IMPACT OF MEMBERSHIP IN AGRICULTURAL ORGANIZATIONS ON COCOA FARMERS' PREFERENCES FOR APPROVED PESTICIDES IN OSUN AND ONDO STATES OF NIGERIA

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Cocoa is one of Nigeria's major cash crops, and its production is directly related to the effective utilization of pesticides. Agricultural organizations may promote the use of approved pesticides in cocoa production. However, empirical evidence of how and to what extent agricultural organizations facilitate the farmers' preference for approved pesticides remains unclear. To address this knowledge gap, this study investigated the impact of membership in agricultural organizations on cocoa farmers' preferences for approved pesticides in Southwestern Nigeria. A multistage sampling procedure was employed to select 200 cocoa farmers for the study. This paper is based on a farm household survey, and the data collected were for the 2021/2022 cropping season. Data were analyzed using descriptive statistics, conjoint analysis, and ordered probit regression models. The results revealed that many of the cocoa farmers were male (71.14%), married (79.5%), fell within the age range of 41 to 60 years (50.6%), belonged to an organization (60.4%), had a family size of 4 to 7 persons (65%), had formal education (73.5%) and access to credit (67%). The result further indicated that the preference range that would deliver the most utility for farmers would include the following product attributes: reduced price (1.650), high efficacy (1.484), ease of use (1.453), harmless (0.519), and imported (0.334). Ordered probit estimates revealed that age, gender, education, farm size, membership of agricultural organizations, and access to credit significantly influenced cocoa farmers' preference for approved pesticides. The results suggested that participation in agricultural organizations significantly influenced cocoa farmers' preference for approved pesticides. It was concluded that policy strategies aimed at improving cocoa farmers' preference for approved pesticides must consider agricultural organizations.

Agricultural Organization, Farmers' preference, Approved pesticide, cocoa farmers

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INTRODUCTION

Cocoa is a vital component of African agriculture, contributing significantly to farmers (Kehinde, Ogundeji, 2022a; Akande et al., 2023). Cocoa plays a crucial role in preserving biodiversity and sound natural resource management and providing additional mechanisms for the diversification and intensification of food crop systems (Kelani et al., 2020; Amujoyegbe et al., 2018; Adesiyan, Kehinde, 2024). Cocoa is currently the largest non-oil foreign exchange earner in Nigeria (Adeyemo et al., 2020; Kelani et al., 2020). As a cash crop, it contributes significantly to the economy of the country and plays an important economic role in the lives of Nigerians (Kolawole et al., 2020). In terms of employment, over five million people derive their income from the cocoa supply chain as farmers, Licensed Buying Agents, Warehouse agents, Processors, and Exporters (Akande et al., 2023). The major cocoa-growing states in Nigeria are Ondo, Cross River, Osun, Ekiti, and Abia. Others are the Edo, Oyo, and Ogun states. Osun State is considered the second-largest cocoa-producing State in Nigeria in terms of production output (Kehinde, Ogundeji 2022b; Oyenpemi et al., 2023). The importance of cocoa production to the Nigeria's economy is seen from three major perspectives: the production opportunity possessed by cocoa farmers; the revenue and employment effects, giving both direct and indirect employment, through the provision of indigenous markets for both food and non-food commodities, especially in Osun state, where about 80% of the population engaged in cocoa production and the ability to earn foreign exchange to subsidize imports and various developmental projects in the country (Aminu et al., 2019; Adeyemo et al., 2020). The cocoa farming households have many members who rely mostly on cocoa production to meet their basic needs through income generated from cocoa farms. Many people are engaged in the supply chain because the cocoa industry encompasses several stages before cocoa can be an exported product. However, cocoa production, which was at its best some decades ago in Nigeria, has diminished significantly in recent years (Kehinde, 2021; Kehinde, 2022). This shortfall was attributed to several factors, including low yield, inconsistent production patterns, and pest and disease incidence (Kehinde, Tijani, 2021; Oyenpemi et al., 2023). It is estimated that about 30 to 40% of potential cocoa production in Nigeria is lost to diseases and pests (Faloni et al., 2020). In some areas with exceptional cases of disease and pest infestation, the loss could be up to or exceed 80% (Kolapo et al., 2022; Oyenpemi et al., 2023). The consequences of pests and disease infestation are a reduction in crop yield, losses in the value of foreign exchange, a reduction in revenue and a negative effect on the farmers' health (Tijani, Masuku, 2019). In monetary terms, annual losses through pest and disease infestation were estimated to be approximately $2 billion (Tijani, Masuku, 2019). While these losses have a significant impact throughout the supply chain, cocoa farmers feel the most immediate and direct impact on household income (Rutherford, 2011; Akande et al., 2023; Adesiyan et al., 2023). However, cocoa farmers would suffer great economic losses without the use of pesticides in its production (Faloni et al., 2022).

Consequently, cocoa farmers use pesticides to tackle these various problems associated with pests and diseases in cocoa production (Aminu, Edun, 2019; Kehinde, Tijani, 2021a). Pesticides are chemical substances such as herbicides, insecticides, rodenticides, fungicides, molluscides, nematicides, and avicides that mitigate the effects of any pest or disease (Aminu, Edun, 2019). According to Oke et al. (2020), cocoa pesticides represent approximately 37% of total annual agrochemical usage in Nigeria. About 125,000 - 130,000 metric tons of pesticides are used on Nigerian cocoa farms annually (Asogwa, Dongo, 2009; Faloni et al., 2022). This could be attributed to the fact that pesticides are the quickest and most effective method of cocoa pest and disease control. However, pesticides in Nigeria are not judiciously used because the majority of cocoa farmers are not aware that pesticides should be used in specific dosages to be cost-effective and to minimize the number of residues on the cocoa beans (Tijani, Masuku, 2019). The misuse of these pesticides has been more prevalent in cocoa production in the rural areas of Nigeria (Aliyu, Majeti, 2020), and it has been established that excessive use of pesticides leaves residues on cocoa that contaminate the products (Faloni et al., 2019; Kehinde, 2022). However, many cocoa importing countries, especially the European Union (EU) countries, have discovered that excessive use of pesticides in cocoa production might be detrimental to their health as such cases of cancer among their citizens. According to Mokwunye et al. (2012), Ugwu et al. (2015), Kehinde, Tijani (2021a), close to 20,000 deaths and 735,000 severe illnesses occurred as a result of cocoa contaminations resulting from inappropriate pesticide application and handling. Consequently, in September 2008, the European Union Legislation on Pesticides Maximum Residue Levels (MRLs) (Regulation 149/2008/EEC) came into effect.

The Regulation set maximum levels on the amount of pesticide residue permitted on imported foods, including cocoa beans and listed some chemicals as recommended ones to the farmers. The European Union resolved to boycott cocoa beans with pesticide levels exceeding the recommended limits (Opoku, 2019). Consequently, all cocoa beans imported into the EU from September 2008 must conform to the new Regulation (Fountain, Hütz-Adams, 2020). If the regulations are not properly adhered to, it has the potential to disrupt the cocoa trade, which could deprive farmers of income and affect the expenditure of the household. Also, it might affect government revenue from exporting cocoa beans (Tijani, Masuku, 2019). In line with the EU regulation, the Federal Government of Nigeria (FGN) made various steps to prevent its cocoa beans from being rejected and also to prevent losses of revenue as a result of poor-quality cocoa beans. The Cocoa Research Institute of Nigeria (CRIN) and the National Agency for Food and Drug Administration and Control (NAFDAC) reviewed pesticides used on cocoa farms and banned some of the previously used pesticides, such as copper sulphate, lindane, carbofuran, etc. (Kehinde, Tijani, 2021). The approved pesticides include Insecticides (Actara 25WG, Esiom 150 SL, Proteus 170 O-TEC); Fungicides (Funguran-OH, Champ DP, Ridomil gold 66 WP, Copper Nordox 75 WP, Ultimax Plus, Kocide 2000, Kocide 101, Cabrio Duo, Red Force, Pergado); Herbicides (Touch down, Clear weed, Roundup), and Fumigant (Phostoxin) (CRIN 2019). Still, some farmers have yet to comply with the usage of approved pesticides and still use the banned ones on their cocoa farms up till date (Kehinde, Tijani, 2021a). This could be attributed to the fact that the approved pesticides might not correspond with the preferences of many of the farmers and thereby subsequently reduce the adoption rate of approved pesticides (Maligalig et al., 2018). Understanding why farmers use a particular pesticide over others in cocoa production shifted our focus to 'preference'. Preference means selecting something over another. Preference is a model of how farmers behave to purchase farm input. A farmer has a set of preferences and values that determine the purchasing of farm inputs. In other words, farmers make decisions to buy a product based on a price that is worth it with the product to obtain good satisfaction.

Farmers' acceptance and their ability to use them properly are dependent on their preferences for attributes of those varieties (Kehinde et al., 2022). However, little is known of the value that the farmer places on the approved pesticides. Although approved pesticides may be high-yielding and leave minimal residue in the cocoa beans, farmers may not like them unless they have some traits that farmers consider important (Phetoe, 2023). Specifically for cocoa pesticides, such a bundle of traits may include safety, approval, ease of use, availability, and price. Nevertheless, approved pesticides are often too expensive for smallholder farmers, and their financing requires a large volume of money, which is mostly not readily available to smallholder cocoa farmers (Kehinde, 2022). So, they stick to old pesticides that are easily accessible through exchange and in the case of local purchase, the price is relatively lower than that of new pesticides (Zerbo, 2014; Kehinde, Tijani, 2021b). In addition, past research efforts have established that smallholder cocoa farmers are resource-poor and credit-constrained from financial institutions (Ogunjimi et al., 2017; Kehinde, Ogundeji, 2022a; Kehinde et al., 2024). Access to credit facilities in the form of loans to the farmers would probably resolve the above-mentioned problems (Obuobisa-Darko, 2015; Oke et al., 2019). Agricultural organization provides a unique way of improving farmers' access to credit, especially when other means fail (Kehinde et al., 2021; Akinola et al., 2023). Furthermore, an agricultural organization is a group of people with different characteristics that allow its members to benefit from financial gains (Ayanwale et al., 2023). Through these organizations, farmers could pool their limited resources together to improve their preference for approved pesticides (Ogunleye et al., 2020; Kehinde et al., 2022; Ayanwale et al., 2024). Aside from financial gains, cooperatives play key roles in the dissemination of extension services using group approaches, increasing access to input services as well as the exchange of ideas and educational opportunities through adult education programs. The agricultural organization provides its members with information to guide their preference for pesticides that otherwise would have been difficult to obtain if they were non-members. Interestingly, several studies have shown that some agricultural organizations are influencing agricultural technology adoption (Abebaw, Haile, 2013; Ma, Abdulai, 2019; Ma et al., 2018; Verhofstadt, Maertens, 2014; Wossen et al., 2017). Despite the rich literature on the relationship between agricultural organizations' membership and technology adoption, what has been less clear so far in empirical terms is how agricultural organization membership affects the farmers' preference for improved technology like approved pesticides

Accordingly, farmers may have an interest in utilizing cooperative services to motivate their preference for pesticides, such as in much of Nigeria (Wainaina et al., 2018). To the best of our knowledge, no empirical studies have systematically investigated the impact of agricultural organization membership on farmers' preference for improved technology like approved pesticides. Based on this premise, this study was designed to assess the impact of membership in agricultural organizations on cocoa farmers' preferences for approved pesticides in Southwestern Nigeria. To this end, this paper specifically describes the socio-economic characteristics of cocoa farmers, evaluates cocoa farmers' preference for approved pesticides and determines the effect of membership in agricultural organizations on cocoa farmers' preferences for approved pesticides. The findings of this study have important implications for policymakers in Nigeria in their efforts to boost cocoa productivity and enhance the food security and income of cocoa farmers by enhancing the adoption of approved pesticides through membership in agricultural organizations. This paper contributes in the following ways. Firstly, to the best of our knowledge, this is the first to provide empirical evidence of the preferences for approved pesticides, which is lacking in most studies on preference. Secondly, unlike previous studies, we employed ordered probit regression models to investigate the effect of membership in agricultural organizations on cocoa farmers' preferences for approved pesticides. The study provides useful insights for enhancing the uptake of approved pesticides in the cocoa farming subsector in Nigeria while accounting for selection bias in the dataset. The following section presents the description of data and empirical models, followed by the presentation of results and discussions in Section 3. Section 4 concludes.

MATERIAL AND METHODS

Description of the study area

The study was conducted in the Osun and Ondo States of Southwestern Nigeria, which are based predominance of cocoa production. Osun state is located in southwestern Nigeria and lies within latitude 7.0°

and 9.0° N, and longitude 2.8° and 6.8° E (Fig. 1). The State covers a total land area of approximately 8,602 km2 with an estimated population of 4,137,627 (N P C , 2006) and lies between 300 and 600 m above sea level with a largely gentle and undulating landscape. The average rainfall ranges from 1125 mm in the derived savannah to 1475 mm in the rainforest belt. The mean annual temperature ranges from 27.2°C in June to 39.0°C in December. The major occupation of the people in the Osun State is farming both food and cash crops (A d a m u , 2014). The soil types are varied but mostly contain a high proportion of clay and sand and are mainly dominated by laterite. The area is mainly agrarian. Food crops grown in the area include maize (*Zea mays*), yam (*Dioscorea*spp.), cassava (*Manihotesculenta*), cocoyam (*Colocasia*spp.), rice (*Oryza sativa*) and vegetable (*Amaranthus* spp.). The cash crops include cocoa (*Theobroma cacao*), kola nut (*Cola nitida*), and oil palm (*Elaeisguinensis*) (O l a w u y i et al., 2022).

Ondo State is located in southwestern Nigeria, with a total land area of approximately 15,500 square kilometres. The state lies between latitudes 50 45′ and 70 52′N and longitudes 40 20′ and 60 05′E (Fig. 2). The tropical climate of the state is broadly of two seasons: the rainy season (April- October) and the dry season (November – March) (O s o t u y i et al., 2021). Temperature throughout the year ranges between 21^{o}C to 29^{o}C, and humidity is relatively high. The climate of Ondo State is of the Lowland Tropical rainforest type, with distinct wet and dry seasons (O n y e k u r u , 2014). In the south, the mean monthly temperature is 27^{0}C, with a mean monthly range of 20^{0}C, while the mean relative humidity is over seventy-five percent (>75%). However, in the northern part of the state, the mean monthly temperature and its range are about 30^{0}C and 6^{0}C, respectively. The mean annual total rainfall exceeds 2000 millimetres. The state economy is agrarian with large-scale production of Cocoa, oil palm, rubber, citrus, and cashew are tree crops that offer the best potential while rice, maize, cassava, sugar cane, yams, plantains, pineapple, and vegetables such as tomato and pepper are valuable food crops that thrive in the state. The main source of revenue for the region is cocoa. Ondo State is indeed the core of the Nigerian cocoa belt, accounting for over 60% of Nigeria's annual cocoa output.

Sampling Procedure

A multistage sampling procedure was employed in selecting respondents for the study. This paper is based on a farm household survey, and the data collected were for the 2021/2022 cropping season. The data was collected between October 2021 and March 2022 through personal interviews. The first stage involved a purposive selection of Ondo and Osun States in Southwestern Nigeria based on the predominance of cocoa production in the State. The second stage was a purposive selection of four LGAs based on their involvement in the use of pesticides in cocoa production. The LGAs are Idanre, Ile-oluji/Okeigbo, Owo and Bolorunduro LGAs in Ondo State, and Ife East, Ife South, Ayedaade, and Atakunmosa East LGAs in Osun State. The third stage was a simple random selection of five villages in each of the LGAs to make a total of forty villages based on the predominance of cocoa production. Using power calculation, a simple

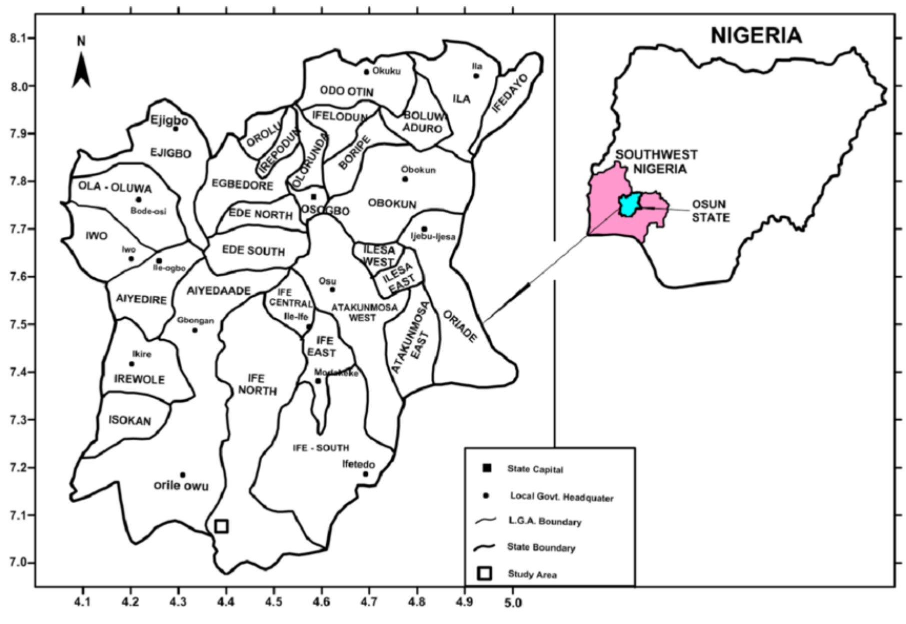

Fig. 1. Map of Osun State showing the local government areas

Source: Google map

random sampling technique was used to select not less than 200 cocoa farmers in the chosen LGAs.

To ensure representativeness and due to the limited budget, a simplified formula Eq. (1), developed by Kothari (2004) was used to calculate the sample size of the respondents at the community level. A 95% confidence level, 5% estimated percentage, and P = 0.5 were assumed in the equations.

$$n = \frac{Z^2 X_p X_q X N}{e^2 X (N-1) + Z^2 X_p X_q} \quad (1)$$

where n is the sample size, N is the population size, e is the estimated proportion, p is the sample proportion, $q = 1 - p$, and z is the value of the standard variate at a given confidence level. Based on this formula, the respondents' sample size is approximately 200 respondents. This total number of farmers were selected from the Cocoa Farmers Association of Nigeria (CFAN) lists using a simple random sampling technique.

Table 1. Attributes and levels

Attributes	Levels
Price	High Low
Availability	Imported Local
Efficacy	High Low
Ease of use	Simple Difficult
Approval of use	Recommended Banned
Safety	Harmful Harmless

Source: Author's compilations

Analytical framework

Data collected were analyzed with the aid of descriptive statistics, metric conjoint analysis, and the ordered probit regression model.

Metric conjoint analysis

Metric conjoint analysis was used to determine the preference for approved pesticides among cocoa farmers, given the bundle of attributes. The model chosen for this study was chosen because it allows one to estimate consumer preferences for a product by aggregating part-worth utilities for each attribute, which helps researchers understand how consumers form preferences for various goods and services (Bonilla, 2010; Kehinde, Tijani, 2021b). The model is built on the assumption that consumers make complex decisions based not on one feature or attribute at a time, but on several features jointly. Six major attributes were picked due to their prevalence and influence on farmers (Table 1). The first step in

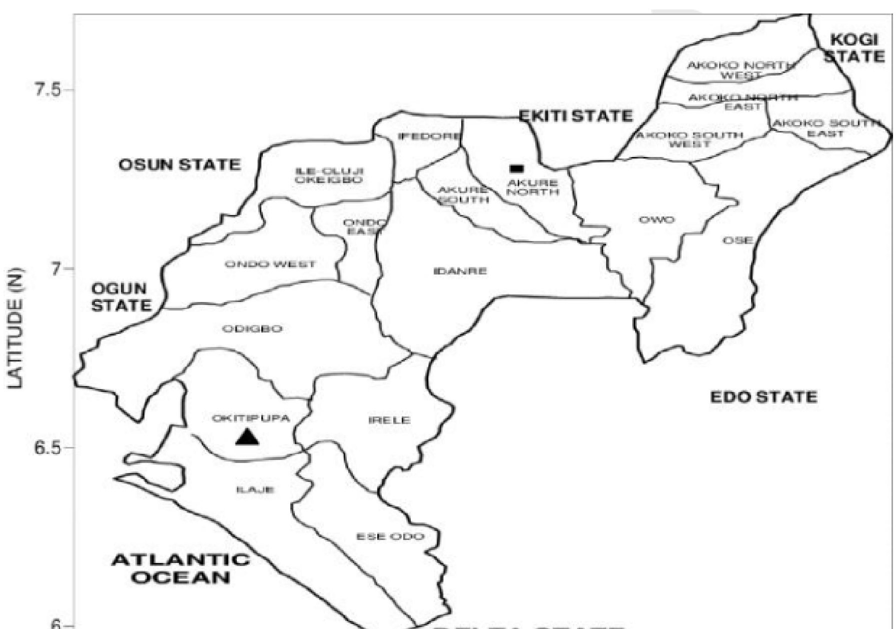

Fig. 2. Map of Ondo State showing the local government areas

Source: Google map

Table 2. Description of variables

Variables	Unit	Expected sign	Description	Studies
Age	Year	+	Measured in years	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Gender	Dummy	+	1= male 0= female	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Marital Status	Dummy	+	1= if a farmer is married 0= otherwise	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Household size	Number of persons	+	Measured in the number of household members	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Religion	Dummy	+	0= Traditional; 1= Abrahamic religion	Kehinde, Tijani, 2021a; Kehinde et al., 2022
Farm size	Hectares	+	Measured in hectares	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Education	Years spent in school	+	Measured in years spent in school	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Farming experience	Years spent in farming	+	Measured in years spent in farming	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Membership in an agricultural organization	Dummy	+	1= if the farmer belongs to a cooperative 0= otherwise	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023
Access to credit	Dummy	+	1= Access; 0= otherwise	Kehinde, Tijani, 2021a; Kehinde et al., 2022; Faloni et al., 2022; Kolapo et al., 2022; Oyenpemi et al., 2023

a conjoint study is to determine the attributes and levels. The selected attributes in this study were obtained from focus group discussions of farmers, a literature review, and results from previous focus group discussions of similar studies (Kehinde et al., 2022). The obtained attributes were compared for the most competitive brands (Agbas, Ceballos, 2019). Price was required as part of the experiment to determine the preference for pesticide use. Current market prices for pesticides available in the market were considered to determine the levels. The most important attributes of consumer choice other than price were efficacy, availability, ease of use, approval of use, and safety. The levels of each attribute are described in Table 1. For price, high and low levels were taken as the two major levels because of variations in the price of pesticides and to ensure convenience. High and low were selected for efficacy because the pesticides' efficacy in terms of concentration of the contained active ingredients can either be high or low. In terms of availability, pesticides were classified as locally available or imported. For approval for use, it can be recommended or banned. Lastly, pesticides were classified as harmful or harmless for Safety. A statistical tool for social sciences was then utilized to create a plan card using the orthogonal array method based on the attributes. These plan cards are made up of traits, and there are 64 ways to combine these attributes, including holdouts. Choosing attribute combinations, on the other hand, results in a complete set of stimuli that a respondent cannot assess at once. Overwhelming information could result from this, which would ultimately make the respondent's preference rating less accurate.

Metric conjoint analysis models the judgments directly. The metric conjoint analysis was also used to determine partial utilities ('part-worths') for all factor values based on the ranked data. The attributes are the independent variables, the judgments comprise the dependent variable, and the part-worth utilities are the β's, the parameter estimates from the model.

The following formula shows a metric conjoint analysis model for three factors:

$$y_{ijk} = \mu + \beta_{1i} + \beta_{2j} + \beta_{3k} + ijk \tag{2}$$

where $X\beta_{1i} = X\beta_{2j} = X\beta_{3k} = 0$ (3)

The predicted utility for the product is:

$$\hat{y}_{ijklmn} = \hat{\mu} + \hat{\beta}_{1i} + \hat{\beta}_{2j} + \hat{\beta}_{3k} + \hat{\beta}_{4l} + \hat{\beta}_{5m} + \hat{\beta}_{6n} \tag{4}$$

This model investigates cocoa farmers' preference for approved pesticides based on six attributes, such as Efficacy, price, ease of use, availability, safety, and approval. The y_{ijk} term is one subject's stated preference for cocoa pesticides with the ith level of efficacy, the j^{th} level of price, and the k^{th} level of easy to use, l^{th} level of availability, m^{th} level of safety, and n^{th} level of approval. The grand mean is μ, and the error is ijklmn.

The following formula shows a metric conjoint analysis model:

$$\Phi(\hat{y}_{ijklmn}) = \hat{\mu} + \hat{\beta}_{1i} + \hat{\beta}_{2j} + \hat{\beta}_{3k} + $$

$$+ \hat{\beta}_{4l} + \hat{\beta}_{5m} + \hat{\beta}_{6n} + ijklmn \tag{5}$$

where $\Phi(y^{ijk})$ designates a monotonic transformation of the variable y; The thresholds μ shows the range of the normal distribution; β represents the effect of changes in explanatory variables.

Ordered probit regression model

The ordered probit regression model was used to determine the impact of membership in agricultural organizations on cocoa farmers' preference for approved pesticides. The rationale for selecting the model is that the attributes of the approved pesticides are ranked in order of their preferences, with price being the most preferred among other attributes. 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 5, and thus, an ordered probit model is used. In statistics, ordered probit is a generalization of the popular probit analysis to the case of more than two outcomes of ordinal dependent variables. The ordered probit model has a dependent variable of ordered categories.

The ordered probit uses the following form:

$$y^* = \beta X_i + \in \tag{6}$$

Where:
y^*= the exact but unobserved dependent in ordinal categories, which were coded as 0, 1, 2,..., j. ; X_i = the vector of independent variables, β = the vector of regression coefficients, and ∈ = the error term, which is assumed to be normally distributed (zero mean and unit variance) with distribution denoted by Φ (.). The response of category j is thus observed when the underlying continuous response falls in the j-th interval as:

$$\begin{aligned} y^* &= 0, \ if\ y^* < 0 \\ y^* &= 1, \ if\ 0 < y^* < 1 \\ y^* &= 2, \ if\ 1 < y^* < 2 \\ y^* &= 3, \ if\ 2 < y^* < 3 \\ y^* &= 4, \ if\ 3 < y^* < 4 \\ y^* &= 5, \ if\ 4 < y^* < 5 \end{aligned} \tag{7}$$

where, Y* (i = 0, 1, 2, 3, 4, 5) are the unobservable threshold parameters that were estimated together.

The model is implicitly expressed as

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 +$$

$$+ \beta_5 X_5 + \cdots + \beta_{10} X_{10} \tag{8}$$

Y= Preference (0=Safety; 1= Approval; 2=Ease of use; 3= Availability; 4=Efficacy; 5=Price)

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= Abrahamic religion); X_6= years of formal Education; X_7= Years of farming experience; X_8= farm size (hectare); X_9= membership of agricultural organization (1=member; 0= otherwise); X_{10}= access to credit (1= Access; 0= otherwise); Ui= error term. This study incorporates the independent variable based on the review of existing literature (Table 2).

RESULTS

Socio-economic characteristics of cocoa farmers

The socio-economic characteristics of the respondents are presented in Table 3. The average age of cocoa farmers is 45 years, and many of the farmers (51 percent) fall within the age bracket of 20 years and 40 years. The findings revealed that the majority of the cocoa farmers involved in the industry are young, which could have a positive impact on the use of approved pesticides in cocoa production. This finding supports the findings of Akintelu et al. (2019) and Adeyemo et al. (2020). Cocoa cultivation is a male-dominated activity in the study area (71 percent). The predominance of male farmers in cocoa cultivation can be attributed to the significant demands of time and effort required in such a business. This finding confirms the findings of Agom et al. (2012) and Lawal et al. (2016). Many of the respondents (80 percent) were married. This suggests

Table 3. Socio-economic Characteristics of Cocoa Farmers

Variables	Cocoa Farmers
Age (%)	
20-40	50.6
41-60	37.4
Above 60	12.0
Total	100.0
Mean	44.84
Male (%)	71.14
Married (%)	79.5
Household size (%)	
1-3	23.0
4-7	65.0
>8	12.0
Total	100.0
Formal education (%)	81.3
Farm size (%)	
Small-scale	92.8
Large-scale	7.2
Agric. organization (%)	60.4
Access to credit (%)	66.7

that cocoa farmers have sufficient responsibilities that might require their dedication to their chosen line of work to maintain a steady stream of money to meet their family's demands. This could have an impact on their choice to use approved pesticides to increase their income. This concurs with Sowunmi et al. (2019) and Aminu, Edun (2019), who discovered that many cocoa farmers were married. This study suggests that literate farmers (74 percent) are involved in cocoa farming in the study area. This suggests that they will be able to understand and use new technology to boost productivity, profitability, and efficiency, such as using approved pesticides. The outcome corroborated reports indicating average cocoa farmers were literate from Oluyole, Sanusi (2009), Lawal et al. (2016), Adeyemo et al. (2020). Most of the farmers (65 percent) have a household of four to seven people. This is typical of the extended family system in the field of study, in which parents, children, and relatives all live in the same house. As a result, this could imply that the farmers use family labor to lower production costs and improve their income. This conclusion is consistent with the findings of Sowunmi et al., (2019). Most farmers (67 percent) have access to credit in the study area. This means that cocoa farmers may be able to obtain the approved pesticides to improve their output. This study further revealed that many cocoa farmers (88 percent) operate at a small-scale level, according to the study of Oluyole, Taiwo (2016), Taphee et al. (2015). A large percentage of farmers (61 percent) belong to an agricultural association to access information about currently approved pesticides. This concurs with Onubuogu et al. (2014).

The estimated cocoa farmers' preferences for approved pesticides

The results of the conjoint analysis of cocoa farmers' preference for approved pesticide attributes are presented in Table 4. Price is the most preferred attribute, which contributes 3.30 of the total utility (11.548), and low price is preferred by the farmers. Efficacy denotes the effectiveness or potential of a particular pesticide. The attribute contributes 2.968 of the total

Table 4. Part-worth or utility estimate of pesticide attributes

Attributes	Levels	Utility estimate	Utility range	Importance (%)
Price	High	-1.650	3.30	23.084
	Low	1.650*		
Efficacy	High	1.484*	2.968	22.411
	Low	-1.484		
Availability	Imported	0.334*	0.668	8.839
	Local	-0.334		
Ease of use	Simple	-1.453	2.906	20.559
	Difficult	1.453*		
Approval	Recommended	*0.647	1.294	10.610
	Banned	-0.647		
Safety	Harmful	-0.519	1.038	14.496
	Harmless	0.519*		

* represents the most preferred attribute level

utility, and the category of preferred efficacy is high. Cocoa farmers prefer pesticides that are difficult in terms of use, and the attribute contributes 2.906 of the total utility. Whether pesticides are banned or recommended will only be of interest to cocoa farmers after the above attributes have been taken into consideration. The utility estimate shows a preference for the recommended pesticides with a utility value of 1.294. Ranked next in the preference order to the cocoa farmers is safety (which contributes 1.038 of the total utility of 11.548). The least preferred is the availability, and it constitutes 0.668 of the total utility of 11.548. Overall, the result indicates that the preference range that would deliver the most utility to pesticide users(farmers) would include product attributes such as reduced price (1.650), high efficacy (1.484), ease of use (1.453), harmless (0.519) and imported (0.334). Producers that deliver pesticides within the stated preference range would have successfully delivered a utility of 10.254 out of 11.548. This concurs with the findings of Kolapo et al. (2022).

Furthermore, Pearson's R^2 and Kendall's tau values were used to assess the validity and reliability of the estimates of the conjoint model. The values of Pearson's R^2 (0.958) and Kendall's tau (0.929) were reasonably high. The values suggest a strong correlation between the averaged variety attribute ratings and the predicted utilities from the conjoint analysis model. This finding supports the report of Oyatoye et al. (2013), Agbas, Ceballos (2019), and Kehinde, Tijani (2021b) that Pearson's R^2 and Kendall's tau values near one indicate a strong correlation between the average variety attribute ratings and the predicted utilities from the conjoint model (Table 5).

Table 5. Correlations between observed and estimated preferences

Correlation	Value	Sig.
Pearson's R	0.958	0.000
Kendall's tau	0.929	0.001

Impact of membership in agricultural organizations on cocoa farmers' preference for approved pesticides

The effect of an agricultural organization on cocoa farmers' preference for approved pesticides is presented in Table 6. Table 6 shows the results of the estimated ordered probit model. The chi-square statistics are statistically significant (Wald Chi2 (7) = 15.25; Prob > Chi2 = 0.000). From the Table, the age of respondents, gender, education, farm size, membership of the agricultural organization, and access to credit significantly influenced cocoa farmers' preference for approved pesticides. The age of the respondents had a negative and significant influence on the probability of cocoa farmers' preference for approved pesticides. Gender had a positive and significant influence on the probability of cocoa farmers' preference for approved pesticides. Education had a positive and significant influence on the probability of cocoa farmers' preference for approved pesticides. Farm size had a positive and significant influence on the probability of cocoa farmers' preference for approved pesticides. Membership in agricultural organizations had a positive and significant influence on the probability of cocoa farmers' preference for approved pesticides. Access to credit facilities had a positive and significant influence on the probability of cocoa farmers' preference for approved pesticides.

Table 6. Impact of membership in Agricultural Organization on cocoa farmers' Preference for approved pesticides

Preference	Coefficient	Marginal effect	Z-value	p>|z|
Age	-0.052	-0.016	-3.24	0.000
Sex	0.848	0.288	3.86	0.000
Religion	0.066	0.023	0.88	0.376
Household size	-0.079	-0.027	-0.22	0.827
Education	0.136	0.069	3.54	0.000
Cocoa farm size	0.026	0.005	2.04	0.003
Organization membership	0.957	0.257	3.65	0.000
Access to credit	0.642	0.152	2.99	0.000
Marital status	0.984	0.360	0.78	0.943
Years of farming experience	0.298	0.064	0.49	0.813
Constant	0.430		2.49	0.020

Number of observations = 200; LR chi^2 (7) = 15.25; Prob > chi^2 = 0.0843; Pseudo R^2 = 0.1191; Log likelihood = -56.408183.

DISCUSSION

This study shows that many of the respondents were male adults, mature, energetic, educated, married, and enterprising. However, cocoa production takes place in smallholdings in the study area, but the farmers have enough hands to serve as family labor for their farm operations. Furthermore, the farmers had organized themselves into agricultural organizations and had significant access to credit. These findings are consistent with the findings of Popoola et al. (2015), Kehinde et al. (2016), Kehinde, Adeyemo (2017), Lawal et al. (2016), Abidogun et al. (2019), Awoyemi, Aderinoye-Abdulwahab (2019), Alao et al. (2020), Adeyemo et al. (2020).

Price is the most preferred attribute, and low price is preferred by the farmers. This indicates that price is the most important factor that attracts pesticide buyers. With a relatively low price, buyers would buy a particular pesticide in the market. After price, cocoa farmers want pesticides with a high level of efficacy. Efficacy denotes the effectiveness or potential of a particular pesticide. This suggests that farmers' preference is also dependent on the high level of pesticide efficacy. The next attribute of efficacy is the ease of use, which denotes the ability to handle or use a particular pesticide. The most striking thing is that cocoa farmers prefer pesticides that are difficult in terms of use. This can be explained by the high level of literacy among the farmers in the study area. It shows that whether a pesticide is simple or difficult in terms of use, farmers do not care since many of them can read and understand the information on the labels of the pesticides. Whether a pesticide is banned or recommended, the utility estimate shows a preference for the recommended pesticides. Safety denotes how harmful or hazardous a pesticide is to the farmers, the environment, or consumers. Farmers preferred harmless pesticides. The least preferred is the availability in this study, which denotes how accessible a pesticide is; pesticides generally can be obtainable either locally or imported. Farmers show a higher preference for imported pesticides because of the trust they have in them. Most farmers in the study area prefer pesticides such as Ridomine, which is made in Ghana. Overall, the result indicates that the preference range that would deliver the most utility to pesticide users (farmers) would include product attributes such as reduced price (1.650), high efficacy (1.484), ease of use (1.453), harmless (0.519) and imported (0.334). The result of Pearson's R^2 and Kendall's tau showed that there is an acceptable level of correlation between profiles and preferences. These findings concur with the reports of Kolapo et al. (2022), Kehinde, Tijani (2021a), Aminu et al. (2019), Aminu, Edun (2019), Issa (2016).

Age of respondents, gender, education, farm size, membership in the agricultural organization, and access to credit significantly influenced cocoa farmers' preference for approved pesticides. The negative relationship between the age of the respondents and the probability of cocoa farmers' preference for approved pesticides could be attributed to the fact that older farmers are more conservative and risk-averse than young farmers. Younger farmers undertake risk and tend to prefer new technologies to old ones. Further, young farmers tend to adopt the best method and technology that is perceived to increase their yield. This finding is in line with Tran et al. (2020). However, this result disagrees with Beshir (2014), Akinnagbe (2017), Denkyirah et al. (2016), Danso Abbeam et al. (2019), Fosu-Mensah et al. (2022). The positive relationship between gender and the probability of cocoa farmers' preference for approved pesticides shows that male farmers have a high preference for approved pesticides. Generally, the assumption is that male farmers predominate cocoa production due to the stress involved in cocoa production. Interestingly, male farmers are tired of the stress and tend to prefer new technologies that would reduce the stress involved in cocoa production. In addition, male farmers have the resources and information to prefer new technologies to female farmers due to socio-cultural barriers in African countries. This agrees with Diiro et al. (2015), Danso-Abbeam, Lloyd (2017). The positive relationship between education and the probability of cocoa farmers' preference for approved pesticides shows that literate farmers have a high preference for approved pesticides. This may be explained by the fact that education improves farmers' capacity to understand information about emerging technology, and as a result, educated farmers are more likely to favour new technologies. According to Lipnevich et al. (2016), education should generally encourage a positive outlook on innovations and practices. It enhances farmers' capacity to obtain, evaluate, comprehend, and use data regarding the adoption of agricultural innovations (Workineh et al., 2022). Because they have an education, farmers will be able to see the value of innovation, such as the usage of approved pesticides. This is consistent with the findings of Denkyirah et al. (2016). The positive relationship between farm size and the probability of cocoa farmers' preference for approved pesticides shows that cocoa farmers with large farms have a high preference for approved pesticides. This may be explained by the fact that vast farms enable the testing of new technologies without jeopardizing the farmers' income or the food security of their families. The study's findings support the hypothesis that large-scale farmers are more likely to favour authorized pesticides. The results corroborate those of Danso-Abbeam et al. (2019) and Mwangi, Kariuki (2015). Additionally, the study by Kehinde, Tijani (2021) suggests that a positive correlation between farm size and the choice of approved pesticides could be explained by the fact that larger farms can diversify their economies more than smaller ones, which increases their revenue. As a result, cocoa-producing households with vast farms are rich enough and have enough farmland to invent new ways to produce cocoa. Membership in agricultural organizations has a positive influence on the probability of cocoa farmers' preference for approved pesticides. This implied that most farmers who belong to agricultural organizations have a high preference for approved pesticides. Being a member of an agricultural organization allows interaction in terms of information and ideas among members. This helps a member of the agricultural organization to prefer new technologies. A farmer's perspective on innovation may be positively altered by joining an agricultural group, which also exposes them to a variety of views and occasionally provides them with improved access to information through extension and training programs. This research suggests that through seminars, workshops, training sessions, and workshops for their members, agricultural organizations improve their members' awareness of the advantages of using approved cocoa pesticides. The outcomes of Kehinde, Tijani (2021a), Kehinde et al. (2018) are supported by this result. Access to credit facilities influences the probability of cocoa farmers' preference for approved pesticides. This implies that farmers who have access to credit facilities have a high preference for approved pesticides. Due to the investment nature of cocoa enterprises, assessing credit is the main source of funds for maintaining cocoa farms. Hence, the amount of credit accessed would increase the purchasing power of farmers. The purchasing power of farmers would encourage their preference for new technologies. This suggests that access to credit enables farmers to use approved cocoa pesticides. This result corroborates the findings of Sebopetji, Belete (2009), Denkhyirah et al. (2016), Sharifzadeh et al. (2018) that accessing financial support helps smallholder farmers to invest in farm inputs such as pesticides for cocoa production.

CONCLUSION

This study investigated the impact of membership in agricultural organizations on cocoa farmers' preferences for approved pesticides in Southwestern Nigeria. A multistage sampling procedure was used to obtain data for the study. Data were analyzed using descriptive analysis, conjoint analysis, and the ordered probit regression model. This study revealed that farmers in the study area would buy pesticides that are cheap in terms of price, with high efficacy, difficult to use, harmless, and imported. Membership in agricultural organizations, along with other socio-economic characteristics such as gender, age, and education among others significantly influenced cocoa farmers' preferences for approved pesticides. Based on the facts emerging from this study, it is therefore recommended that pesticides producing industries should find a way of producing pesticides that possess the following attributes namely; affordable price, and high efficacy in terms of effectiveness, it might be difficult in terms of use since they can read the instruction on the usage, harmless to the farmers, environment and the consumer of the cocoa products and imported in term of the source. Also, the Government and other organizations should disseminate this information about preference for approved pesticides through agricultural organizations. In addition, the establishment of more agricultural organizations, as well as the strengthening of the existing agricultural organizations, should be encouraged in southwestern Nigeria to increase the uptake of approved pesticides.

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