THE EFFECTS OF FARMERS' ORGANIZATION AND ACCESS TO CREDIT ON FARMERS' PREFERENCE FOR ATTRIBUTES OF IMPROVED RICE VARIETIES IN EKITI STATE, NIGERIA †

[LOS EFECTOS DE LA ORGANIZACIÓN DE AGRICULTORES Y EL ACCESO AL CRÉDITO SOBRE LA PREFERENCIA DE LOS AGRICULTORES POR LOS ATRIBUTOS DE LA VARIEDAD DE ARROZ MEJORADA EN EL ESTADO DE EKITI, NIGERIA]

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SUMMARY

Background. Currently, in Nigeria, there is a rising anxiety about food security, with particular focus on rice being a staple food. Farmers' preferences are crucial in improving the development of rice varieties to increase rice production. Therefore, it is important to investigate farmers' preference for the attributes of improved rice varieties and the factors underlying the preference. **Objective.** This study was conducted to determine the effect of access to credit and farmers' organization on farmers' preference for improved rice variety attributes in Ekiti State. **Methodology.** A multi stage sampling procedure was employed to select 150 rice farmers for the study. Data were analyzed using conjoint analysis and ordered probit regression model. **Results.** The results revealed that majority of the respondents were male (68%), married (96%), fell within the age range of 41 to 60 years (66%), belong to an organization (58%), have family size of 6 to 10 persons (76%), had formal education (92%) and access to credit (68%). The results further revealed that the improved rice variety attributes most preferred by rice farmers are yield (1.523) and grain size (0.745), followed by price (0.680). While, maturity has the least utility range (0.196). The findings also revealed that age of respondents, years of farming experience, membership of farmers' organization and access to credit significantly influenced farmers' preference for the attributes of improved rice varieties. **Implications.** The paper adds evidence for a better understanding of factors driving farmers' preference for improved rice variety attributes. **Conclusions**. It was concluded that policy strategies aimed at improving farmers' preference for the attributes of improved rice varieties must consider the farmers' organization and access to credit.
Key words: Farmers' Organisation; Access to Credit; Farmers' Preference; Rice Varieties and Ekiti State.

RESUMEN

Antecedentes. Actualmente, en Nigeria, existe una creciente ansiedad por la seguridad alimentaria, con especial atención a que el arroz sea un alimento básico. Las preferencias de los agricultores son fundamentales para mejorar el desarrollo de variedades de arroz para aumentar la producción. Por lo tanto, es importante investigar la preferencia hacia los atributos de las variedades mejoradas de arroz y los factores subyacentes a la preferencia que son cruciales para fomentar el interés de los agricultores. **Objetivo.** Este estudio se realizó para determinar el efecto del acceso al crédito y la organización de agricultores en la preferencia de los agricultores por los atributos mejorados de las variedades de arroz en el estado de Ekiti. **Metodología.** Se empleó un procedimiento de muestreo de múltiples etapas para seleccionar a 150 productores de arroz para el estudio. Los datos se analizaron mediante un análisis conjunto y un modelo de regresión probit ordenado. **Resultados.** Los resultados revelaron que la mayoría de los encuestados eran hombres (68%), casados (96%), estaban dentro del rango de edad de 41 a 60 años (66%), pertenecen a una organización (58%), tienen un tamaño de familia de 6 a 10 personas (76%), tenían educación formal (92%) y acceso a crédito (68%). Los resultados revelaron además que los atributos de variedades de arroz más específicos preferidos por los productores de arroz son el rendimiento (1.523) y el tamaño del grano (0.745), seguidos del precio (0.680). Entre los atributos específicos del arroz considerados en el estudio, la madurez tiene el menor rango de utilidad (0.0196). Los hallazgos también revelaron que la edad de los encuestados, los años de experiencia agrícola, la

pertenencia a una organización de agricultores y el acceso al crédito influyeron significativamente en la preferencia de los agricultores por los atributos de las variedades mejoradas de arroz. **Implicaciones.** Se presenta evidencia para una mejor comprensión de los factores que impulsan la preferencia de los agricultores por los atributos mejorados de las variedades de arroz. **Conclusiones.** Se llegó a la conclusión de que las estrategias de política destinadas a mejorar la preferencia de los agricultores por los atributos de las variedades mejoradas de arroz deben tener en cuenta la organización de los agricultores y el acceso al crédito.

Palabras clave: Organización de agricultores; Acceso al crédito; Preferencia de los agricultores; Variedades de arroz y estado de Ekiti.

INTRODUCTION

Rice (*Oryza sativa*) is one of the most important staple foods in Nigeria, accounting for about 10.5% of the average calorie intake of Nigerians (FAO, 2019) and 6% of household expenses (Toluwase *et al*., 2019). Nigeria is the second largest rice producer in Africa thanks to production growth of 70% over the past decade (United States Department of Agriculture-Foreign Agricultural Service, 2019), which is expected to continue growing over the next decade. As for its consumption, rice is among the foods whose consumption has no cultural, religious, ethnic or geographical limits (Ibitoye *et al*., 2014; Osabuohien *et al*., 2018). It is widely consumed in urban and rural areas of Nigeria (Omoare, 2016). Currently, rice consumption has surpassed its domestic production, making Nigeria the second largest rice importer after China with an average of 2.4 million tons per year (Durand-Morat *et al*., 2019; OECD / FAO, 2019). Meanwhile, Nigeria has been a major importer of rice in Africa, which is also expected to continue growing over the next decade due to increasing population and urbanization. (Maji *et al*., 2015; Durand-Morat *et al*., 2019; OECD / FAO, 2019; USDA-ERS, 2019).

Whereas, according to Oikeh *et al*. (2008), Humphrey and Robinson (2015), Ugalahi *et al*. (2016) and Omoare (2016), Nigeria has all it takes and the potential with adequate agro-ecologies (plateau, rain plain, irrigated plain, deep water and mangrove) to reach the level of self-sufficiency in rice production. The most popular rice in Nigeria is Upland rice and Swamp rice; and the main rice producing areas, among others, are Niger, Borno, Ebonyi, Taraba, Kano, Ekiti, Ogun. However, rice production in north-eastern Nigeria is in decline due to the current Boko-Haram uprising looming in the area (Omoare and Oyediran, 2020). In eastern Nigeria, rice production is declining due to poor agricultural practices and flooding (Onyeneke, 2017). In the southwest, production is dominated by smallholder farmers, especially in Ekiti State, who use rudimentary technologies and traditional methods to produce over 80% of our national production (Olayinka and Alfred, 2019). We also have pest and disease problems that affect the level of production in the tropics, for example trypanosomiasis, birds and rodents, winds, etc. They

are very common in Nigeria. In particular, the main problem is that Nigerian rice is grown mainly by smallholder farmers (80 percent) on less than one hectare in rainy conditions, leading to relatively low productivity (Takeshima and Bakare, 2016; Onyeneke, 2017: Olayinka and Alfred, 2019; Omoare and Oyediran, 2020).

It is evident from the above-mentioned that Nigeria's rice production potential has not yet been fully explored. Nigeria currently produces around 8 million tons per year but can produce 14 million tons per year if appropriate measures are taken (Federal Ministry of Agriculture and Rural Development, 2012 and Goronyo, 2019). The total potential area for irrigated rice production is estimated at 1.6 million hectares, of which only 47.798 hectares are available (FAOSTAT, 2015). However, rice consumption is on the rise as the country continues to import rice to serve its people (Goronyo, 2019). Current statistics on rice importation to Nigeria indicate a negligible import of 426 tons of rice (Roy-Macauley, 2019). This is attributed to the recent ruling by the federal government on the closure of the border. Before the land borders were closed, the importation of rice was considered a waste of foreign currency due to the country's comparative advantage in rice production (Oyediran, 2016). Even with that, as now, the country is still insufficient in rice production (Roy-Macauley, 2019). Indeed, it is regrettable that a great country like Nigeria, with enormous human, capital and natural resources, continues to bear the brunt of the excruciating pain of importing rice. Currently, a bag of rice (50kg) is sold for as high as ₦25,500 – ₦31,000 in the local markets hence, making it non-affordable for most low-income households. This has been partly attributed to the fact that Nigerian rice farmers are unable to produce enough rice and meet quality standards. This is because they lack some key resources available to other farmers in more developed nations (Ojehomon *et al*., 2009; Dimelu *et al*., 2014). However, efforts are being made to improve rice productivity (Johnson and Ajibola, 2016; Olayinka and Alfred, 2019).

One of the noteworthy efforts is the development and introduction of improved varieties for rice growers. As a result, improved varieties of rice seed varieties with high yield and early maturing attributes have been

disseminated to farmers in Nigeria. These include NERICA 1-18, NERICA L18-L60, Igbemo, FARO 44, FARO 51, among many others. The government has spent more than 10 billion naira to spread these varieties and they are currently available to farmers in the market (World Bank, 2008; Falola *et al.*, 2013). Given the concerted effort, ensuring its sustainability is the only long-term solution to preserve the national rice production. Therefore, analyzing which attributes of the improved rice varieties farmers value most, is also vital for increasing domestic rice production (Naseem *et al.*, 2013; Jin *et al.*, 2020). Farmers' perceptions of new varieties are directly related to the attributes of improved rice varieties such as high yield, early maturing, grain size, among others, which is particularly important in determining which variety they will adopt (Laborte *et al.*, 2015; Ghimire *et al.*, 2015; Jin *et al.*, 2020). Farmers are more likely to evaluate a technology using certain criteria, which differ from criteria that breeders consider preferable. However, farmers' daily activities would indicate which of these attribute combinations is the most desirable for improving rice productivity.

A better understanding of rice farmers' unique preferences for improved varieties can help breeders focus their research on the farmers' unique preferences and thereby subsequently increase field adoption rates (Maligalig *et al.*, 2018). As a result, effective coordination between research institutes and farmers (Spielman *et al.*, 2011) has led to the development of improved varieties dependent on farmers' preferences (Burman *et al.*, 2018; Fajardo Vizcayno *et al.*, 2014; Sánchez *et al.* 2017). As a result, many new improved varieties incorporating farmers 'preferences have spread to farmers' fields (Burman *et al.*, 2018). Despite this, the situation remains the same. Most farmers prefer local varieties with lower yields than improved rice varieties (Conteh *et al.*, 2012; 2014; Louhichi and Paloma, 2014). This statement agrees with previous literature (Birol *et al.*, 2012; Ward *et al.*, 2014; Kassie *et al.*, 2017; Maligalig *et al.*, 2018) which suggests that farmers' preferences for variety attributes are heterogeneous. This is because farmers are often different in terms of socioeconomic characteristics, household and farm resources, behaviors and attitudes (Hallyer *et al.*, 2012; Maligalig *et al.*, 2018). Available information indicates that rice growers prefer improved varieties with more desired attributes that are too expensive for their purchasing power and therefore cannot afford them (Louhichi and Paloma, 2014). Therefore, they stick to traditional varieties that are easily accessible through exchange and, in the case of local purchase, the price is relatively lower than hybrids (Cavane, 2011; Kehinde and Tijani, 2021).

As noted by Kehinde *et al.* (2018) and Kehinde (2020), access to credit could increase the willingness of agricultural households to adopt improved varieties with multiple desired attributes that are apparently expensive. However, most rice farmers rarely have access to formal sources of credit. Due to the lack of access to formal sources of credit, farmers come together to form farmers' organizations because members in a group have access to credit more easily than they would individually; members collect scarce resources, own them and manage them on their own to overcome poverty, deprivation, helplessness in the face of market forces, unemployment and low self-esteem. Farmers' organizations create the platform for acquiring credit and other relevant resources, such as information that drives adoption. It plays an important role in mobilizing and distributing credit to farmers and creates a path for members to pool capital and other resources. There is a wide and diverse range of activities carried out within and by organized groups of people, which also includes attracting additional funds and supporting external agencies keen to work in areas where the rural population is well organized (Arthur, 2016). By raising capital and other resources, members undertake profitable activities to realize the economies of scale from bulk purchase and the funds to support their preference for improved varieties, which, if performed by individuals, would result in a higher cost of ownership and efforts (Afolami, *et al.*, 2012; Ibitoye, 2013; Dimelu *et al.*, 2014; Kehinde and Tijani, 2021).

Given this background, it is expected that many research efforts will be directed in this regard. However, there has been little empirical research on farmers' preferences for crop attributes. Limited empirical studies on attribute preference of improved rice varieties (Jara-Rojas *et al.*, 2012; Yokouchi and Saito 2016) have been limited to a variety of socioeconomic factors influencing farmers' preference. To our knowledge, there have been no conscious efforts to investigate the effect of farmers' organization and access to credit on attribute preference of improved rice varieties. Consequently, this paper contributes to the existing literature by attempting to investigate the effect of farmers' organizations and access to credit on attributes preference of improved rice varieties in Ekiti state, Nigeria. And as such, this is precisely where the novelty of this study lies. To achieve this, this study is guided by the following specific objectives; describes the socio-economic characteristics of rice producers in the study area; evaluates farmers' preference for attributes of improved rice varieties and determines the effect of farmers' organization and access to credit on the preference for attributes of improved rice varieties.

MATERIALS AND METHODS

Study area and data collection

The study was conducted in Ekiti state. Ekiti state was selected based on the dominance of rice farmers in the state. The study area is located between longitude 4°5 'and 5°45' east of the Greenwich meridian and between latitude 7°15 'and 8°5' north of the equator (Figure 1). The state of Ekiti enjoys a tropical climate with two distinct seasons. The area has a generally undulating land surface supported by metamorphic rocks. It enjoys a tropical climate with two distinct seasons: the rainy season (April to October) and the dry season (November to March). The temperature varies from 21 °C to 28 °C, with high humidity. Winds from the southwest and northeast blow in the rainy and dry seasons, respectively. The tropical forest exists in the southern part of the state, while the Guinean savannah occupies the northern suburbs. Agriculture is the main socio-economic activity of the population. Farmers grow roots and grains, but most Ekiti communities are known for their rice production. Ugwu (2014) described Ekiti as one of the 13 major rice producing states in Nigeria. The main settlements where rice is the main crop are Igbemo, Ilumoba, Ijan, Ado, Aramako and Ijero. This is solely due to the type of soil present and, furthermore, can be attributed to their culture, it is not surprising that people called the local rice produced in Ekiti "Igbemo rice" (Omotoso *et al.*, 2014).

A multi-stage sampling procedure was used to select one hundred and fifty (150) rice producers for the study. The first phase was purposive selection of five (5) Local Government Areas (LGAs). These LGAs are Ekiti west, Irepodun / Ifelodun, Ado, Ijero and Ikole LGA. The selection of the five LGAs was based on the high volume of rice production in these LGAs. The second phase was the simple random selection of two rice-producing villages in each LGA. The third and final phase involved a simple random selection of 15 rice farmers in each of these villages. A total sample of 150 rice farmers was selected for the study. The sample size of 150 respondents is justified for the conjoint analysis based on Kehinde and Tijani (2021)´s report that sample size greater than 100 respondents is appropriate for a conjoint study.

Data analysis

Firstly, descriptive statistics (mean, percentages and frequency distribution) were used to describe the socioeconomic characteristics of rice farmers. The data were further analyzed with the aid of conjoint analysis and ordered probit regression model.
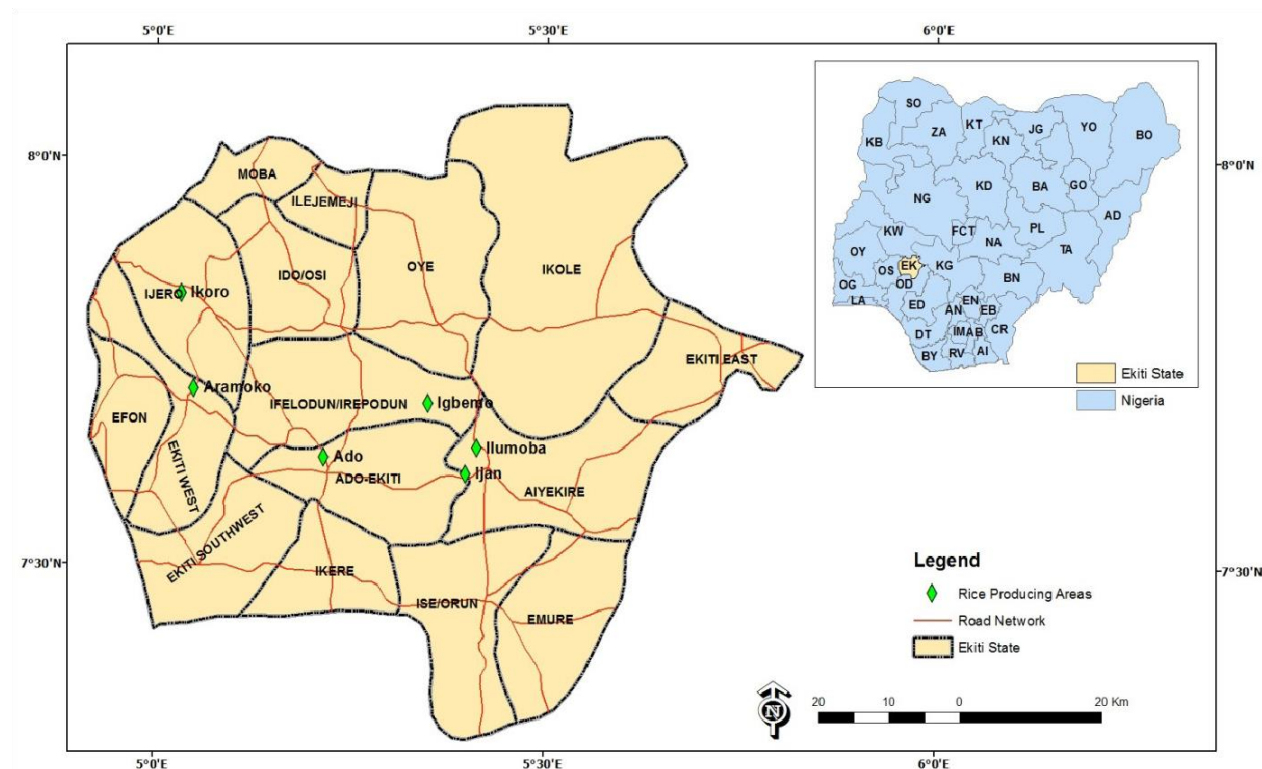

Figure 1. Map of Ekiti State.

Table 1. Sampling procedure for the study.

State	LGAs	Villages		Rice farmers	
		Proportion used	Number of villages	Proportion used	Number of registered farmers
Ekiti	Ekiti west	2	18	30	39
	Irepodun/Ifelodun	2	44	30	67
	Ado	2	28	30	53
	Ijero	2	31	30	61
	Ikole	2	39	30	66
Total	5	15		150	286

Conjoint analysis

A conjoint analysis was used to assess farmers' preference for improved attributes of rice varieties. Conjoint analysis is commonly found in behavioral studies where the predictive variables are called attributes and the dependent variable is often a general evaluation of a product. The method was used because it provides a technique for measuring and evaluating the relative importance of each feature of a hypothetical product. The conjoint analysis is based on the premise that people evaluate the value or utility of a product / service / idea (real or hypothetical) by combining the separate amounts of utility provided by each attribute, in this study, the product is improved attributes of the rice varieties. In a conjoint experiment, the researcher constructs a series of hypothetical products by combining selected levels of each attribute. These combinations result in the stimulus design that is presented to the respondents. Consumers will provide their ratings based on interest behavior, known as choice task (Agbas and Ceballos, 2019). In conjoint analysis, a product can be described as a combination of a set of attribute levels, in which a utility value is estimated for each attribute level that quantifies the value a person assigns to each attribute level. The utility values, provided by each attribute level, then determine the total utility of the buyers. This study created a fractional factorial design (a subset of a full factorial design using all possible profiles) using the SAS Proc Factex software program. Attribute levels were determined by literature reviews and focus groups composed of field experts

The study has two phases. Phase I was the Key informant Interview (KII) in which 35 randomly selected consumers, called informants, participated to identify the key and important attributes of the improved rice varieties used in the study area through face-to-face interviews for 5 days. During the interview, the informants were asked to rank the eight (8) intrinsic attributes from most to least based on his or her preferences. Based on the result of the analysis, four attributes for the intrinsic were selected and used in the study. Following the outcome of Phase I, the four most preferred attributes selected from the key informant interview were used in Phase II of the study. Phase II used individual cards/profiles presented to respondents where they classified each profile according to their preferences. The individual tabs consist of individual product profiles. These product profiles are a combination of attribute levels.

In phase II, an appropriate experimental design and investigation tool was constructed to collect the aggregated data. Information on the desired improved rice variety attributes was gathered in the focus group discussion with key informants which was then used to generate the plan sheet used to design the questionnaire. Farmers have listed several attributes, including yield, maturity, grain size, marketability, flavor, pest and disease resistance, ease of harvest, seed price, easy access to seed purchase, ease of processing, among many others. Of which four main attributes are: The yield, maturity, grain size and price of the seed were selected. For this study, three-level attributes (grain size and yield) and two-level attributes (maturity and seed price) were selected using a full factorial design. The independent variables are attributes of the improved rice varieties which are yield, grain size, seed price and maturity, while the dependent variables are the respondent's preferences for fictitious products (Table 2). At this stage, consumers were asked to rate their overall preference for selected hypothetical products.

The final step of Conjoint analysis is the analysis of the consumers' partial utilities for improved rice variety attributes. The partial utilities ("part-worths") values were determined based upon the ranked data. With part-worths, it is possible to compute the metric total utilities of all incentives and the relative importance of the single object attributes. The part-worth utilities are the β's, the parameter estimates

from the discrete model. The sum of the part-worth utilities for each product is an estimate of the utility for that good. The following formula shows a metric conjoint analysis model.

$$yijkl = \mu + \beta 1i + \beta 2j + \beta 3k + \beta 4l + \epsilon ijkl \quad (1)$$

Where;

The $yijkl$ term is one subject's stated preference for an improved rice variety attribute with the ith level of maturity, the jth level of grain size, the kth level of yield and the lth level of seed price. The grand mean is μ, and the error is $\epsilon ijkl$. The predicted utility for the $ijkl$ product is:

The predicted utility for the ijk product is:
$$\hat{y}ijk = \hat{\mu} = \hat{\beta} 1i = \hat{\beta} 2j = \hat{\beta} 3k \quad (2)$$

Table 2. Attributes and levels.

Attributes	Levels
Price	High
	Low
Yield	Low
	Moderate
	High
Grain size	Small
	Medium
	Long
Maturity	Late
	Early

Source: Author's compilations

Ordered probit regression model

Ordered probit regression model was used to determine the effect of access to credit and farmers' organisation on farmers' preference for improved rice variety attributes. The rationale for selecting the model is that an ordered probit model could be used to model relationships between a polytomous response variable which has an ordered structure and a set of regressor variables. In this study, the variable of interest takes integer values ranging from 0 to 3 and thus, an ordered probit model is used. The ordered probit has a dependent variable that are ordered categories.

The ordered probit model can be expressed as:
$$y^* = x'\beta + \varepsilon \quad (4)$$

where $y*$ is unobserved and is given by:
Where:
y^* = the exact but unobserved dependent in ordinal categories which was coded as 0, 1, 2,…, j; X' = the

vector of independent variables, β = the vector of regression coefficients which we wish to estimate and ε = the error term which is assumed to be normally distributed (zero mean and unit variance)
where y^* is unobserved and is given by:

$$\begin{cases} y = 0 \;\; if \; y^* \le 0 \\ \quad = 1 \;\; if \; 0 < y* \le \alpha_1 \\ \quad = 2 \;\; if \; \alpha_1 < y* \le \alpha_1 \\ \quad . \\ \quad . \\ \quad = J \; if \; \alpha_{j-1} \le y* \end{cases} \quad (5)$$

where values of y are observed and α are unknown parameters to be estimated. We assume that ε follows a normal distribution with zero mean and unit variance. Then the probabilities of each outcome can be expressed as:

$$Pr(y = 0|x) = \phi(-x'\beta)$$
$$Pr(y = 1|x) = \phi(\alpha_1 - x'\beta) - \phi(-x'\beta)$$
$$Pr(y = 2|x) = \phi(\alpha_2 - x'\beta) - \phi(\alpha_1 - x'\beta)$$
$$.$$
$$.$$
$$Pr(y = j|x) = 1 - \phi(\alpha_{j-1} - x'\beta). \quad (6)$$

The equations were estimated using STATA 15.

The empirical model is implicitly expressed as
$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \ldots \ldots \beta_{10} X_{10} + Ui \quad \ldots \quad (7)$$
Y= Preference (1=Maturity; 2= Price; 3=Yield; 4= Grain size)

The explanatory variables are: X_1= age of respondent (years); X_2= Gender (1=male; 0 = female); X_3= marital status (1=married; 0= otherwise); X_4= household size (actual number); X_5= Religion (0= Traditional; 1= Islam; 2= Christianity); X_6= years of formal Education; X_7= Years of farming experience; X_8= farm size (hectare); X_9= membership of farmers' organisation (1=member; 0= otherwise); X_{10}= access to credit (1= Access; 0= otherwise); Ui= error term. This study incorporates the independent variable based on review of existing literature.

RESULTS AND DISCUSSION

Socio-economic characteristics of rice farmers

The socio-economic characteristics of the rice farmers are presented in Table 4. Majority of the respondents (66%) fall within the age range of 41-60 years. This result indicates that that rice production in Ekiti State

is dominated by active and productive farmers The implication is that they are vibrant and energetic and more likely to handle risks involved in adopting improved technologies in rice agricultural production. This finding is in line with Onyeneke (2017) and Toluwase *et al*. (2019) s' finding. Majority of the rice farmers are male (68%). This implies rice farming in the study area is dominated by male farmers. This is consistent with the findings of Dontsop-Nguezet *et al*. (2011), Afolami *et al*. (2012), Dimelu *et al*. (2014), Chekene and Chancellor (2015) who also found that male farmers dominate rice production in Ekiti States. This could be due to the strenuous and time-consuming nature of rice farming activities. Therefore, women are typically involved in activities like weeding, fertilizer application, bagging etc. Majority (96%) of the farmers are married. This implies that larger proportion of respondents have stable family which would help in making decisions particularly in agricultural production. Married farmers are more "advantaged" in farming production and adoption of agricultural technologies because their spouses and children constitute the major labour force in rice production. This was also corroborated by Ayoola *et al*. (2011) and Onyeneke (2017). Majority of the farmers (76%) have a household size of 6-10 members. This implies that the farmers have enough hands for farm works in the area of study. This is consistent with the findings of Dontsop Nguezet *et al*. (2011) who found the average household size of rice farmers in Nigeria to be 10 persons. According to Olumba (2014), large family size could be as a result of polygamous nature of the rural farmers. He further opined that, this could be linked to the fact that most rural farmers consider large household size as a good

and economical way of maximizing farm returns by using family labour. Family labour is important in rice production as it reduces the amount spent on hired labour, as opined by Garba *et al*. (2011). Majority (92%) of the farmers have formal education. Thus, the bulk of the farmers is somewhat educated and can presumably interact to generate new ideas to changing conditions in rice production. The result implies that literate farmers are into rice production in the area of study. This supports the findings of Kolawole *et al*. (2012) and Olumba (2014) who stated that the literacy level of farmers could enhance their level of understanding and desirability of adopting new farm technologies or relating in a good way with the extension agents. Ninety- three (93%) of the farmers cultivate a rice on farm size of 1-5 hectares. This implies that rice production is being done on smallholding in the study area. This confirms the observation by Daramola (2005), Kadiri *et al*. (2014) and Omoaare and Oyediran (2020) that Nigeria rice sector is dominated by smallholder farmers and there is little or no specialization. This could be attributed to several factors such as poor infrastructural facilities, poor or lack of access to inputs, low technical expertise, weak linkage networks in rice innovation system (Dimelu *et al*., 2014). The result further stated that the average rice farming experience in the area of study was 26 years. This implies that many of the farmers are quite "old" in rice production as such, they have and high exposure in rice production. Long years of farming experience could be an advantage for increased rice production since it may encourage rapid adoption of improved rice technology (Omoare and Oyediran, 2020). This could be attributed to the fact that within these years the farmers may have attended

Table 3. Description of variables.

Variables	Unit	Expected sign	Description
Age	Year	+	Measured in years
Gender	Dummy	+	1= male 0= female
Marital Status	Dummy	+	1= if farmer is married 0= otherwise
Household size	Number of persons	+	Measured in number of household members
Religion	Nominal	+	0= Traditional; 1= Islam; 2= Christianity
Farm size	Hectares	+	Measured in hectares
Education	Years spent in school	+	Measured in years spent in school
Farming experience	Years spent in farming	+	Measured in years spent in farming
Membership of farmers' organisation	Dummy	+	1= if farmer belongs to cooperative 0= otherwise
Access to credit	Dummy	+	1= Access; 0= otherwise

many trainings on rice production and therefore, should equip them with better knowledge of rice farming. This finding is consistent with the findings of Kadiri *et al*. (2014). Fifty-eight (58%) of the respondents belong to an organization. This implies that there is organized farmers' society in the study area. The fairly high percentage of organization membership could be attributed to the benefit they could derive from such organization, such as, credit facilities like (loans, inputs) and opportunities of sharing information on modern rice practices. Sixty-eight (68%) of the farmers have access to credit. The implies that the farmers have access to credit in the study area. This could be attributed to the fact that the farmers in the study area have organized farmers' society.

Farmers' preference for improved rice variety attributes

Farmers' preference for improved rice variety attributes are presented in Table 5. Grain size (1.523) is the most important attributes that rice farmers prefer amongst other improved rice variety attributes considered in this study. The most preferred attribute level of grain size is the small grain size (0.942). This result showed that the farmers are really concerned about the grain size. However, irrespective of the grain size, yield (0. 745) is also an important attribute that the farmers look up to. This is evident with high yield (0.419) being the most preferred attribute level for yield. This result could be attributed to the fact that rice farmers belief that small grain size rice varieties produce numerous grains which could improve rice yield. The Table further showed that price (0.68) at which the seed is purchased is the next preferred attribute the farmers look up to in purchasing an improved rice variety. The utility estimate showed that low price (.340) is more preferred to high price (-.340). This implies that farmers are also concerned with the affordability of the improved rice variety attributes, owing that if the seed to be grown and is not bought at a much lower price, then enough profit will not be realised at the end of the season. Amongst the specific improved rice variety attributes considered in the study, maturity (0.196) has the least utility range. The utility estimate showed that early maturity level (0.098) is more preferred than late maturity (-0.098). This showed that farmers are much more concerned about growing a variety that matures early in order to realizing capital invested on time. Although a farmer's choice of a particular improved seed variety is guided by many criteria, it was found that most farmers preferred to have most of the traits of their choice combined in a particular seed variety. Alternatively stated, farmers prefer improved rice varieties that carry different attributes according to their feelings and needs. Overall, the results indicate that the preference range that would deliver the most utility for farmers would include variety attributes such as high yield (0.419), small grain size (0.942), low price (0.340) and early maturity (0.098). Scientists that deliver rice varieties within this stated preference range would have successfully delivered a utility of 1.8 out of 3.1. This finding concurs with the report of Sonda (2008), Tiamiyu *et al*. (2014), and Leake and Adam (2015).

Table 4. Socio-economic characteristics of rice farmers

Variables	Rice Farmers
Age (%)	
20-40	13.0
41-60	66.0
Above 60	21.0
Total	100.0
Male (%)	68.0
Married (%)	96.0
Household size (%)	
1-5	16.0
6-10	76.0
>11	8.0
Total	100.0
Formal education (%)	92.0
Farm size (%)	
Small-scale	93.0
Large-scale	7.0
Total	100.0
Years of farming experience	25.84 (±12.49)
Agric. organization (%)	58.0
Access to credit (%)	68.0

In addition, derived utility values were used to determine the importance of each attribute. Table 6 shows two statistics, Pearson's r and Kendall's tau to evaluate the validity of the joint analysis model. The finding shows a strong agreement between average product valuations and expected earnings from the conjoint analysis model. In terms of intrinsic quality attributes, Pearson's r is 0.953 with a p-value of 0.000. While for extrinsic quality attributes, Kendall's tau statistic is 1.0 with a p-value less than 0.003. This implies that there is a meaningful perfect relationship between observed and predicted preferences. This finding collaborates with the reports of Agbas and Ceballos (2019) and Kehinde and Tijani (2021).

Table 5. Utilities Table showing the preference for improved rice variety attributes.

Rice Attributes	Levels of Attributes	Utility Estimates	Utility Range	Importance (%)
Maturity	Early	0.098*	0.196	6.23
	Late	-0.098		
Grain Size	Small	0.942*	1.823	48.44
	Medium	-0.361		
	Long	-0.581		
Yield	High	0.419*	0.745	23.70
	Moderate	-0.093		
	Low	-0.326		
Price	High	-0.340	0.680	21.63
	Low	0.340*		
Total			3.144	100

* Represents the most preferred attribute level

Table 6. Correlations between observed and estimated preferences.

Correlation	Value	Significance
Pearson's R	0.953	0.000
Kendall's tau	0.722	0.003

Effects of access to credit and farmers' organisation on farmers' preference for improved rice variety attributes

Table 7 shows the results of the estimated ordered probit model. The chi-square statistic is statistically significant (Wald Chi^2 (10) = 46.92; Prob > Chi^2 = 0.000). This justifies the rationale for using the ordered probit model. From the Table 7, age of respondents, years of farming experience, membership of farmers' organization and access to credit significantly influenced farmers' preference for improved rice variety attributes. The age of the respondents has a negative and significant influence on the probability of farmers' preference for improved rice variety attributes. This implies that younger farmers have higher preference for some of improved rice variety attributes considered. For instance, the lower the number of aged farmers the higher the probability of preferring early maturing attribute of improved rice variety (by 48.3%), low price (42.7%), high yield (by 42.2%), and the higher the likelihood of preferring small sized grains (by 46.2%). This could be traced to the fact that young farmers have more physical strength to carry out agricultural production activities than their old counterparts and as such, they are energetic and spend time in obtaining information on improved technologies. Also, farmers' mental capacity to cope with the daily challenges and demands of farm production activities decreases with advancing age. All these may plausibly explain why the probability of farmers' preference for improved rice variety attributes decreased with advancement in age. This result collaborates with the findings of reports of Falola *et al*. (2013) and Busari *et al*. (2015). The years of farming experience has a positive and significant influence on the probability of farmers' preference for improved rice variety attributes. This implies that farmers who have many years of farming experience are more concerned about the choice of improved rice variety attributes to be planted. The higher the years of farming experience, the higher the probability of preferring early maturing attribute of improved rice variety (by 0.9%), low price (0.7%), high yield (by 0.5%), and the higher the likelihood of preferring small sized grains (by 0.4%). This could be as a result of experience and knowledge, they have gathered over the years about improved rice variety attributes. This means that the longer the farmers engage in rice farming, the more their preference for improved rice variety attributes. This could result from the fact that farming experience enhances acquisition and development of relevant skills in farming (Falola *et al*., 2013). Membership of rice farmers' organization has a positive and significant influence on the probability of farmers' preference for improved rice variety attributes. The higher the years of membership in farmers' organization, the higher the probability of preferring early maturing attribute of improved rice variety (by 48.5%), low price (33.4%), high yield (by 28.0%), and the higher the likelihood of preferring small sized grains (by 39.8%). This implied that most farmers who belong to farmers' organisation have the opportunity of being introduced to improved rice variety attributes. Thus, they have an edge in knowledge and adoption of the technologies above others. Members in a farmer group may influence one another to choose better technologies. It can be attributed to the fact that social group allows cross fertilization of ideas among farmers. Farmers' organisations expose farmers to a wide range of ideas and sometimes gives farmers the opportunity to have better access to information, through training and

Table 7. Effects of Access to credit and farmers' organisation on farmers' preference for improved rice variety attributes.

Preferences	Coefficient	Z	Marginal effects			
			Early Maturity	Low price	High yield	Small size
Age	-1.033***	-3.11	0.483	0.427	0.422	0.462
Gender	0.148	0.55	0.064	0.069	0.054	0.066
Marital Status	1.044	1.40	0.380	0.290	0.152	0.240
Household size	-0.114	-1.31	0.028	0.036	0.047	0.048
Religion	0.197	0.78	0.009	0.021	0.059	0.016
Years of Education	0.021	0.10	0.007	0.005	0.006	0.002
Years of Farming experience	0.044***	3.44	0.009	0.007	0.005	0.004
Farm Size	0.066	0.93	0.003	0.006	0.008	0.006
Farmers' Organization	1.571**	2.51	0.485	0.334	0.280	0.398
Access to credit	1.794***	2.75	0.169	0.188	0.138	0.145
Observation	150					
LRChi (10)	46.92					
Prob>Chi^2	0.000					
Log likelihood	-98.794					
Pseudo R$_2$	0.294					

***, ** &* represent significance levels at 1%,5% & 10%, respectively

extension services, which may positively change their attitude toward an innovation. This creates an avenue for awareness of improved agricultural technologies and also provides access to credit, creating adequate capital for farmers to procure inputs such as fertilizer, improved seeds, herbicides, pesticides and payment for labour required for adoption. This finding conforms to Nchinda *et al*. (2010), Akudugu (2012) and Kehinde *et al*. (2018). Access to credit facilities has a positive and significant influence on the probability of farmers' preference for improved rice variety attributes. The higher the access to credit, the higher the probability of preferring early maturing attribute of improved rice variety (by 16.9%), low price (18.8%), high yield (by 13.8%), and the higher the likelihood of preferring small sized grains (by 14.5%). The rise in use of improved technologies is attributed to an increase in the purchasing power as a result of the credit accessed. Hence, farmers with higher amount of credit would acquire improved technologies. This could be attributed to the fact that farmers who don't have access to credit facilities are always very careful about new technologies to be adopted unlike those with access. Farmers with little or no access are therefore satisfied with the already known variety and are not ready or willing to try new ones. This result suggests that credit access from governments or microfinance agencies would increase the likelihood of adoption of improved seed varieties This is in line with the study of Kehinde (2020).

CONCLUSIONS

This study explored the effect of farmers' organizations and access to credit on preference for attributes of improved rice varieties in Ekiti State, Nigeria. A multistage sampling procedure was used to obtain data for the study. Data were analyzed using conjoint analysis and ordered probit regression model. The study concluded that the majority of the rice farmers were male, small scale and at their productive age. The result further indicates that the preference range that would deliver the most utility for farmers include variety attributes such as high yield (0.419), small grain size (0.942), low price (0.340) and early maturity (0.098). Scientists that deliver rice varieties within this stated preference range would have successfully delivered a utility of 1.8 out of 3.1. It was concluded that access to credit and farmers' organization membership along with other socio-economic characteristics such as age, and farming experience significantly influence farmers' preferences for improved rice variety attributes. Based on the findings of the study, rice breeders are thereby encouraged to produce a small grain size variety with high yielding and early maturity characteristic, and the variety should be affordable among rice farmers in order to increase rice productivity. The dissemination of these varieties should be carried out through farmers' organization. Also, Government and non-governmental credit institutions should provide rice farmers with adequate

access to credit facilities. In addition, focus should be on young farmers with relatively longer years of farming experience. Younger farmers who have higher preference for high yielding varieties with preference for moderately small to medium grain size should be considered more for the dissemination of these varieties although experience of the farmers should also be considered.

Conflict of interest. The authors declare that there are no known competing financial or personal interests associated with this publication.

Compliance with ethical standards. The research presents original data that are not submitted to other journals at the same time. Besides, the research was conducted according to the established procedures of the Obafemi Awolowo University, Ile-Ife, Nigeria.

Data availability. Data are available with the corresponding author at: (kehindeayodeji8@gmail.com) upon reasonable request.

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Annex 1. Hypothetical rice varieties combining four attributes likely to affect farmers' preference.

Plan Card	Maturity	Grain Size	Yield	Seed Price	Please rank according to your preference
A	Late	Small	Low	Low	
B	Late	Long	Moderate	High	
C	Late	Medium	High	High	
D	Early	Small	Moderate	High	
E	Early	Small	High	High	
F	Early	Medium	Low	High	
G	Early	Long	High	High	
H	Early	Medium	Moderate	Low	
I	Early	Long	Low	High	