Multinomial Regression Analysis of Cowpea (*Vigna Unguiculata) Supply Response to* Consumers' Varietal Preferences in Delta State, Nigeria

Egbune, S. O, Achoja, F.O* & Edoja, P.E.

Department of Agricultural Economics, Faculty of Agriculture, Delta State University, Abraka, Nigeria

***Corresponding Author**

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ABSTRACT

Cowpea, commonly known as Beans is a vital protein source that goes with many varieties for consuming households in Nigeria. Empirical evidence is lacking on its consumers' preferences and varietal diversification as drivers of market supply patterns. This study analysed consumers' preferences for cowpea varieties and their effects on market-driven varietal supply patterns in Delta State, Nigeria. A multistage sampling procedure was used to select 120 cowpea consumers and 120 marketers across three Local Government Areas (viz: Ukwuani, Ughelli South, and Warri South). Primary data were collected with structured questionnaires and analysed using descriptive statistics, Multinomial Regression, Likert-scale, and t-test. Results showed that majority of the respondents, preferred Oloyin (Honey Bean) emerging as the dominant and most preferred variety (39.2%). This was followed by Ife Brown (22.7%) and White Beans (20.6%). The findings showed mean monthly household consumption was 14.47 kg did not differ significantly from the mean quantity supplied by marketers (15.62 kg) ($t = 1.3$, $p = 0.18$). It shows that the supply of Oloyin (honey beans) is responding positively to increasing market demand. Result of multinomial regression revealed that grain colour, taste, grain size and seasonal availability increased the likelihood of consumer varietal choices. Hypothesis testing indicated that consumer preference, price premium, trader numbers and income were significant determinants of cowpea varietal diversification. The study concludes that cowpea consumer preferences are the primary driver of market-driven varietal supply in Delta State, Nigeria. It recommends that breeders should align new varieties with key consumer choice indicators

Keywords: multinomial regression, cowpea (*vigna unguiculata), supply response,* consumers, varietal preferences, sensory attributes.

INTRODUCTION

Cowpea (*Vigna unguiculata*) is a major grain legume and the most important food legume in Nigeria, providing affordable protein to millions of households, especially in rural and low-income urban areas (FAO, 2024). Cowpea is the most important food legume in sub-Saharan Africa and the primary source of affordable plant protein for millions of low-income households (Boukar et al., 2019; IITA, 2023). Its protein-rich seeds provide valuable nutrition to people, including babies. Unlike many other legumes, cowpea's green leaves and immature pods are also edible as vegetables and they are rich in vitamins and minerals. Cowpea is important for food security and the livelihoods of millions of smallholder farmers who rely on it for economic and nutritional well-being (Bolarinwa, 2022). Cowpea contributes to the general improvement of the farmers' standard of living since it is grown for food, vegetables, fodder, green manure, and cover crops (Osipitan et al., 2021).

Nigeria remains the world's largest producer and consumer of cowpea, contributing over (3.5 million tonnes) annually, approximately 45% of global production followed by Niger (1.9 million tonnes), Burkina Faso (1.1 million tonnes), and Ghana (0.26 million tonnes) (FAOSTAT, 2025).

The average per capita consumption in West Africa ranges from 15–35 kg/year, with northern Nigeria recording the highest figures (up to 50 kg/year in some states), while southern zones generally report lower per capital cowpea consumption than the north, reflecting difference in income and dietary habits (FAOSTAT, 2025).

Cowpea, commonly called beans and black-eyed peas in Nigeria, comes in different varieties (Horn et al., 2022, Nkomo, 2021).



Oloyin (Honey) Beans *Ife Brown Beans* *White Beans*

Fig. 1: Varieties of cowpea.

The most important varieties of cowpea traded and consumed in Nigeria include Ife Brown, Sokoto White, Oloyin (honey bean), SAMPEA-14, SAMPEA-20, IT97K-499-35, IT89KD-288, Kanannado, and several local landraces (Boukar et al., 2019; Omoigui et al., 2024). Diversified cowpea varietal presence in markets and on farms is increasingly seen as an important strategy to address the sustainability challenges of the present-day agriculture, such as economic viability for farmers, resilience to pests and climate change, nutritional diversity, and social acceptability by consumers (Togola et al., 2023). The decision to stock or cultivate diverse cowpea varieties may be affected by consumer-based factors like seed coat colour, seed size, cooking time, swelling capacity, taste, and price variations.

Recent evidence from northern Nigeria shows that market-driven processes have contributed to a growing number of cowpea varieties traded in major markets, driven primarily by urban consumer demand for white-seeded and fast-cooking types (Omoigui et al., 2024). However, no similar study has been conducted in Delta State, where consumption patterns and income levels differ significantly, creating a critical knowledge gap that the present study to has filled.

Agricultural sustainability is no longer optional but mandatory. As the population continues to grow, and pressures on agricultural resources intensify, the unavailability of sufficient food in most of the region means the world suffers food insecurity (Michael Jahi Chappell, 2009). Cowpea (*Vigna unguiculata* (L.) Walp.) has many varieties that exist in the world, but information on the most preferred variety among consumers is still scanty and mostly outdated, especially in Delta State.

Despite the high nutritional and economic importance of cowpea (*Vigna unguiculata* (L.) Walp.), limited empirical evidence exists on consumers' preferences for grain quality attributes and how these preferences drive market-led varietal diversification, particularly in Delta State. Previous investigations on cowpea were mainly focused on the production stage to the neglect of post-harvest issues such as marketing, consumer preferences, and associated variables (Langyintuo et al., 2003; Mishili et al., 2009; Kuchida et al., 2022).

There is a lack of information on factors that determine consumers' preference for cowpea varieties in Delta State. While producers continue to focus primarily on yield and pest resistance, there is growing evidence that

consumer-preferred traits are the major determinants of market success of new varieties in West Africa (Asare et al., 2021). There is growing recognition that a deeper understanding of consumer preferences and an improved demand-led breeding and seed system are required to sustain the cowpea value chain and enhance food and nutrition security in West Africa (Langyintuo et al., 2003; Mishili et al., 2009; Omoigui et al., 2024).

Consumer preference is an important driver of agricultural production intensification, including export response (Asare et al., 2021). Consumer preference for some cowpea varieties could therefore stimulate variety-based supply responses and could lead to the extinction of less-preferred ones if no conscious effort is made to maintain diversity.

The broad objective of this study is to Analyze Cowpea (*Vigna unguiculata*) Consumers' Preferences and Effects on Market-driven Varietal Diversification Pattern in Delta State. The specific objectives are to;

i. elicit the varieties of cowpea available in markets in Delta State;

ii. identify the dominant variety of cowpea consumed by households;

iii. ascertain the quantity of cowpea consumed by households;

iv. assess the quantity of cowpea supplied by marketers;

v. evaluate the factors that influence cowpea varietal diversification among consumers; and

vi. estimate effects of consumer preferences for cowpea varieties in Delta State.

H_{o1}: There is no significant difference between the demand and supply of cowpea.

H_{o2}: There is no significant relationship between consumer preference and varietal diversification.

LITERATURE REVIEW

Conceptual Framework

This framework assumes a linear but interactive relationship:

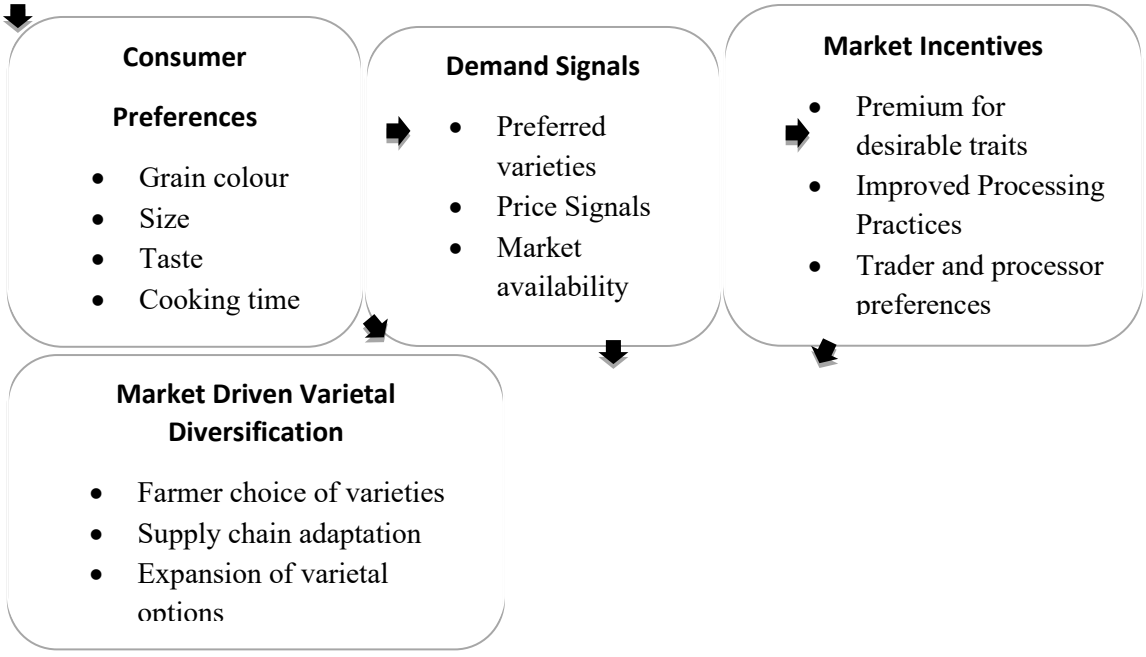


Figure 2: Conceptual framework of the study

Theoretical Framework

This study is based on three theoretical frameworks that aims to provide the intellectual foundation for analyzing and understanding how consumers preferences shape varietal diversification in agricultural market specifically cowpea (*Vigna unguiculata)* production in Delta state. These theoretical frameworks are; Theory of Supply Response and Theory of Consumer Behavior were reviewed to guide the study.

Theory of Supply Response

This study employs the theory of supply response as one of its theoretical frameworks to analyze how consumer preferences for cowpea varieties influence varietal diversification patterns in Delta State. The theory of supply response provides a systematic approach to understanding how agricultural producers adjust their production decisions in response to market signals, particularly price incentives generated by consumer demand patterns (Nerlove, 1958). This framework is particularly appropriate for examining the relationship between consumer preferences and varietal choice decisions, as it explicitly addresses the dynamic processes through which market-expressed preferences translate into observable production patterns over time.

The theory of supply response posits that farmers make production decisions based on expected profitability, which is fundamentally shaped by market prices, production costs, and risk considerations (Askari and Cummings, 1977). In the context of cowpea production in Delta State, this theoretical framework explains how farmers' decisions regarding which varieties to cultivate respond to consumer preference-driven price differentials and market demand signals. Understanding these response mechanisms is essential for predicting how sustained consumer preferences will affect long-term varietal diversification outcomes and for designing effective agricultural policies that balance market efficiency with genetic diversity conservation.

The theory of supply response originated from agricultural economics research examining how farmers in developing countries respond to price incentives. Marc Nerlove's (1958) seminal work established the foundation by demonstrating that agricultural supply decisions are inherently dynamic rather than static. Farmers base their current production decisions not only on current prices but also on past price experiences and expectations about future market conditions. This dynamic specification recognizes the fundamental time lags between planting decisions and harvest outcomes that characterize agricultural production systems. This relationship can be conceptualized as:

$$Q_{it} = f(P^{e}_{it}, C_{it}, T_{it}, R_{it}, Z_{it})\text{----------eqn 2.1}$$

Where:

Q_{it} = desired supply of variety i at time t

P_{it} = expected price for variety i

C_{it} = production costs

T_{it} = technology factors

R_{it} = risk considerations

Z_{it} = other relevant factors (institutional, policy, environmental)

However, actual supply may differ from desired supply due to adjustment costs, information constraints, and institutional rigidities. This leads to the partial adjustment mechanism central to dynamic supply response models (Nerlove, 1958):

$$Q_{it} - Q_{it-1} = \lambda(Q_{it} - Q_{it-1})\text{----------eqn 2.2}$$

Where λ represents the coefficient of adjustment ($0 < \lambda \leq 1$). When $\lambda = 1$, adjustment is instantaneous; values closer to zero indicate slower adjustment processes common in agricultural systems with significant switching costs.

Application to Cowpea Varietal Choice in Delta State

Applying supply response theory to cowpea varietal diversification requires adapting the framework to address the specific characteristics of variety selection decisions. Unlike simple quantity responses to aggregate commodity prices, varietal choice involves discrete decisions among multiple alternatives, each with distinct characteristics valued differently by consumers and possessing different agronomic properties (Smale et al., 2001).

In Delta State, farmers choose among multiple cowpea varieties characterized by attributes such as seed color (white, brown, cream), seed size (small, medium, large), cooking time, yield potential, disease resistance, and drought tolerance. Consumer preferences, manifested through variety-specific market prices and demand patterns, create differentiated economic incentives that influence these varietal choices. Supply response theory predicts that varieties commanding higher market prices due to strong consumer preferences will expand their cultivation share over time, while varieties with weaker consumer acceptance will contract or potentially disappear from production systems (Langyintuo et al., 2003). The supply response framework applied to varietal choice can be conceptualized through a discrete choice model. The probability that farmer j chooses to cultivate variety i at time t depends on the expected utility (profit) associated with that variety relative to alternatives:

$U_{ijt} = V_{ijt} + \varepsilon_{ijt}$----------eqn 2.3

Where U_{ijt} represents the utility farmer j expects from variety i, V_{ijt} is the systematic component determined by observable characteristics (expected price, yield, production costs, risk), and ε_{ijt} captures unobserved factors. Farmer j selects variety i if it provides higher expected utility than all alternative varieties. Aggregating individual farmer decisions generates market-level supply response for each variety. The total area allocated to variety i depends on the proportion of farmers finding that variety most profitable among available options. This aggregation process links micro-level farmer decisions to macro-level varietal diversification patterns observable in Delta State's agricultural system.

Price Expectations and Adaptive Behavior

A critical component of supply response theory concerns how farmers form price expectations that guide their production decisions. Nerlove (1958) proposed the adaptive expectations mechanism, whereby farmers update their price expectations based on observed price realizations:

$P^e_{it} - P^e_{it-1} = \theta (P_{it-1} - P^e_{it-1})$---------- eqn 2.4

Where:

P^e_{it} = expected price for variety i in period t

P_{it-1} = observed price in the previous period

θ = coefficient of expectation adjustment ($0 < \theta \leq 1$)

This formulation implies that farmers revise their expectations by correcting a fraction of the previous period's expectation error. In the Delta State context, adaptive expectations suggest that sustained consumer preferences manifested through consistently higher prices for specific varieties (such as white-seeded types) progressively reinforce farmer expectations that these varieties will remain more profitable. Over multiple growing seasons, these expectations solidify, leading to more definitive production shifts toward preferred varieties (Askari and Cummings, 1977). The expectation formation process directly influences the speed and

magnitude of supply response to consumer preference signals. Farmers who learn quickly and form accurate expectations will adjust their variety choices more rapidly, accelerating varietal diversification changes. Conversely, information constraints or uncertainty about the permanence of consumer preferences may slow responses, allowing greater variety diversity to persist despite strong market signals favoring particular varieties.

Risk and Portfolio Considerations

Supply response theory extends beyond simple profit maximization to incorporate risk considerations, which are particularly relevant to varietal choice decisions. Farmers typically face multiple sources of uncertainty including price variability, yield risk from weather and pest pressures, and market demand fluctuations (Just and Pope, 2002). Variety selection represents a risk management strategy, with diversity across varieties potentially reducing overall farm income variability.

Expected utility theory provides the foundation for incorporating risk into supply response models. Risk-averse farmers maximize expected utility rather than expected profit:

$E[U(\pi)] = E[U(\Sigma_i P_i \cdot Y_i \cdot A_i - \Sigma_i C_i \cdot A_i)]$---------- eqn 2.5

Where:

$U(\cdot)$ = utility function (concave for risk-averse farmers)

π = profit

P_i, Y_i = stochastic price and yield for variety i

A_i = area allocated to variety i

C_i = production costs for variety i

Okello et al. (2018) found that education level, income, and urban residence were strong predictors of preferences for improved vegetable varieties in East Africa, with more educated and affluent consumers placing higher value on nutritional attributes and quality characteristics. Similarly, Sawadogo et al. (2020) documented significant socioeconomic differentiation in cowpea consumption patterns across West African countries, with urban households consuming more diverse varieties and exhibiting stronger preferences for convenience attributes.

Theory of Consumer Behavior

Consumer behavior theory provides a fundamental lens for understanding how individuals make purchasing decisions in agricultural markets. This theoretical foundation is particularly relevant for analyzing cowpea consumption patterns in Delta State, as it explains the underlying mechanisms through which consumers evaluate, select, and purchase agricultural products based on their preferences, constraints, and market conditions (Kotler and Keller,2016).

Consumer Preference Formation

Consumer preferences for agricultural products are shaped by multiple factors including sensory attributes, cultural traditions, nutritional awareness, and previous consumption experiences. Preference heterogeneity across consumers creates market segmentation opportunities and drives demand for varietal diversity in agricultural markets.

Recent studies have highlighted the multidimensional nature of consumer preferences for legumes in African markets. Banful et al. (2022) found that urban consumers in West Africa exhibit distinct preference patterns for

cowpea attributes compared to rural consumers, with urban households placing higher value on convenience attributes such as reduced cooking time and pre-processing.

MATERIALS AND METHODS

Study Area

The study was conducted in Delta State, Nigeria. Delta State lies between latitudes 5°00′ and 6°30′N and longitudes 5°00′ and 6°45′E. The state has a land area of about 18,050 km² and is divided into three agricultural zones: Delta North, Delta Central, and Delta South. The state has 25 Local Government Areas (LGAs) and is characterized by a tropical climate with distinct wet and dry seasons. The major occupation of the people is farming, fishing, and trading. Cowpea (*Vigna unguiculata*) is one of the major grain legumes cultivated and widely consumed in the state, especially in the Delta North (Anioma) and parts of Delta Central agro-ecological zones.

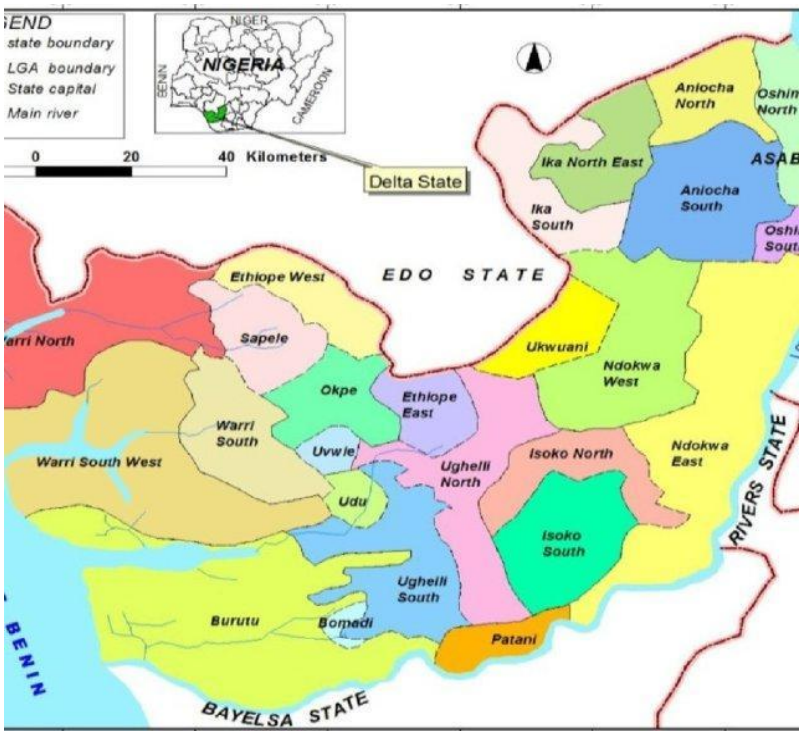


Figure 3: Map of Delta State showing different Local Government Areas

Sampling Procedure and Sampling Size

A multistage sampling procedure was used to select respondents for this study to ensure broad coverage and representativeness across the study area. In the first Stage, (3) Local Government Areas (LGAs) was selected across the study area using a stratified sampling technique. The Selected LGAs are; Ukwuani (represent key supply chains and consumption dynamics), Ughelli South (transitional dynamics) and Warri South (major urban consumption hub with high demand and supply from the north). These LGAs were selected because they capture variations in consumption pattern, varietal diversity, and market dynamics across the state's agro-ecological zones.

The second stage involved the purposive selection of four (4) communities within each of the selected LGAs. This purposive approach is necessary to target communities that are densely populated and are high consumers and marketers of cowpea. In each community, ten (10) cowpea consumers (buyers) and ten (10) cowpea marketers (sellers) was randomly selected, making a total of one hundred and twenty (120) cowpea consumers and one hundred and twenty (120) cowpea marketers. This yielded a total of 240 respondents (3 LGAs * 4 communities * 20 respondents (consumer and sellers), ensuring a fair and unbiased selection of participants involved in cowpea marketing and consumption.

Data Collection

Data for this study was generated from primary sources. Primary data was collected with the aid of a structured questionnaire from 240 respondents. The structured questionnaire contained questions relating to the specific objectives of the study. Section A contained the socio-economic characteristics of the cowpea consumers and marketers, section B contained questions relating to the varieties of cowpea available in Delta State, Section C contained questions relating to the dominant varieties of cowpea consumed by households Section D contained questions relating to the quantity of cowpea consumed by households, section E contained questions relating to the quantity of cowpea supplied by marketers and section F contained questions relating to the factors that influence cowpea varietal diversification among consumers, while Section G contained questions relating to long term effects of consumer preferences for cowpea varieties in Delta State.

Data Analysis

Descriptive (mean, percentage, table, charts) and inferential statistics (multinomial regression) was employed to analyze collected data. Factors that influence consumer preference for cowpea varieties was analyzed using a demand function derived from a multinomial regression model and effects of consumer preferences for cowpea varieties in Delta State was estimated using (likert scale).

Objective 1: The varieties of cowpea available in markets in Delta State was achieved using descriptive statistics (mean, frequency count, percentage).

Objective 2: The dominant variety of cowpea consumed by households was achieved using descriptive statistics (mode, mean and percentage).

Objective 3: The quantity of cowpea consumed by household was ascertained using descriptive statistics (mean, median).

Objective 4: The quantity of cowpea supplied by marketers was assessed using descriptive statistics (mean, mode).

Objective 5: The factors that influence cowpea varietal diversification among consumers was achieved using multinomial regression.

$$\mathbf{CP= B_0 + B_1P + B_2CT + B_3GS + B_4GC + B_5SA + B_6T + ei}$$ **---------- eqn 3.1**

Where;

CP = Cowpea Preference (Variety preferred by household)

P = Price per unit (₦)

CT = Cooking Time (Hours)

GS = Grain Size (g)

GC = Grain Color (White =1, 0 = Otherwise)

SA = Seasonal Availability (Peak Season=1, 0 otherwise)

T = Taste (Sweet =1, 0 = Otherwise)

B_0 = Intercept term/constant

B_1 - B_6 = Coefficients of parameter estimates

ei = Error term

Multiple regression model for cowpea varietal diversification (supply)

$$\mathbf{CS = B_0 + B_1CP + B_2PP + B_3MD + B_4NT + B_5CI + ei}$$

Where;

CS = Cowpea Supply

CP = Consumer Preference

PP = Price for preferred variety

MD = Market distance (km)

NT = Number of traders surveyed

CI = Consumer Income level

B_0 = Intercept

B_1 -B_5 = Coefficients

ei = Error term

Objective 6: The effects of consumer preferences for cowpea varieties in Delta State was estimated using (likert scale).

Where;

1= No influence

2= Slight influence

3= Strong influence

4= Very strong influence

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

This section presents the socioeconomic profiles of both cowpea consumer and marketer respondents surveyed across three Local Government Areas (LGAs) in Delta State: Ukwuani, Ughelli South, and Warri South. A total of 120 consumer respondents and 120 marketer respondents were interviewed. Understanding these characteristics is important because socioeconomic factors significantly influence both consumption behavior and marketing decisions in agricultural value chains (Sawadogo et al., 2020).

As presented in Table 1, the majority of consumer respondents were female, accounting for 62.5% (n=75) of the total sample, while males constituted 37.5% (n=45). This female dominance in cowpea consumption is consistent with the established role of women as primary household food purchasers and meal preparers in Delta State and across Nigeria (Oluwole et al., 2021). Women are typically the household nutritional gatekeepers and thus tend to be more involved in cowpea purchasing decisions.

Sex Distribution

Table 1: Sex Distribution of Consumer Respondents

Sex	Frequency	Percentage (%)
Male	45	37.5
Female	75	62.5
Total	120	100

Source: Field Survey, 2026

Among marketers, females were also dominant at 68.3% (n=82), with males comprising 31.7% (n=38). This finding corroborates the observations of Gaya et al. (2020) and Anthony et al. (2023), who noted the strong prevalence of female traders in cowpea markets across Nigerian states, reflecting the feminization of food retail trade. The dominance of women in both consumption and marketing suggests that gender-sensitive policies targeting women would be particularly effective in influencing cowpea market outcomes in Delta State.

Table 2: Sex Distribution of Marketer Respondents

Sex	Frequency	Percentage (%)
Male	38	31.7
Female	82	68.3
Total	120	100

Source: Field Survey, 2026.

Age Distribution

The age data in Table 3 reveal that the majority of both consumers (35.0%) and marketers (38.3%) were concentrated in the 31–40 years age group, followed by the 41–50 years cohort (25.0% and 28.3% respectively). The mean age of consumer respondents was 37.4 years, while that of marketers was 39.1 years. This suggests that cowpea consumption and trade in Delta State are dominated by economically active adults in their prime productive years, consistent with findings by Joshua et al. (2019) in Adamawa State, where 64% of cowpea producers were aged between 20 and 49 years. The relatively young mean age of consumers suggests a large, economically active consumer base that is likely to be responsive to quality improvements and marketing innovations.

Table 3: Age Distribution of Respondents

Age (Years)	Consumer Freq.	Consumer %	Marketer Freq.	Marketer %
< 20	6	5	3	2.5
21 – 30	28	23.3	22	18.3
31 – 40	42	35	46	38.3
41 – 50	30	25	34	28.3
51 – 60	10	8.3	12	10
> 60	4	3.4	3	2.5
Total	120	100	120	100
Mean age (years)	37.4		39.1	

Source: Field Survey, 2026.

Educational Level, Household Size, Income, and Experience

As shown in Table 4, the majority of consumer respondents (41.7%) had attained tertiary education, followed by secondary education (36.7%), primary (15.0%), and no formal education (6.7%). By contrast, marketers were predominantly at the secondary education level (43.3%), with a lower proportion holding tertiary qualifications (23.3%). This disparity may reflect the different occupational demands of consumers (many of whom are white-collar workers in urban Warri) versus marketers (who may have entered trade at an earlier educational stage).

The mean household size was 5 persons for consumers and 5.6 for marketers, both within the 4–6-person bracket (46.7% and 50.0% respectively). Larger household sizes are positively correlated with higher cowpea demand, as cowpea serves as a key protein source for large families in Delta State (Bolarinwa, 2022). The mean monthly income of consumers was ₦104,500, while marketers reported a higher mean of ₦118,300. This income advantage among marketers reflects earnings from trade margins.

Regarding experience, the majority of consumers (40.0%) had >10 years of cowpea purchasing experience, while 43.3% of marketers had 6-10 years' experience levels. Mean experience was 7.2 years for consumers and 9.4 years for marketers, indicating a well-seasoned market with established preferences and trading relationships that are not easily disrupted by new variety introductions.

The marital status distribution revealed that 60.0% of consumers were married, 26.7% were single, 8.3% were widowed, and 5.0% were divorced. Married respondents tend to have larger household sizes and more stable food provisioning patterns, which supports consistent cowpea demand.

Table 4: Educational Level, Household Size, Income, and Experience of Respondents (n=120 each)

Variable	Consumer Freq.	Consumer %	Marketer Freq.	Marketer %
Educational Level				
No Formal Education	8	6.7	12	10
Primary	18	15	28	23.3
Secondary	44	36.7	52	43.3
Tertiary	50	41.7	28	23.3
Total	120		120	
Household Size (persons)				
1 – 3	22	18.3	18	15
4 – 6	56	46.7	60	50
7 – 9	30	25	32	26.7
> 9	12	10	10	8.3
Mean household size	5.4		5.6	
Average Monthly Income (₦)				
< 50,000	24	20	14	11.7
50,000 – 100,000	38	31.7	40	33.3
100,000 – 150,000	32	26.7	46	38.3
> 150,000	26	21.7	20	16.7
Mean income (₦)	104,500		118,300	
Years of Cowpea-Related Experience				
< 2 years	14	11.7	8	6.7

2 – 5 years	34	28.3	26	21.7
6 – 10 years	24	20	52	43.3
> 10 years	48	40	34	28.3

Source: Field Survey, 2026.

Varieties of cowpea available in markets in Delta State

Five cowpea varieties were available in Delta State markets: Oloyin (Honey beans), Ife Brown, White Beans, Light cream and Local landraces were available in Delta state markets. Oloyin and Ife brown were the most widely stocked, followed by white beans. This finding suggest that despite the documented agronomic advantages of the improved varieties, traders stock follow demand rather than breeder's priorities.

Dominant variety of cowpea consumed by households

As shown in Table 5 and Figure 3, Oloyin (Honey Bean) emerged as the most preferred variety, with 39.2% of consumers identifying it as their primary choice and a mean preference score of 4.62. Ife Brown ranked second (22.7%; mean score = 4.18), followed by White beans (20.6%; mean score = 3.94), and Light Cream (10.3%; mean score = 3.10). local landraces ranked fifth (7.2%; mean score = 2.87)The strong preference for Oloyin (Honey Bean) is consistent with its well-established reputation for superior taste, large grain size, short cooking time, and high swelling capacity during processing, all of which are critical for popular Delta State dishes such as moi-moi and akara. These findings align with Mishili et al. (2009) and Omoigui et al. (2024), who documented the dominance of high-quality local varieties in consumer-driven markets across Nigeria. The relatively lower ranking of improved varieties such as Light Cream beans and the local landraces, despite their documented agronomic advantages, suggests a persistent gap between breeder priorities (yield, pest resistance) and consumer demand signals (sensory quality, cooking performance). The findings also align with Mishili et al. (2009), who observed that consumer preferences for agricultural product attributes vary considerably across different local markets.

Table 5: Ranking of Preferred Cowpea Varieties by Consumers and Marketers

Variety	Most Preferred (%)	Rank	Mean Preference Score
Oloyin (Honey Bean)	39.2	1st	4.62
Ife Brown	22.7	2nd	4.18
White Beans	20.6	3rd	3.94
Light Cream	10.3	4th	3.1
Local landraces	7.2	5th	2.87

Source: Field Survey, 2026.

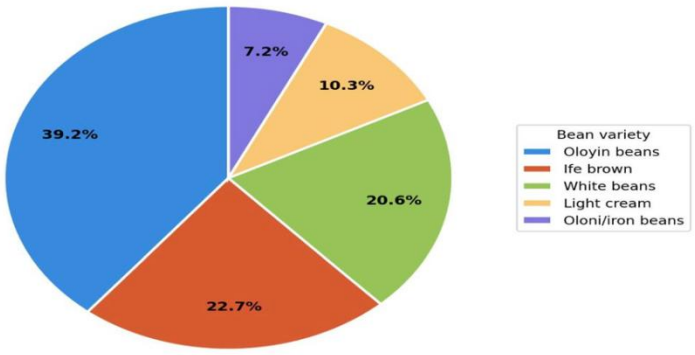


Figure 3: Preferred Cowpea Varieties by Consumers (n=120)

Quantity consumed by households

This section examines the frequency of cowpea consumption and quantities purchased per month. Table 6 show that the largest group of respondents (35.0%) consumed cowpea once a week, followed by 2-3 times per week (29.2%), fortnightly (15.0%), daily (12.5%), and monthly (8.3%). The mean monthly quantity purchased was 14.47 kg per person. This relatively high consumption frequency confirms Delta State as a significant cowpea consumption zone, consistent with FAOSTAT (2026).

The quantity distribution shows that 47.5% of respondents purchased >15 kg per month, while 37.5% purchased 10–15 kg per month, and 13.3% purchased 5-10kg per month and the remaining 1.7% purchased less than 5 kg per month. Higher-quantity purchasers tend to be larger households or those using cowpea commercially (e.g., for akara or moi-moi vending). The daily consumers (12.5%) largely comprised households that regularly prepare cowpea-based dishes, particularly akara for breakfast and moi-moi for lunch.

Table 6: Cowpea Consumption Pattern of Consumer Respondents (n=120)

Variable	Frequency	Percentage (%)	Mean Qty/Month (kg)
Frequency of Consumption			
Daily	15	12.5	10.2
2-3 times per week	35	29.2	7.8
Once a week	42	35	4.5
Fortnightly	18	15	2.8
Monthly	10	8.3	1.5
Total	120	100	–
Quantity Purchased per Month (kg)			
< 5 kg	2	1.7	4.14
5 – 10 kg	16	13.3	7.94
10 – 15 kg	45	37.5	12.76
> 15 kg	57	47.5	18.02
Mean quantity (kg/month)	–	–	14.47

Source: Field Survey, 2026.

Quantity of cowpea supplied by marketers

This section presents results in fulfilment of Objective 4, showing the quantity of cowpea supplied to the market by marketer respondents per month. Table 4.7 shows that the majority of marketers (70%) less than 12.5 kg of cowpea per month, while 15% supplied 12.5-25 kg. Only 10% supplied 25-50 kg, and 5% supplied greater than 50kg. For the quantity supplied, the mean monthly supply per marketer was 15.62kg compared with a mean monthly consumption of 14.47 kg. This minimal difference reflects the aggregative role of marketers, who supply preferred cowpea to households.

Table 7: Quantity of Cowpea Supplied by Marketers per Month (n=120)

Variable	Frequency	Percentage (%)	Mean Qty/Month (kg)
Quantity Supplied per Month (kg)			
< 12.5 kg	84	70	5.88
12.5-25 kg	18	15	17.67
25-50 kg	12	10	38.5
>50kg	6	5	100
Total	120	100	

Mean; supply(kg/month)			15.62

Source: Field Survey, 2026.

Test of hypothesis reveals that the mean quantity supplied (15.62) was slightly higher than the mean quantity demanded (14.47) but the difference was not statistically significant. Based on this result, the null hypothesis (H_0) is hereby accepted. This suggests that, for the cowpea in Delta State, supply and demand are broadly in balance, with no significant surplus or shortage in the market. Supply was far more variable than demand, suggesting that the marketers supply levels fluctuate more, possibly due to seasonality, storage constraints or differences in market scale, while demand is steadier. The result aligns with Achoja, et al (2020) and shows that suppliers are actively listening to and responding the language of the consumers.

Table 8. T-test of Significant Difference between Quantity of cowpea Supplied and Quantity Demanded.

Group	n	Mean (kg/month)	Std. Deviation
Quantity Supplied (Marketers)	120	15.62	8.38
Quantity Demanded (Consumer)	120	14.47	4.31

Hypothesis	t-value	df	p-value	Decision
H_{01}: There is no significant difference between demand and supply	t = 1.3	178	0.18	H_{01}; no significant difference exists

Source: Field Survey, 2026.

Factors influencing varietal diversification among consumers: Multinomial Regression

To identify the factors that significantly influence consumer decisions to purchase preferred cowpea varieties, a Multinomial Regression model was estimated, following Achoja et al. (2020) who applied multinomial regression to analyse varietal diversification and consumer preference patterns for yam in Delta State, Nigeria. The dependent variable was the preferred cowpea variety chosen by the respondent (Oloyin = 1, Ife Brown = 2, White Beans = 3, Light Cream = 4, Local landraces = 5), with Oloyin (Honey Bean) as the reference category. Six independent variables were included: Price per unit (P), Cooking Time (CT), Grain Size (GS), Grain Colour (GC), Seasonal Availability (SA), and Taste (T), in accordance with the analytical model specified in Chapter Three. The estimated coefficients reported in Table 4.8 identify the significant determinants of cowpea varietal choice and directly answer Objective 5 by establishing which explanatory variables, P, CT, GS, GC, SA, and T significantly shape varietal preference and diversification outcomes among consumers in Delta State, consistent with the analytical framework of Achoja et al. (2020).

Table 9: Multinomial Regression Results showing Factors Influencing Cowpea Purchase Decisions (n=120)

Variable	Coefficient (β)	Std. Error	p-value
Constant (β_0)	-2.148	0.612	0.001**
Price per unit (₦) (P)	-0.423	0.148	0.004**
Cooking Time (CT)	-0.387	0.122	0.002**
Grain Size (GS)	0.562	0.183	0.002**
Grain Colour (GC)	0.814	0.224	0.000**
Seasonal Availability (SA)	0.318	0.147	0.031*
Taste (T) [Sweet=1]	0.746	0.201	0.000**

Source: Field Survey, 2026.

The multinomial regression model demonstrated good overall fit. The likelihood ratio was significant ($p < 0.001$), confirming that the model as a whole significantly predicted cowpea variety choice. Pseudo $R^2 = 0.614$, indicating that the model explained approximately 61.4% of the variance in consumer variety choice decisions. The model correctly classified 81.7% of cases overall.

Price per Unit

Price per unit had a significant negative effect on purchasing the preferred variety ($\beta = -0.423$, $p = 0.004$). An increase in price significantly reduced the likelihood of purchase, meaning that for every unit increase in price, the odds of purchasing the preferred variety decreased by approximately 34.5%. This is consistent with standard consumer theory: as price rises, demand for a product decline, particularly among lower-income households. This finding corroborates Musa et al. (2019) and Hellin and Fisher (2019), who noted that price premiums for preferred varieties create access barriers for lower-income consumers.

Cooking Time lag

Cooking time had a significant negative coefficient ($\beta = -0.387$, $p = 0.002$; OR = 0.679), indicating that as cooking time increases, the probability of purchase decreases. Consumers strongly prefer shorter-cooking varieties, and varieties requiring longer cooking durations are less likely to be selected. An odds ratio of 0.679 implies that each unit increase in cooking time reduces the odds of purchase by approximately 32.1%. This confirms the growing importance of convenience attributes in urban food markets (Odogwuu et al., 2021; Boukar et al., 2016), where time constraints reduce tolerance for long food preparation.

Grain Size

Grain size had a significant positive effect ($\beta = 0.562$, $p = 0.002$; OR = 1.754), meaning that larger grain size increases the likelihood of purchase. An odds ratio of 1.754 implies that for every unit increase in grain size score, the odds of selecting the variety increase by 75.4%. Consumers associate larger grain size with better value for money and superior processing performance, particularly for moi-moi production, which requires substantial soaking and blending. This result is consistent with Coulibaly et al. (2015) and Kuchida et al. (2022), who found 100-seed weight to be a major predictor of consumer willingness to pay in West African cowpea markets.

Grain Colour

Grain colour (white = 1) had the largest positive coefficient ($\beta = 0.814$, $p < 0.001$; OR = 2.257), indicating that white-seeded varieties are more than twice as likely to be selected compared to non-white varieties, holding all other factors constant. This finding confirms the overwhelming preference for white-seeded cowpea varieties in Delta State, driven by their visual appeal and suitability for the preparation of culturally significant dishes (Momoh, et al., 2012; Mishili et al., 2009). The odds ratio of 2.257 underlines the significant commercial premium that white-seeded varieties command in local markets.

Seasonal Availability

Seasonal availability had a significant positive effect at the 5% level ($\beta = 0.318$, $p = 0.031$; OR = 1.374). When preferred varieties are available during peak consumption seasons, the probability of purchase increases. Consistent supply throughout the year is therefore a critical factor in maintaining consumer loyalty to specific varieties. This is consistent with Mohammed et al. (2019), who noted that limited availability constrains consumer access to preferred varieties, pushing demand toward available substitutes.

Taste

Taste had the second largest positive coefficient in the model ($\beta = 0.746$, $p < 0.001$; OR = 2.108), indicating that sweet-tasting varieties have more than double the odds of being purchased compared to less palatable alternatives. This confirms that taste is also a powerful intrinsic driver of cowpea variety selection, overriding

even the effects of cooking time and grain size for many consumers. These findings are consistent with Odogwu, et al. (2021), who identified taste improvement as the second most demanded cowpea attribute by Nigerian stakeholders across the value chain.

Multiple Regression results of factors that influence varietal diversification on cowpea supply (n=120 marketers)

Consumer Preference Score (β = 0.634, p < 0.001)

Consumer preference was the strongest predictor of varietal diversification and is the variable that directly tests the hypothesis. Holding all other variables constant, a one-unit increase in the preference score raises varietal diversification by 0.634 units. Marketers are profit-seeking intermediaries who stock what sells fastest, and households buy on specific attributes: grain colour, taste, grain size and cooking time (Table 8). Where these preferences are strong and consistent, they send clear and repeated demand signals through the market, and marketers who ignore them carry unsold stock. Marketers therefore stock a wider range of varieties to serve different consumer segments. This is the market-driven varietal diversification process described by Walker and Alwang (2015), in which consumer demand signals transmitted through traders drive variety turnover. It is also consistent with Omoigui et al. (2024) and Kuchida et al. (2022) in northern Nigeria, and with Mishili et al. (2009), who showed that cowpea purchasing in West Africa is driven by grain attributes.

Test of hypothesis reveals that the model was statistically significant ($F = 31.72$, $p < 0.001$), and an adjusted R^2 of 0.56 (56%) shows that the included variables jointly explain about 56% of the variation in varietal diversification among cowpea marketers. H_0 is rejected and the alternative hypothesis is accepted that there is significant relationship between consumer preference and varietal diversification.

Price Premium for Preferred Variety (β = 0.487, p = 0.001)

Price premium was the second strongest predictor. A higher premium on preferred varieties increases the variety range marketer's stock. The premium is the channel through which consumer preference becomes profit: it rewards marketers for sourcing more preferred varieties, and it passes back to farmers as an incentive to produce them. This is the price-incentive mechanism described by Hellin and Fisher (2019) and the central idea of supply response theory (Nerlove, 1958). It also connects with Table 4.8, where price lowers the probability of purchase. Preferred varieties earn a premium for marketers but may be less affordable to lower-income households, which is why the study identifies high prices as a barrier to the full expression of consumer preference.

Market Distance (β = -0.214, p = 0.004)

Market distance had a significant negative effect: markets farther from the centre of consumer concentration showed lower varietal diversity. Distance raises transport and search costs, reduces the volume of demand a marketer can serve, and weakens the transmission of consumer preference signals, so marketers in distant markets stock fewer, more dependable varieties. This agrees with Bellon et al. (2020), who found that proximity to urban demand accelerates preference-driven varietal turnover. For the long run, it suggests that supply shifts first and fastest near urban centres, while remote markets, where demand signals are weaker, may retain landraces for longer.

Number of Traders (β = 0.322, p = 0.005)

The number of traders in a market is used here as a measure of trader density and competition. It had a positive and significant effect on varietal diversification. Where many traders compete, each has an incentive to differentiate by stocking different varieties and serving different consumer segments. Dense trader networks also spread information about emerging preferences and speed up varietal turnover. Trader density therefore amplifies the effect of consumer preference, which is consistent with the view that market actors, rather than extension services, are now the main drivers of varietal turnover in Nigerian cowpea markets (Manda, et al., 2023; Omoigui, et al., 2024).

Consumer Income Level (β = 0.188, p = 0.047)

Consumer income had a positive but weaker effect, significant only at the 5% level. Higher-income consumers can pay for quality attributes and premium varieties, which creates demand for a broader range of cowpea types and encourages marketers to stock them. This agrees with Banful et al. (2022), who found that urban consumers place higher value on convenience attributes such as shorter cooking time. In the long run, it means supply diversification will expand first where purchasing power is greatest, while low-income markets may remain limited to the cheaper and more widely available varieties.

Table 10 Multiple Regression results of factors that influence varietal diversification on cowpea supply (n=120 marketers)

Variable	Coefficient (β)	Std. Error	t-value	p-value	VIF
Constant (β_0)	1.842	0.524	3.51	0.001**	–
Consumer Preference	0.634	0.156	4.06	0.000**	1.42
Price Premium for Preferred Variety	0.487	0.138	3.53	0.001**	1.68
Market Distance (km)	-0.214	0.073	-2.93	0.004**	1.23
Number of Traders Surveyed	0.322	0.112	2.87	0.005**	1.51
Consumer Income Level	0.188	0.094	2	0.047*	1.38
R^2 = 0.582; Adjusted R^2 = 0.561; F= 31.72					

Source: Field Survey, 2026.

Effects of consumer preferences on varietal diversification

Marketer were asked to assess the extent to which consumer preferences influence the varieties of cowpea sold in markets, and whether such preferences have, over the past 2–3 years, changed the number of different cowpea varieties available in markets. The first item was measured on a 4-point scale (1 = no influence to 4 = very strong influence), while the second was measured as a categorical trend (decrease, increase, stay the same). The results are presented in Table 10.

As shown in Table 10, the majority of marketers (41.7%) reported that consumer preference exerts a very strong influence on the varieties of cowpea they stock, while a further 38.3% rated this influence as strong influence (scale point 3). Only 5.0% of marketers perceived no influence at all. The mean influence score of 3.17 (out of a maximum of 4.00) indicates that, on average, marketers perceive consumer preference to exert a strong-to-very-strong influence on the composition of cowpea varieties sold in Delta State markets.

Regarding the trend, 65.0% of marketers reported that consumer preferences over the past 2–3 years have caused the number of different cowpea varieties available in markets to increase, while 23.3% perceived no change and 11.7% perceived a decrease. This perceived change increase corroborates the finding that marketers are consistent with actively expanding and adjusting their variety portfolios to satisfy a wide range of consumer preferences.

Table 10: Marketer-Perceived Influence of Consumer Preference on Varietal Diversification Over Time (n=120)

Response	Frequency	Percentage (%)
Influence of consumer preference on cowpea varieties sold in markets (1 = no influence, 4 = very strong influence)		
1 (No influence)	6	5
2	18	15
3	46	38.3

4 (Very strong influence)	50	41.7
Total	120	100
Mean influence score	3.17	(out of 4.00)
Perceived change in number of cowpea varieties available in markets over the past 2–3 years, attributable to consumer preference		
Decrease	14	11.7
Increase	78	65
Stay the same	28	23.3
Total	120	100

Source: Field Survey, 2026.

CONCLUSION

This study analyzed cowpea consumers' preferences and effects on market-driven varietal diversification patterns in Delta State, Nigeria. Based on the findings of this study, there is sufficient evidence to draw the following conclusion;

- Consumer preferences are the primary drivers of cowpea varietal diversification patterns in Delta State.
- Specific sensory and processing attributes of cowpea grain colour, taste, grain size, and cooking time create differentiated utilities and price signals that stimulate marketers to selectively stock preferred varieties. To that extent, dominant variety effectively function as a driven varietal selection mechanism among cowpea marketers.
- Hypothesis testing confirms that there is no significant difference between the demand (14.47kg) and supply (15.62kg) of cowpea. Therefore, the null hypothesis was accepted which indicates that the demand and supply of cowpea is broadly in balance showing that marketers actively respond to consumer preferences. Furthermore, the null hypothesis of no significant relationship between consumer preference and varietal diversification was rejected ($F=31.72$, $P<0.001$), confirming that consumer preference significantly drives varietal diversification.
- The study further concludes that Oloyin (Honey Bean) has emerged as the dominant cowpea variety in Delta State markets due to its superior performance on taste, cooking time, and grain size, despite not being a white-seeded variety.
- The study has aligned with the theory of consumer behavior to cowpea consumption by emphasizing the sensory attributes as determinant of cowpea varietal choices and market supply diversification patterns.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

- Cowpea breeders (IAR and IITA) should prioritize development of varieties with short cooking time, good taste, and high swelling capacity to align with consumer preferences.
- Establish a real-time market information system on variety availability, prices, and quality attributes to bridge information gaps between consumers, traders, and producers.
- Implement price stabilization mechanisms including strategic reserves and subsidized distribution during off-peak periods to improve affordability of preferred varieties.
- Establish community-based seed banks and participatory breeding programs to conserve local landraces threatened by market-driven preference for commercial varieties.
- Future research should employ discrete choice experiments and longitudinal studies to further quantify consumer willingness-to-pay and track long-term impacts on varietal diversity.
- Future studies should consider variety-specific models to isolate preference drivers for individual cowpea varieties.

REFERENCES

1. Abdulai, A., and Huffman, W. (2014). The adoption and impact of soil and water conservation technology: An endogenous switching regression application. Land Economics, 90(1), 26–43.
2. Abebe, B., and Alemayehu, M. (2022). Cowpea (Vigna unguiculata L. Walp.) production, challenges and opportunities in Ethiopia: A review. Cogent Food Agriculture, 8(1), 2036765.
3. Achoja, F.O., Emmanuel, C.E., and Ogisi, D.O., Overehirha, R.T. (2020). Multinomial Regression Analysis of Yam (DISCOREA SPP.) Consumers' Prefernces and Varietal Diversification Pattern in Nigeria. Asian Journal of Agriculture and Rural Development, 10(2), 698-707.
4. Afolami, C.A., Obayelu, A.E. and Vaughan, I.I. (2020). Information and communication technologies adoption and farmer welfare: Evidence from cowpea producers in Ogun State, Nigeria. Cogent Food Agriculture, 6(1), 1821498.
5. Ajeigbe, H.A., Akinseye, F.M. and Abdullahi, S.N. (2021). Seed systems and cowpea varietal adoption in Nigeria: Challenges and opportunities. Journal of Crop Improvement, 35(4), 612–629.
6. Akinlade, O. M., Omonona, B. T., and Lawal, A. O. (2020). Urban consumer preferences for fast-cooking cowpea varieties in southwestern Nigeria. Journal of Agricultural Science, 12(5), 123–134.
7. Akinyele, I. O. (2009). Nutritional importance of cowpea in Nigerian diets. Nigerian Journal of Nutritional Sciences, 30(2), 1–10.
8. Anthony, O. E., Nwachukwu, I. and Obiechina, C. (2023). Economic analysis of cowpea marketing in Nigeria. Journal of Agricultural Economics and Rural Development, 9(1), 150–162.
9. Arise, A. K., Aluko, R. E., and Alashi, A. M. (2021). Nutritional and bioactive properties of cowpea: A review. Food Reviews International, 37(4), 1–18.
10. Asare, B., Nboyine, J. A., and Asafu-Agyei, J. N. (2021). Consumer preferences and market potential for cowpea in northern Ghana. Journal of Agricultural Economics and Development, 10(2), 34–45.
11. Asare-Marfo, D., Birol, E. and Roy, D. (2013). Investigating demand for biofortified crops: Insights for future research. HarvestPlus Working Paper No. 10. Washington, D.C.: IFPRI.
12. Asfaw, S., Cattaneo, A., and Kimathi, G. (2021). Pulse consumption and preference heterogeneity in sub-Saharan Africa. Food Policy, 102, 102094.
13. Askari, H., and Cummings, J. T. (1977). Estimating agricultural supply response with the Nerlove model: A survey. International Economic Review, 18(2), 257–292.
14. Banful, A. B., Nkonya, E., and Oboh, V. (2022). Constraints to fertilizer use in Nigeria: Insights from the middle belt region. Journal of Development and Agricultural Economics, 14(3), 56–68.
15. Bellon, M. R., Kotu, B. H., Azzarri, C., and Caracciolo, F. (2020). To diversify or not to diversify, that is the question. Pursuing agricultural development for smallholder farmers in marginal areas of Ghana. World Development, 125, 104682.
16. Bolarinwa, I. F. (2022). Nutritional and economic importance of cowpea in Nigeria. African Journal of Food Science, 16(4), 89–97.
17. Boukar, O., Bhattacharjee, R., and Fatokun, C. (2019). Cowpea. In J. M. Mundt (Ed.), Grain legumes: Strategies and perspectives (pp. 67–90). Springer.
18. Boukar, O., Massawe, F., and Muranaka, S. (2016). Breeding priorities for cowpea in sub-Saharan Africa. Plant Breeding Reviews, 40, 157–188.
19. Chavas, J. P., and Holt, M. T. (1990). Acreage decisions under risk: The case of corn and soybeans. American Journal of Agricultural Economics, 72(3), 529–538.
20. Coulibaly, O., and Lowenberg-DeBoer, J. (2002). The economics of cowpea in West Africa. In C.A. Fatokun et al. (Eds.), Challenges and Opportunities for Enhancing Sustainable Cowpea Production (pp. 351–366). IITA, Ibadan, Nigeria.
21. Ehlers, J. D., Hall, A. E., and Patel, P. N. (1997). Genetics of resistance to bacterial blight in cowpea. Crop Science, 37(4), 1136–1142.
22. FAO. (2024). The state of food and agriculture 2024: Agrifood systems transformation for sustainable development. Food and Agriculture Organization of the United Nations.
23. FAO and ICRISAT. (2015). Climate resilient agriculture: A synthesis of ICRISAT's work on climate change and food security in West Africa. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and Food and Agriculture Organization of the United Nations. Patancheru, India: ICRISAT.

24. FAOSTAT (2026). Crop production data for Nigeria. Food and Agriculture Organization Statistics Division. Rome: FAO.
25. FAOSTAT. (2025). Food and Agriculture Organization statistical database.
26. FMARD (2024). Federal Ministry of Agriculture and Rural Development, Nigeria. Annual Report 2023. Abuja: FMARD.
27. Gaya, H. I., Mohammed, B., and Tegbe, T. S. B. (2020). Economics of cowpea marketing in Borno State, Nigeria. Nigerian Journal of Agricultural Economics, 10(1), 78–89.
28. Haleegoah, J., Ruysschaert, G., and Vranken, L. (2019). Familiarity and preference for cassava varieties in Ghana. African Journal of Agricultural and Resource Economics, 14(2), 123–138.
29. Hellin, J. and Fisher, E. (2019). Building the evidence base for enabling environment for developing seed market systems: Insights from Sub-Saharan Africa. World Development, 115, 260–274.
30. Horn, L. N., Ghebrehiwot, H. M., and Shimelis, H. A. (2022). Cowpea: Production, uses and breeding. Legume Science, 4(3), e135.
31. Ifegwu, O. C. (2014). Consumer preferences and market signals in cowpea value chain. International Journal of Agricultural Economics, 3(4), 56–67.
32. IITA (2023). Annual Report 2022-2023. International Institute of Tropical Agriculture. Ibadan: IITA.
33. Joshua, M., Abdullahi, A., and Umar, B. F. (2019). Costs and returns of cowpea production in Mubi South LGA, Adamawa State, Nigeria. Journal of Agricultural Economics and Rural Development, 5(2), 234–241.
34. Just, R. E., and Pope, R. D. (2002). The agricultural producer: Theory and statistical measurement. In B. L. Gardner G. C. Rausser (Eds.), Handbook of agricultural economics (Vol. 1A, pp. 629–741). Elsevier.
35. Kaka, Y. M., Abdulkadir, M. B., and Umar, H. Y. (2020). Analysis of cowpea marketing in Kara market, Sokoto State, Nigeria. Bayero Journal of Pure and Applied Sciences, 13(1), 89–97.
36. Katungi, E., Larochelle, C., and Alwang, J. (2017). Adoption of common bean varieties in Uganda. Agricultural Economics, 48(6), 677–688.
37. Kouakou, K. E., Kouassi, K. N., and Dje, K. B. (2022). Consumer preferences for cowpea grain quality in Côte d'Ivoire. African Journal of Food, Agriculture, Nutrition and Development, 22(5), 20145–20160.
38. Kuchida, S., Tofa, A. I., and Omoigui, L. O. (2022). Market-driven varietal turnover in northern Nigeria cowpea markets. Agronomy Journal, 114(3), 1789–1801.
39. Lancaster, K.J. (1966). A new approach to consumer theory. Journal of Political Economy, 74(2), 132–157.
40. Langyintuo, A. S., Lowenberg-DeBoer, J., Faye, M., Lambert, D., Ibro, G., Moussa, B., and Ntoukam, G. (2003). Cowpea supply and demand in West and Central Africa. Field Crops Research, 82(2-3), 215–231.
41. Manda, J., Alene, A. D., and Mukuma, C. (2018). Market participation and variety adoption among smallholder farmers in Zambia. Journal of Development Studies, 54(10), 1802–1819.
42. Manda, J., Alene, A.D. Gardebroek, C. (2023). The role of market actors in cowpea varietal turnover in Nigeria. Agricultural Economics, 54(1), 61–75.
43. Markowitz, H. (1952). Portfolio selection. The Journal of Finance, 7(1), 77–91.
44. Martey, E., Wiredu, A. N., and Etwire, P. M. (2019). Nutritional awareness and adoption of improved cowpea varieties in northern Ghana. Journal of Agricultural Science, 11(7), 45–56.
45. Mekonnen, D., Gerber, N., and Matz, J. A. (2022). The role of legumes in addressing protein deficiency in sub-Saharan Africa. Global Food Security, 33, 100632.
46. Michael Jahi Chappell. (2009). From food security to farm to fork: The multiple challenges of agricultural systems. Annals of the New York Academy of Sciences, 1170(1), 95–102.
47. Mishili, F.J., Fulton, J., Shehu, M., Kushwaha, S., Marfo, K., Jamal, M., Kergna, A., Lowenberg-DeBoer, J. (2009). "Consumer Preferences for Quality Characteristics along the Cowpea Value Chain in Nigeria, Ghana and Mali." Agribusiness, 25(1), 16–35.
48. Mohammed, A.B., Barron, M. Njeru, E.M. (2019). Market-driven seed systems and cowpea variety adoption in East Africa. Food Policy, 88, 101762.
49. Momoh, E. J., Omoigui, L. O., and Kamara, A. Y. (2012). Regional variation in consumer preferences for cowpea in Nigeria. Journal of Food Science and Technology, 49(4), 456–463.

50. Moussa, B. (2011). Drought tolerance in cowpea. African Journal of Biotechnology, 10(62), 13456–13462.
51. Murdock, L. L., Coulibaly, O., and Baoua, I. (2012). Hermetic storage technologies for cowpea protection. Journal of Stored Products Research, 51, 1–8.
52. Murugkar, S., Gulati, P., and Gupta, A. (2022). Cowpea flour in gluten-free products. Journal of Food Science and Technology, 59(4), 1234–1245.
53. Musa, H., Jibrin, J. Ndunguru, A. (2019). Consumer preferences for cowpea grain attributes in West Africa. Agronomy, 9(8), 447.
54. Nassary, E. K., Baijukya, F., and Ndaki, S. (2020). Sensory attributes and consumer acceptance of legume varieties in Tanzania. African Journal of Food Science, 14(8), 234–245.
55. NBS (2026). Selected food prices watch. National Bureau of Statistics, Abuja, Nigeria.
56. NBS. (2025). National Bureau of Statistics commodity price watch. NBS Nigeria.
57. Nerlove, M. (1958). The dynamics of supply: Estimation of farmers' response to price. Johns Hopkins Press, Baltimore.
58. Nkomo, L. (2021). Cowpea production trends in sub-Saharan Africa. South African Journal of Plant and Soil, 38(4), 301–310.
59. Nordhagen, S., Ickowitz, A., and Rowlands, D. (2023). Declining protein intake in low-income countries. The Lancet Global Health, 11(4), e498–e499.
60. Odogwu, B. A., Anyiro, C. O., and Mbatia, O. L. E. (2021). Factors limiting cowpea consumption and stakeholder preferences in Nigeria. African Journal of Food, Agriculture, Nutrition and Development, 21(7), 18456–18473.
61. Okello, J. J., Zhou, Y., and Kwikiriza, N. (2018). Socioeconomic determinants of consumer preferences for biofortified crops in East Africa. Food Policy, 81, 95–06.
62. Oluwole, O. B., Omojasola, P. F., and Afolabi, O. O. (2021). Gender and food choice in Nigerian households. Gender and Development, 29(2), 345–362.
63. Omoigui, L.O., Ekeleme, F. Kamara, A.Y. (2024). Market-driven cowpea variety adoption in Nigeria: Trader and consumer perspectives. Journal of Agricultural Science, 162(1), 55–68.
64. Osipitan, O.A., Adigun, M.O. Kolawole, G.O. (2021). Cowpea production constraints and opportunities in Nigeria. Agronomy, 11(2), 298.
65. Pawlak, K., and Kołodziejczak, M. (2020). The role of agriculture in ensuring food security by 2050. Sustainability, 12(13), 5432.
66. Phillip, D., Nkonya, E., and Pender, J. (2019). Cowpea production systems in Africa. Agricultural Systems, 174, 45–56.
67. Rivas, L., Mmbaga, T., and Kirkby, R. (2016). Global cowpea production trends. Legume Perspectives, 12, 23–27.
68. Rubyogo, J. C., Maguru, M., and Sperling, L. (2019). Developing seed systems with farmers in East and Central Africa. Food Security, 11(4), 767–778.
69. Ruzzante, S., Labarta, R., and Bilton, A. (2021). Adoption of agricultural technology in sub-Saharan Africa. World Development, 146, 105561.
70. Sadoulet, E. De Janvry, A. (1995). Quantitative development policy analysis. Johns Hopkins University Press, Baltimore.
71. Saka, J. O., Adewumi, M. O., and Ogunleye, K. Y. (2018). Grain quality and consumer acceptance of cowpea in Nigeria. Journal of Food Science and Technology, 55(9), 3456–3464.
72. Sawadogo, N., Tankoano, A., Sawadogo, M. Compaore, H.R. (2020). Cowpea consumption patterns across West African countries. Food and Nutrition Bulletin, 41(3), 412–423.
73. Sibhatu, K. T., and Qaim, M. (2018). Farm production diversity and dietary quality. Global Food Security, 19, 1–9.
74. Sindhu, S. S., et al. (2019). Soil fertility improvement by symbiotic rhizobia for sustainable agriculture. In Soil Fertility Management for Sustainable Development (pp. 101–166).
75. Singh, B.B., Ajeigbe, H.A., Tarawali, S.A., Fernandez-Rivera, S. Musa, A. (2022). Improving the production and utilization of cowpea as food and fodder. Field Crops Research, 84(1–2), 169–177.
76. Singh, I., Squire, L., and Strauss, J. (1986). Agricultural household models: Extensions, applications, and policy. Johns Hopkins University Press.

77. Smale, M., Bellon, M. R., and Aguirre Gómez, J. A. (2001). Maize diversity, variety attributes, and farmers' choices in southeastern Guanajuato, Mexico. Economic Development and Cultural Change, 50(1), 201–225.
78. Talsma, E. F., Melse-Boonstra, A., and Brouwer, I. D. (2016). Impact of information on acceptance of biofortified crops. Public Health Nutrition, 19(14), 2567–2575.
79. Teeken, B., Olaosebikan, O., and Haleegoah, J. (2018). Cassava trait preferences of men and women farmers in Nigeria. Food Security, 10(4), 879–886.
80. Togola, A., Boukar, O., Chamarthi, S.K., Fatokun, C., Gaur, P.M. Gueye, B. (2023). Genetic diversity and breeding challenges in cowpea. Plants, 12(4), 878.
81. Tomlins, K., Bennett, B., and Sanni, L. (2018). Cultural influences on food preferences in Africa. Food Quality and Preference, 68, 234–245.
82. USDA-ERS. (2019). International agricultural productivity. U.S. Department of Agriculture Economic Research Service.
83. Vaiknoras, K., Larochelle, C., and Birol, E. (2019). Information, technology, and consumer acceptance of biofortified foods. Food Policy, 88, 101768.
84. Walker, T. S., and Alwang, J. (2015). Crop improvement, adoption, and impact of improved varieties in food crops in sub-Saharan Africa. CABI.
85. Wooldridge, J.M. (2010). Econometric analysis of cross section and panel data (2nd ed.). MIT Press, Cambridge, MA.