-Ante Carbon Balance Tool (Ex- Act). We set the implementation phase at 10 years and the capitalisation phase (the period between termination of the active project intervention and further changes that may occur due to the prior intervention, e.g., in soil carbon content or in biomass) at 20 years to give a project duration of 30 years. The estimated carbon sequestration potentials were valued at carbon prices between US\$10/tCO_2 Eq. and US\$50/tCO_2 Eq. in determining the incentives presented to the farmers. This was based on World Bank Carbon Pricing Watch (World Bank and ECOFYS, 2016), which put carbon prices as at April 1, 2016, in most European and North American Carbon markets at between US\$6/tCO_2 Eq. and US\$53/tCO_2 Eq.

The choice attributes of concern and their levels are summarised in Table 1. These were combined into profiles (i.e. options presented in the choice sets) using the orthogonal design procedures in Statistical Package for Social Scientists (SPSS) version 17. This procedure creates a reduced set of profiles that are small enough to include in a survey but large enough to assess the relative importance of each attribute. The orthogonal main-effects design framework permits statistical testing of several factors without testing every combination of factor levels.

For the purpose of this study, two sets of orthogonal main-effect designs – each consisting of 25 profiles - were generated in two runs; and were randomly combined with the *status quo* in creating the tasks that were presented to the respondents (see Table 2 for example). This process produced 25 sets of tasks, which were divided into five blocks, each with five tasks that were presented sequentially to all respondents. The main essence of blocking the choice tasks given to the respondents is to facilitate the ease of administration to the respondents. It will also reduce the tiredness that comes from administering such huge choice tasks to each respondent. Following Kjaer (2005), the blocks were randomly assigned to respondents in a systematic manner: the first respondent to be interviewed gets tasks in Block A, the second B, . . . and the fifth E. The cycle was in the same order for respondents 6 – 10, 11 – 15, etc. The task was simple for the respondent to choose the most and the least important options from the three options (labelled A, B, and C).

Methodology

The Study Area and Data:
The study was conducted in selected farming communities reputed for rice production across the six geopolitical zones, and covering five of the seven Agro-ecological zones (AEZs) of Nigeria. Administratively, Nigeria is made of 36 Federating States and the Federal Capital Territory (FCT). The States are commonly grouped into six (6) geopolitical zones: Northeast, Northwest, North-central, Southeast, Southwest and South-south geopolitical zones. Nigeria is covered by three types of vegetation: forests (where there is significant tree cover), savannahs (insignificant tree cover, with grasses and flowers located between trees), and montane land; and is commonly divided into seven Agro-ecological zones; namely the Sahel Savannah, the Sudan Savannah and the Northern as well as Southern Guinea Savannah. Others AEZs include the Derived Savannah, the Mid-Altitude and the Humid Rainforests, all of which are suitable for maize and rice, among several other crops like cassava, yams, etc.

Research Design:
In this analysis, we made use of the 2017 Federal University of Agriculture, Abeokuta (FUNAAB)-ECOWAS-RAAF PASANAO[2] Survey, which was a nationwide survey of Cereals Production Systems and Willingness to Accept Incentives to Adopt Climate Smart Practices among Smallholders in Nigeria. This survey provides information on land use choices and ecosystem service valuation which we used to infer the willingness to accept incentives for a shift to Climate-smart Agriculture among lowland rice farmers in Nigeria. The 31-page farm household questionnaire contained six sections covering community characteristics, household information, production resource use, costs and outputs, environmental impacts awareness and mitigation strategies, land use choices and ecosystem service valuation, and household welfare and livelihood outcomes. The fieldwork was implemented over three months, between January 2017 and April 2017. The survey was conducted by FUNAAB in partnership with the National Cereals Research Institute (NCRI), Badeggi, in combined efforts to provide evidence-based recommendations in support of agricultural development programming and policy formulation in Nigeria.

The three-stage sampling design was adopted:

Stage I: Purposive selection of 11 States that have been the leading rice producers in Nigeria (excluding conflict-prone areas), based on production statistics from [National Bureau of Statistics (NBS), 2016].

Stage II: Purposive selection of Three (3) Agricultural Blocks from the main rice producing areas of the State, and two (2) Extension Cells per block - that is, 6 Cells per State, and 66 Cells in all.

Stage III: Proportionate stratified random selection of seven (7) lowland rice farmers from members of Rice farmers' association (RIFAN) in each of the selected Cells,

This design yielded a total sample of 462 rice farmers but only 441 households supplied complete information.
Empirical Strategy and Data Analysis:

This study uses choice experiment, which has its theoretical foundation in Lancaster's attribute theory

[2] Economic Community of West African States (ECOWAS) Regional Agency on Agriculture and Food (RAAF) Programme for Food and Nutrition Security in West Africa (PASANAO)

of consumer choice (Lancaster, 1966) and an econometric basis in models of random utility (Luce, 1959; McFadden, 1974). Lancaster (1966) proposed that consumers [and, users of a production input or technology] derive satisfaction not from goods themselves, but from the properties or characteristics (simply, attributes) they possess. The random utility theory extended the attribute, positing that observation of utility is possible only imperfectly. Hence, the utility (U) derivable from the attributes embedded in a good can be conceptualised as consisting of systematic (deterministic) component, V which in this study are the attributes of AP-CSAPs for lowland rice farmers (Table 1) and an error (random/stochastic) component, ε which is independent of the deterministic part and follows a predetermined distribution (McFadden, 1974; Hanemann *et al.*, 1991). That is the utility of an individual i from an alternative k in a choice situation n is:

$$U_{ikn} = V_{ikn} + \varepsilon_{ikn} \quad (1)$$

Thus, an individual i will choose an alternative k from a specific choice set, n, given the utility of U, if the utility of individual i making a choice of an alternative k from a specific choice set, n (U_{ikn}) is greater than the utility of any other alternative l in choice set n:

The probability that individual i chooses alternative k is:

$$P_{ikn} = Pr(U_{ikn} > U_{iln}) \forall_k \neq l \quad (2)$$

$$U_{kn} > U_{jn} \rightarrow V_{kn} + \varepsilon_{kn} > V_{jn} + \varepsilon_{jn} \; \forall_j \neq k; k, j \in J \quad (3)$$

V thus becomes the explainable proportion of the variance in choice and ε the non-explainable. Random utility model assumes that individual acts rationally and chooses the alternative with the highest level of utility.

The Random Parameter (Mixed) Logit:
The conditional or multinomial logit model which is often used to estimate choice experiment data assumes preference to be homogenous across respondents. Preferences, however, are in fact heterogeneous and accounting for this heterogeneity enables estimation of unbiased estimates of individual preferences and enhances the accuracy and reliability of estimates of demand, participation, marginal and total welfare (Greene, 2003). To take into account preference heterogeneity we use a random parameters logit model (RPL).

The RPL or mixed logit model allows for the coefficients to be random (Kjaer, 2005). The random parameters logit is regarded as a highly flexible model that can approximate any random utility model and relaxes the limitations of the traditional multinomial logit. The choice of the mixed logit analytical framework was motivated by the fact the mixed logit obviates three of the limitations of the standard logit model by allowing for random preference variation, unrestricted substitution patterns, and correlation in unobserved factors over time (Train, 2003). Following Train (2003), the probability that individual i chooses alternative j from the choice set S, in situation t is given by:

$$Prob(V_{ijt} = 1 | X'_{i1t}, X'_{i2t}, \ldots, X'_{iKt}, \Omega) = \int \frac{\exp[X'_{ijt}\beta_i]}{\sum_{k=1}^{K} \exp[X'_{ikt}\beta_i]} f(\beta|\Omega) d\beta \quad (4)$$

where the vector Ω defines, the parameters characterizing the distribution of the random parameters, which the researcher can specify.

From equation (4), X'_{ijt} is a vector of observed variables and socio-economic characteristics of the farmers. Coefficient vector β_i is unobserved for each i and varies in the population density $(\beta|\Omega)$, where Ω is vector of parameters of continuous population distribution. The coefficient vector β_i is the parameters associated with person i, representing that person's preference. These preferences vary over people; the density of this distribution has parameters Ω. The aim of the estimation procedure is to estimate Ω, that is, the population parameters that describe the distribution of individual parameters. The log-likelihood function is:

$$LL(\Omega) = \Sigma_i ln V_i(\Omega) \quad (5)$$

This log-likelihood function is maximized via simulation, specifically $V_i(\Omega)$, and is approximated by a summation over values of β_i generated by Halton draws (Train, 1998).

The distribution of β_i can be either continuous or discrete. A model with continuously distributed coefficients is usually called a mixed logit model (Hole, 2007). The mixed logit has been applied in several circumstances (Asrat *et al*., 2010; Greiner, 2016) in economics including environmental, transport and agricultural economics.

Even though the unobserved heterogeneity can be accounted for with the use of a mixed logit model, the model fails to explain the sources of heterogeneity (Boxall and Adamowicz, 2002). To detect the sources of heterogeneity while accounting for unobserved heterogeneity would be by the inclusion of respondent characteristics in the utility function as interaction terms. This would permit mixed logit model to pick up preference variation in terms of both unconditional taste heterogeneity (random heterogeneity) and individual characteristics (conditional heterogeneity), and hence improve model fit (Asrat *et al*., 2010).

Given consistent estimates of RPL model parameters, the coefficient associated with the j^{th} attribute, β_j is the marginal utility of that attribute. Given any two attributes, the ratio of their coefficients (β_j/β_s) measures the marginal rate of substitution (i.e. the trade-off) of one attribute in terms of the other; and where the referenced attribute is that of income (price), the ratio, ($\beta_j/-\beta_{price}$) is the Marginal WTP or WTA (Hjelmgren and Anell, 2007; Casey *et al*., 2008).

Results and Discussion

Descriptive Results:
As a background to subsequent analyses, the socio-economic background of the study respondents (lowland rice farmers in Nigeria) was analysed and the results summarised in Table 3. As shown in the table, a typical rice farmer in Nigeria is about 45years old with mean years of schooling of 7years. He is 99.9% likely to be a male and married. The mean household size was eleven (11) people while the mean size of household landholdings was 2.23 ha.

Preference for AP-CSAPs to Mitigate Climate Change in Lowland Rice Production:
The results of the mixed logit are reported in Table 4. Six thousand, six hundred and fifteen (6,615) choice observations were included in the model estimation, with data on 441 respondents each with 15 choice sets (three options per task and five tasks). In line with *a priori* expectation, higher incentive level was found to be significantly associated with the likelihood that a farmer will accept an offer to shift to a AP-CSAP option. This confirms the expected positive supply response to increase in the value of the incentives that may be provided to the farmers to invest in CSA that have the potentials to sequester carbon while promoting soil health and raising productivity and income. This is in consonance with Latacz-Lohmann *et al*., (2014) in which higher payment increases the likelihood of "greening" being preferred to opt-out option.

The farmers showed significant ($p < 0.01$) strong preference for rice varieties that have short and medium maturing as against the reference category (late maturing). This implies that farmers were willing to forgo late maturing rice varieties for early and medium maturing. This trade-off connotes relatively yield increase and reduction in the quantity of GHG that will be emitted. Similarly, more preference was given to intermittent flooding and rain-fed when compared to continuously flooded. This is because changes in the water management reduce the time the field is flooded and allow the soil to dry during the growing season, hence drastic reduction in CH_4 and N_2O emission (Hussain *et al*., 2015).

The farmers were indifferent to the burning of straw on their farm as it does not significantly have any influence on their preference. However, exporting straw from the farm to feed livestock or to prepare compost was significantly more preferred to incorporating the straw into the soil for more than 30 days before planting as against the base category (straw incorporation less than 30 days).

This can be because of the slow decomposition rate of rice straw which may not be completed within the short turnaround time of fewer than three weeks before the next rice cropping season. Considering the marginal rate of substitution results in terms of willingness to plant early maturing varieties, we found that the respondents were willing to give up 1.12 units of medium maturing to plant additional unit of early maturing varieties. Similarly, they will give up 1.81, 1.35, and 1.45 units of intermittent flooding, rain-fed, and straw incorporated respectively to obtain one additional unit of early maturing. The tradeoff values of straw burnt for other attribute was shocking as the respondents showed more preference for burning their straw on the field when compared to the other attributes.

In Table 4, the standard deviations (SD) of all the random coefficient (attributes) were all significant which means that there was significant variation among responses, or heterogeneity around the mean parameter estimate within the sample, implying we reject the assumption of homogeneous preferences for all the attribute levels. This is in conformity with the findings of O'keeffe (2014).

Marginal Willingness to Accept Incentives among the Lowland Farmers:
Table 5 shows the marginal WTA based on parameter estimates from Table 2. The results reveal that lowland rice farmers were willing to accept incentives to embrace early and medium maturing as well as irrigation intermittently flooded, rain-fed, straw burnt, straw exported and straw incorporated more than 30 days before cultivation to combat climate change issues. All other things being equal, the marginal WTA figures for the AP-CSAPs by the average lowland rice farmer in Nigeria are ₦82,315.60 (US$269.89) per hectare for medium maturing, ₦73,810.54 (US$242.00) per hectare for early maturing varieties, ₦133,730.84 (US$438.46) per hectare for intermittent flooding, ₦99,574.99 (US$326.48) per hectare for rain-fed, ₦36,608.91 (US$126.59) per hectare for straw burnt, ₦53,478.22 (US$175.34) per hectare for straw exported, and ₦107,078.56 (US$351.08) per hectare for straw incorporated more than 30 days before cultivation. The farmers' willingness to accept highlight the extent to which they value ecosystem sustainability.

Conclusions

This study has contributed to the literature on the preferences for AP-CSAPs as well as the trade-off, both with respect to carbon price and other attributes (variety, water and straw management) of a hypothetical PES scheme, among lowland rice farmers in Nigeria. Using the RPL model, we evaluated the AP-CSAPs attributes and the result indicates that higher incentive level was found to be significantly associated with the likelihood that a farmer will accept an offer to shift to a AP-CSAPs to sequester carbon while promoting soil health and raising productivity and income. We also found that farmers were willing to trade-off rice varieties with late maturing for early and medium maturing varieties. Similarly, more preference was given to intermittent flooding and rain-fed when compared to continuously flooded. This is because changes in the water management reduces the time the field is flooded and allow the soil to dry during the growing season, hence drastic reduction in CH_4 and N_2O emission.

The farmers were, however, indifferent to the burning of straw on their farm as it does not significantly have any influence on their preference to shift to AP-CSAPs. On the contrary, exporting straw from the farm to feed livestock or to prepare compost was significantly more preferred to incorporating the straw into the soil for more than 30 days before planting as against the incorporation of straw few days before cultivation.

Arising from the foregoing, this study concludes that lowland rice farmers are willing to accept incentives to shift to AP-CSAPs provided the policy actions that will facilitate the implementation of all the hypothetical attributes and incentives are put in place by the government and relevant stakeholders.

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Table 1: Attributes and Levels of AP-CSAPs for Lowland Rice Farmers

Attributes	**Levels**
Variety	Late Maturing (> 120 days); Medium Maturing (100 - 120 days); Early Maturing (< 90 - 100days)
Water Management	Continuously Flooded; Intermittently Flooded; Rain-fed
Straw Management	Straw Burnt; Straw Exported; Straw Incorporated less than 30 days before cultivation; Straw Incorporated more than 30 days before cultivation
Carbon Price ($/t$CO_2$ Eq.)	10; 20; 30; 40; 50

Table 2: A Typical Task Presented to Respondents

Options	Card ID	Variety	Water Management	Straw Management	Price	Carbon Seq.	Incentives	Choice
A	17	Late maturing	Continuously Flooded	Straw Incorporated <30days before cultivation	-	-	-	
B	17	Early maturing	Rain-fed	Straw burnt	10	-12.2	61,000	
C	17	Late maturing	Intermittently Flooded	Straw Incorporated <30days before cultivation	50	-5.8	145,000	

Note: Official Exchange rates at the time of the study was an average of ₦305.44/US$

Table 3: Descriptive Statistics of Sampled Lowland Rice Farmers

Variable	**Mean (Std. Dev.)**
Age (years)	45 (12)
Gender (Female =1)	.06 (0.24)
Marital status	.09 (0.36)
Household size	11 (7)
Dependent ratio	1.70 (1.53)
Years of Schooling	7 (6)
Farm size (ha)	2.23 (3.71)

Table 4: Estimated Random Parameter Logit Result

			Preference Space (Marginal Rate of Substitution)			
Choice	**Coef.**	**z**	**Early maturing**	**Intermittent Flooding**	**Exporting straw**	**Burning straw**
Mean						
Incentive	5.44E-06***	7.04	-	-	-	-
Medium maturing	0.4474***	4.43	1.12	0.62	1.54	2.13
Early maturing	0.4012***	2.8	-	0.55	1.38	1.91
Intermittent Flooded	0.7268***	5.56	1.81	-	2.5	3.46
Rainfed	0.5412***	3.87	1.35	0.74	1.86	2.58
Straw burnt	0.2098	1.36	0.52	0.29	0.72	-
Straw exported	0.2907**	2.02	0.72	0.4	-	1.39
Straw incorporated	0.582***	3.72	1.45	0.8	2	2.77
Standard Deviation	Coeff.	z				
Medium maturing	0.8394***	5				
Early maturing	1.6598***	6.98				
Intermittent Flooded	1.474***	9.03				
Rainfed	0.8953***	3.2				
Straw burnt	1.6355***	5.73				
Straw exported	1.1168***	3.76				
Straw incorporated	0.9932**	2.81				
Model Fit Statistics						
LR chi2(7)	143.67					
Log likelihood	-1983.53					
Prob > chi2	0					

Source: Field survey; 2017

***, **, * represent statistical significance at 1%, 5% & 10%.

Table 5: Estimated Marginal WTA Incentives to Embrace Climate-Smart Practices

Variables	Willingness to Accept		Lower limit		Upper limit	
	Naira	$	Naira	$	Naira	$
Medium maturing	82,315.60	269.89	125,645.32	411.95	38,985.87	127.82
Early maturing	73,810.54	242.00	131,354.01	430.67	16,267.07	53.33
Intermittent flooding	133,730.84	438.46	203,042.25	665.71	64,419.44	211.21
Rainfed	99,574.99	326.48	166,932.50	547.32	32,217.49	105.63
Straw burnt	38,608.91	126.59	99,419.81	325.97	(22,201.99)	(72.79)
Straw exported	53,478.22	175.34	114,240.01	374.56	(7,283.57)	(23.88)
Straw incorporated	107,078.56	351.08	174,940.82	573.58	39,216.30	128.58

Source: Field survey; 2017