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EFFECT OF CERTIFIED MAIZE SEED ADOPTION ON FOOD SECURITY AMONG FARMING HOUSEHOLDS IN ENUGU STATE, NIGERIA

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ABSTRACT
Food insecurity remains a persistent challenge in Nigeria, driven by low agricultural productivity and limited use of improved seed technologies such as certified maize seeds. Despite evidence of their benefits, adoption of certified maize seeds remains inconsistent, and there is limited empirical evidence on their impact on household food security in Enugu State. This study therefore assessed the effect of certified maize seed adoption on household food security among maize farmers in Enugu State, Nigeria. The study was conducted using a cross-sectional survey design. A multi-stage sampling technique was used to select 120 maize farmers, comprising 57 adopters and 63 non-adopters of certified maize seeds. Data were collected using structured questionnaires and Focus Group Discussions. Data were analyzed using descriptive statistics, Food Insecurity Experience Scale (FIES), and binary logistic regression models to examine adoption determinants and the effect of certified seed use on food security. Certified maize seed adoption was found to significantly improve household food security. About 64.9% of adopting households were food secure compared with only 6.3% of non-adopting households. Logistic regression results showed that adoption had a positive and statistically significant effect on household food security. Household size and annual farm income were significant factors influencing adoption decisions. The study concludes that certified maize seed adoption significantly improves household food security among maize farmers in Enugu State. Strengthening access to certified seeds and improving farmers' economic capacity could enhance adoption rates and contribute to improved food security outcomes.

Keywords: Maize, Certified, Adoption, Food security, Farming households

Introduction
Food security serves as a pivotal factor influencing the extent of individuals' welfare and well-being, as well as economic growth and advancement (Falola et al., 2023). Food security consists the aspects of availability, accessibility, utilization, and stability of food, ensuring consistent access to safe, nutritious food for a healthy and active life by individuals (Hendriks et al., 2023).

In Nigeria, a significant prevalence of food insecurity has persisted for the last forty years due to the diminished focus on food production amidst the dominance of oil as the primary export

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commodity (Nwozor et al., 2019). This circumstance has been further worsened by the implementation of neo-liberal economic strategies including the devaluation of the national currency, promotion of trade liberalization, and the withdrawal of governmental involvement in economic endeavors (Markantonatou, 2022). Elements such as environmental disasters, cultural and spiritual conflicts have also contributed to worsening the problem of food insecurity in Nigeria. Millions grapple with hunger and malnutrition as this pressing global concern persists, thus the urgent need to increase agricultural productivity.

The use of improved seeds and inorganic fertilizers has been shown to significantly impact food security pillars, enhancing food availability, access, utilization, and stability for maize farmer. Initiatives like the Seeds of Discovery (SeeD) platform have been instrumental in developing high-yielding and stress-tolerant maize varieties, contributing to increased production levels and resilience in the face of climate change. Therefore, seed certification is an imperative tool for ensuring quality in the Nigerian seed industry.

However, research indicates a notable deficiency in the country's capacity for national seed certification. In 2019, Nigeria had a mere 50 seed inspectors and 75 seed certification officers, many of whom were seconded to Agricultural Development Project offices across the 36 states and the Federal Capital Territory (FCT) (Otitoju et al., 2022). This indicates a low adoption of certified seeds across the country and a need to establish evidence of its usefulness.

While maize is the predominant cereal crop in sub-Saharan Africa (SSA) and serves as a crucial staple food for a population exceeding 1.2 billion in sub-Saharan Africa and Latin America, its yield in Nigeria lags behind many other African countries and is significantly lower than the global average despite the multiple uses of this crop in human nutrition, livestock production and industrial sectors. According to recent data from the Food and Agriculture Organization (FAO), the average maize yield in Nigeria for 2020 was approximately 1.7 tons per hectare (FAO, 2022). This is considerably lower than some other major African maize producers. For instance, South Africa achieved an average yield of 5.9 tons per hectare, while Egypt recorded 7.7 tons per hectare in the same year (FAO, 2022).

This poor yield, in spite of the progress in agricultural technology, may be attributed partly to the utilization of unapproved maize seeds, typically of substandard quality and lacking in resistance to diseases and pests. Consequently, there is a shortage in maize output, leading to negative implications on food security. This clearly highlights the urgent need to increase its productivity in the country. particularly through the adoption of innovative approaches in maize production.

The benefits of certified seeds of different crops such as rice, potato and maize, related efficiency and supply studies in various regions of the country have been established in

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literature. (Izuogu & Onwe, 2023; Tuquerrez et al., 2023; Atieno et al., 2023; Natogmah et al., 2023; Baglan et al., 2020) However, there remains a notable gap in evidence on how certified maize seed use affects food security among rural farming households in Enugu State, Nigeria.

This study therefore aims to address this gap by assessing the effect of certified maize seed adoption on household food security in Enugu state. Specifically, it seeks to describe the socio-economic characteristics of farmers using certified and traditional seeds, investigate the factors influencing adoption of certified maize seeds, examine and compare the food security status of households using certified versus traditional seeds, and determine the effect of certified maize seed use on household food security. The results will provide evidence for the adoption of certified seeds to promote agricultural productivity and improve national economy.

Conceptual framework:

The conceptual framework of this study explains the pathways through which farmers' socio-economic characteristics and institutional factors influence the adoption of certified maize seeds and subsequently affect household food security in Enugu State, Nigeria. It assumes that farmers' background characteristics such as age, sex, education, household size, farm size, farming experience, income level, and access to extension services shape their awareness, access to information, risk perception, and capacity to adopt improved agricultural technologies (e.g., certified maize seeds) (Feder et al., 1985; Asfaw et al., 2012).

These socio-economic characteristics are expected to influence adoption decision, which is a central mediating variable in the framework. Adoption of certified maize seeds refers to the use of improved, quality-assured seed varieties that are genetically enhanced for higher yield, disease resistance, and better adaptability compared to traditional seeds. Farmers who adopt certified seeds are more likely to experience improved productivity, reduced crop failure risk, and enhanced food availability at the household level.

However, adoption is not determined by socio-economic factors alone. Institutional and environmental factors such as seed price, availability of input markets, access to credit, extension contact, and perceived seed performance also play a significant role in shaping adoption behaviour.

Household food security, which is the core outcome variable, is influenced both directly and indirectly by socio-economic characteristics and seed adoption status. Food security in this study is reflected in food availability, accessibility, utilization, and stability at the household level. It is expected that households using certified maize seeds will have improved yields and income, thereby enhancing their food security status compared to households relying on traditional seeds.

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In summary, the framework posits that socio-economic and institutional factors influence the likelihood of adopting certified maize seeds, and this adoption subsequently improves household food security outcomes. This structure highlights the role of improved seed technology as a critical pathway for enhancing agricultural productivity and strengthening household welfare in rural farming communities.

Theoretical Framework

This study is anchored on three complementary theoretical perspectives: Diffusion of Innovations Theory, Agricultural Household Theory, and Welfare Economics Theory.

The Diffusion of Innovations Theory by Rogers (2003) explains how new agricultural technologies such as certified maize seeds are adopted over time within a social system. It posits that adoption depends on perceived attributes of the innovation such as relative advantage, compatibility, complexity, trialability, and observability. Farmers who perceive certified seeds as superior in yield, disease resistance, and profitability are more likely to adopt them compared to traditional seeds. Social influence, communication channels, and extension services also play a key role in accelerating adoption decisions.

The Agricultural Household Theory explains the relationship between production decisions and consumption outcomes within farm households. It assumes that households act both as producers and consumers. Therefore, the adoption of certified maize seeds affects production output, which in turn influences household consumption patterns and food security status. This theory is particularly relevant because it links farm-level decisions directly to household welfare outcomes such as food availability and stability.

The Welfare Economics Theory provides a broader justification for evaluating food security outcomes. It assumes that individuals and households seek to maximize utility derived from consumption and income. Improved seed adoption increases agricultural productivity, leading to higher income and improved food consumption, thereby enhancing household welfare.

Together, these theories explain that adoption of certified maize seeds is influenced by perceived benefits and socio-economic conditions (Diffusion of Innovations), production-consumption linkages within households (Agricultural Household Theory), and overall welfare improvement through increased productivity and income (Welfare Economics Theory).

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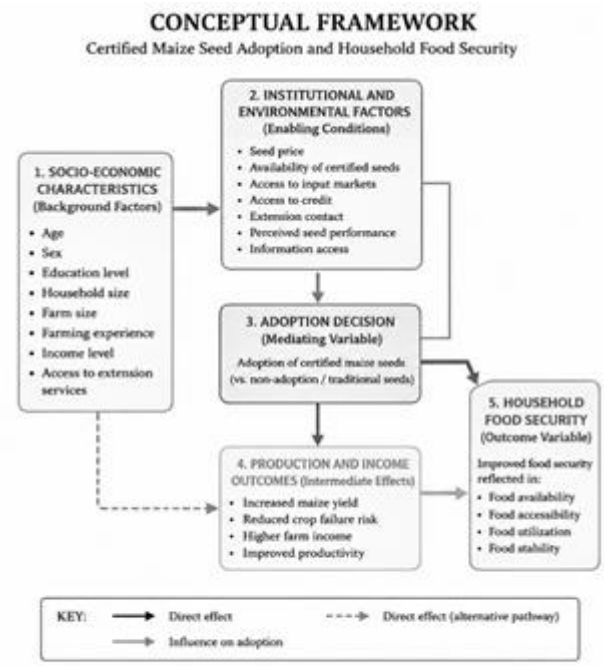

Figure 1: Conceptual framework of certified maize seed adoption and household food security (Adapted and modified from Feder et al., 1985; Asfaw et al., 2012; World Bank, 2010)

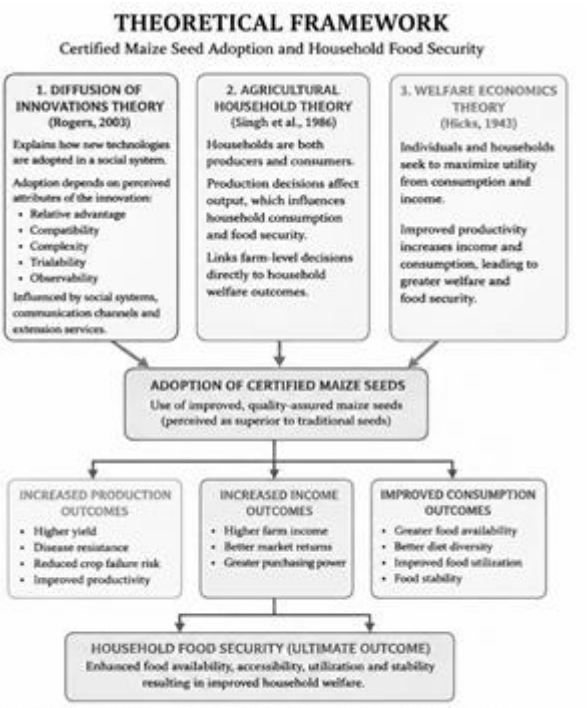

Figure 2: Theoretical framework of certified maize seed adoption and household food security (Adapted from Rogers, 2003; Singh et al., 1986; Hicks, 1943)

Methodology

Study Area and Design

The study was conducted in Enugu State, Southeast Nigeria, located between latitudes 5°55′N and 7°08′N and longitudes 6°52′E and 7°55′E. The state shares boundaries with Kogi State (north), Abia and Ebonyi States (south), Ebonyi State (east), and Anambra State (west). Enugu State is characterized by a tropical savanna climate, fertile soils, and a predominantly agrarian population, making it suitable for maize production and agricultural research (Umeugokwe et al., 2025).

Agriculture remains a major livelihood activity in the state, with maize as one of the dominant staple crops. However, productivity is constrained by limited access to improved seed varieties, pests and diseases, and inadequate agricultural infrastructure. This study focuses on assessing the effect of certified maize seed adoption on household food security.

A cross-sectional survey design was adopted to collect data at a single point in time on socio-economic characteristics, adoption behaviour, and household food security status among maize farmers.

Study Population and Sampling Technique

A multi-stage sampling technique was employed. In the first stage, four Local Government Areas (LGAs)—Nsukka, Udenu, Igbo-Etiti, and Enugu Ezike—were purposively selected due to their high concentration of maize farmers.

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In the second stage, registered maize farmers were stratified into adopters and non-adopters of certified maize seeds using a sampling frame obtained from the Enugu State Agricultural Development Programme (ENADEP). From each LGA, three communities were randomly selected from each stratum, giving a total of twelve communities (six communities per stratum across adopters and non-adopters).

In the third stage, ten maize farmers were systematically selected from each of the six communities per stratum. This resulted in 60 certified maize seed adopters and 60 non-adopters, giving a total sample size of 120 respondents but 57 and 63 certified maize seed adopters and non-adopters were interviewed disproportionately due to inconsistency of respondents.

Eligible respondents were maize farming households actively engaged in maize production during the study period. Both male and female farmers were included, while non-farming households were excluded.

Data Collection

Data were collected from primary sources using a structured and pre-tested questionnaire administered through face-to-face interviews. The instrument captured information on socio-economic characteristics, adoption of certified maize seeds, institutional factors, and household food security status.

In addition, Focus Group Discussions (FGDs) were conducted to complement quantitative data and provide deeper insights into farmers' perceptions of certified seed adoption, constraints, and food security experiences.

The questionnaire was designed, validated, and refined to ensure clarity, relevance, and consistency with the study objectives.

Data Analysis

Data obtained from the survey were coded and analyzed using appropriate statistical software. Both descriptive and inferential statistical techniques were employed to achieve the study objectives.

Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize and compare the socio-economic characteristics of maize farmers using certified seeds and those using traditional seeds.

The factors influencing the adoption of certified maize seeds were analyzed using binary logistic regression. The technique was considered appropriate because the dependent variable (adoption status) is dichotomous, taking the value of one for adopters and zero for non-

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adopters. The model estimates the probability of adopting certified maize seeds as a function of selected socio-economic and institutional characteristics of farmers.

Household food security status was assessed using the Food Insecurity Experience Scale (FIES) developed by the Food and Agriculture Organization (FAO). The FIES consists of eight experience-based questions that capture varying degrees of food insecurity resulting from limited access to food due to financial or resource constraints. Responses were categorized into mild, moderate, and severe food insecurity based on established FAO guidelines. The prevalence of food insecurity was determined from the proportion of households experiencing moderate and severe food insecurity.

To examine the effect of certified maize seed adoption on household food security, a binary logistic regression model was estimated. Household food security status served as the dependent variable, while adoption of certified maize seeds and selected socio-economic characteristics constituted the explanatory variables. The model estimated the likelihood of a household being food secure as influenced by certified seed adoption, farm size, educational status, annual income, and household size.

The adequacy and goodness-of-fit of the logistic regression models were assessed using the likelihood ratio test, pseudo-R^2 statistics, and classification accuracy measures. Statistical significance of explanatory variables was evaluated at the 1%, 5%, and 10% probability levels. This analytical framework enabled the identification of factors influencing certified maize seed adoption and the estimation of its contribution to household food security among maize farming households in Enugu State.

Model Specification

Binary Logistic Regression Model for Adoption

The binary logistic regression model was used to examine factors influencing adoption of certified maize seeds. The model is specified as:

$Y = \beta 0 + \beta 1\ G + \beta 2\ A + \beta 3\ I + \beta 4\ Ed + \beta 5 +\ MO + \beta 6 +\ AC +\ e$ ……e q1

Where Y represents adoption of certified seeds indicator (adopted = 1, not adopted = 0). B_0 is the constant while β_1 to β_6 represents regression co efficient, G represents gender, A represents age, I represent income, Ed represents the educational level (years), MO represents major occupation (maize farmer =1 otherwise =0), AC represents access to credit and e represents the error term.

Food Insecurity Experience Scale (FIES)

Household food security status was assessed using the Food Insecurity Experience Scale (FIES), developed by the Food and Agriculture Organization (FAO). The FIES measures

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food access limitations across three domains: uncertainty or anxiety about food supply, inadequate food quality, and insufficient food quantity. The scale consists of eight dichotomous (Yes/No) questions reflecting household food-related experiences due to lack of resources. These include worrying about food availability, inability to eat nutritious food, limited dietary diversity, meal skipping, reduced food intake, food shortages, hunger experiences, and going without food for a whole day.

Food insecurity severity was classified into three categories: mild food insecurity, characterized by worry about food availability and reduced food quality (Questions 1–3); moderate food insecurity**,** characterized by reduced food quantity and meal skipping (Questions 4–6); and severe food insecurity, characterized by experiences of hunger and going without food for an entire day (Questions 7–8).

Households classified as experiencing moderate and severe food insecurity were considered food insecure.

Model for Effect of Certified Seed on Food Security

A second binary logistic regression model was used to determine the effect of certified maize seed adoption on household food security.

$Y = \beta 0 + \beta 1 + ACS + \beta 2 + Fs + \beta 3 + Es + \beta 4 + Ai + \beta 5 + Hs + e$ eq2

Where Y represents household food security [1= farming household is food secure, 0 = farming household is food insecure], β_0 is the constant, β_1 to β_5 are the regression co-efficient of the predictors, ACS represents adoption of certified seeds, Fs represents farm-size, Es represents educational status, Ai represents annual income and Hs represents household size.

Results

Table 1 presents the socio-economic characteristics of farmers who use certified maize seeds (CMS users) and those who use traditional seeds (non-users). The results show that male farmers constituted the majority of respondents in both groups, accounting for 78.9% of CMS users and 68.3% of non-users. Similarly, most households were male-headed, representing 94.7% of CMS users and 96.8% of non-users.

With respect to age, the largest proportion of respondents in both groups were between 31 and 40 years, representing 38.6% of CMS users and 39.7% of non-users. Most respondents were married, accounting for 91.2% of CMS users and 87.3% of non-users. Household sizes tended to be larger among CMS users, with 73.7% having five or more household members compared with 47.6% of non-users.

Regarding education, secondary education was the most common educational attainment among both CMS users (49.1%) and non-users (52.4%). Farming was the major occupation

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among CMS users (49.1%), while trading was the predominant occupation among non-users (44.4%). In terms of farming experience, the highest proportion of CMS users (38.6%) and non-users (38.1%) had between 11 and 20 years of farming experience.

The distribution of annual farm income shows that 50.9% of CMS users earned above ₦400,000 annually compared with 35.4% of non-users. Similarly, a greater proportion of CMS users (64.9%) earned above ₦500,000 annually from non-farm activities compared with 28.6% of non-users. Monthly expenditure was also generally higher among CMS users, with 43.8% spending above ₦50,000 monthly compared with 27.4% of non-users.

Concerning financial situation, 42.1% of CMS users reported being financially stable compared with 6.3% of non-users. Farm size was generally small for both groups, with the majority of respondents cultivating approximately 1.0 hectare of land.

Table 1: Socio-economic characteristics of users and non-users of certified maize seeds

Socio-Economic Characteristics	CMS users		Non-CMS users	
	Frequency	Percentage	Frequency	Percentage
Gender				
Male	45	78.9	43	68.3
Female	12	21.1	20	31.7
Household Head Gender				
Male	54	94.7	61	96.8
Female	3	5.3	2	3.2
Age				
23-30	5	8.8	6	9.5
31-40	22	38.6	25	39.7
41-50	14	24.6	21	33.3
51-60	11	19.3	11	17.5
61+	5	8.7	0	0
Marital Status				
Single	2	3.5	6	9.5
Married	52	91.2	55	87.3
Widowed	3	5.3	2	3.2
Number of People in Household				
3-4	15	26.3	33	52.4
5-6	24	42.1	22	34.9
7-8	14	24.5	8	12.7
9+	4	7.1	Nil	Nil
Highest Educational Level				

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Socio-Economic Characteristics	CMS users		Non-CMS users	
	Frequency	Percentage	Frequency	Percentage
No formal education	4	7	2	3.2
Primary l	17	29.8	20	31.7
Secondary	28	49.1	33	52.4
Tertiary	8	14.1	8	12.7
Primary Occupation				
Farming	28	49.1	25	39.7
Trading	19	33.3	28	44.4
Civil servant	10	17.5	10	15.9
Farming Experience (Years)				
7-10	21	36.8	16	25.4
11-20	22	38.6	24	38.1
21-30	7	12.3	23	36.5
31+	7	12.3		
Annual Farm Income (₦)				
<200,000	11	19.3	14	22.6
200,000 - 400,000	17	29.8	25	40.3
400,001 - 600,000	15	26.3	11	17.7
600,001+	14	24.6	11	17.7
Annual Non-Farm Income (₦)				
<200,000	7	12.3	7	20
200,000 - 500,000	13	22.8	16	45.7
500,001 - 1,000,000	30	52.6	8	22.9
1,000,001+	7	12.3	2	5.7
Sources of Credit				
Money Lender	1	1.8	60	95.2
Cooperative Society	9	15.8	3	4.8
Friends & Family	47	82.5	60	95.2
Type of Economic Association				
Cooperative Society	1	1.8	1	1.6
Farmers' Association	4	7	62	98.4
None	51	89.5		
Monthly Expenditure (₦)				
15,000 - 30,000	13	22.8	23	37.1
31,000 - 50,000	21	36.8	18	29
51,000 - 100,000	21	36.8	15	24.2
100,000 and above	4	7	2	3.2
Financial Situation				
Stable	24	42.1	4	6.3
Unstable	29	46	29	46

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Socio-Economic Characteristics	CMS users		Non-CMS users	
	Frequency	Percentage	Frequency	Percentage
Struggling	17	27	17	27
Farm Size (Hectares)				
0.5 Ha	1	1.6	1	1.6
1.0 Ha	54	85.7	54	85.7

Adoption of certified maize seeds among farmers

Table 2 shows the adoption status of certified maize seeds among respondents. The results indicate that 52.5% of the farmers had adopted certified maize seeds, while 47.5% were non-adopters.

Table 2: Adoption of certified maize seeds

Adoption Response	Frequency	Percentage (%)
Adopters of CMS	63	52.5
Non-adopters of CMS	57	47.5
Total	120	100.0

Factors responsible for adoption of certified maize seeds

The binary logistic regression results presented in Table 4.2.2 show that the model was statistically significant (LR statistic = 144.2802, $p < 0.01$) with a McFadden R^2 of 0.454, indicating that the explanatory variables accounted for approximately 45.4% of the variation in adoption decisions.

Among the explanatory variables, household size and annual farm income significantly influenced adoption of certified maize seeds. Household size had a positive and significant effect ($\beta = 0.883974$, $p < 0.05$), indicating that farmers with larger households were more likely to adopt certified maize seeds. Annual farm income also had a positive and significant effect ($\beta = 1.61E{-}05$, $p < 0.10$), suggesting that farmers with higher farm incomes were more likely to adopt certified seeds.

Table 3: Binary logit regression of factors responsible for adoption of certified maize seeds

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
Constant	-1.655671	5.583347	-0.296537	0.7668
Household head gender	0.11844	3.153674	0.037556	0.97
Age	-0.072699	0.066922	-1.086338	0.2773
Marital status	1.071664	0.949825	1.128275	0.2592
Household size	0.883974***	0.345118	2.561366	0.0104
Highest education level	-0.777721	0.575506	-1.351369	0.1766

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Primary occupation	-0.502522	0.580463	-0.865726	0.3866
Farming experience	-0.010006	0.072906	-0.137239	0.8908
Annual farm income	1.61E-05*	9.60E-06	1.682605	0.0925
Annual non-farm income	-5.74E-07	1.02E-06	-0.563674	0.573
Access to credit	2.077412	1.486408	1.397605	0.1622
Monthly expenditure	4.58E-07	5.17E-06	0.088451	0.9295
Financial situation	-1.273172	0.9632	-1.321815	0.1862
Farm size	-0.463553	1.774691	-0.261202	0.7939

Table 4: Goodness-of-Fit Statistics of the Binary Logit Model for Certified Maize Seed Adoption

Statistic	Score
McFadden R-squared	0.454354
S.D. dependent variable	0.485135
Akaike info criterion	0.821959
Schwarz criterion	0.995991
Hannan-Quinn criterion	0.892081
Restricted Deviance	317.5504
LR statistic	144.2802
Mean dependent variable	0.48077
S.E. of regression	0.38472
Sum squared residuals	5.62432
Log likelihood	-18.199
Deviance	36.3984
Restricted log likelihood	-36.005
Average log likelihood	-0.35
Prob (LR statistic)	0

Food security status of farming households using certified maize seeds and traditional seeds

Table 5 compares the food security status of households using certified maize seeds and those using traditional seeds. The results show that 64.9% of households using certified maize seeds were food secure, while 35.1% were food insecure. In contrast, only 6.3% of households using traditional seeds were food secure, whereas 93.7% were food insecure.

Table 5: Food security status of farming households using certified maize seeds and traditional seeds

Category	Frequency	Percentage (%)
Farmers using certified maize seeds		
Food non-secure	20	35.1

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Food secure	37	64.9
Farmers not using certified maize seeds		
Food non-secure	59	93.7
Food secure	4	6.3

Effect of certified maize seeds on farming household food security

Table 4.4 presents the binary logistic regression results for the effect of certified maize seed adoption on household food security. The model was statistically significant (LR statistic = 47.97585, $p < 0.01$) and explained about 66.8% of the variation in household food security (McFadden $R^2 = 0.668380$).

Three variables significantly influenced food security. Farming experience had a positive and significant effect ($\beta = 0.258046$, $p < 0.10$), indicating that more experienced farmers were more likely to be food secure. Financial situation had a negative and significant effect ($\beta = -3.129744$, $p < 0.10$), implying that financially constrained households were more likely to experience food insecurity. Adoption of certified maize seeds had a strong positive and highly significant effect ($\beta = 4.713687$, $p < 0.05$), showing that households using certified maize seeds were more likely to be food secure than non-users.

Table 6: Binary logit regression of effect of certified maize seed adoption on household food security.

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
Constant	3.177073	11.25046	0.282395	0.7776
Household head gender	-1.284505	5.044029	-0.254658	0.799
Age	-0.138998	0.114189	-1.217262	0.2235
Marital status	-1.529213	2.015949	-0.758557	0.4481
Household size	0.805647	0.59743	1.348521	0.1775
Highest education level	-0.18723	1.092561	-0.171368	0.8639
Primary occupation	0.478711	0.7779	0.615389	0.5383
Farming experience	0.258046**	0.144148	1.790142	0.0734
Annual farm income	-3.22E-06	1.80E-05	-0.179212	0.8578
Annual non-farm income	1.16E-05	1.11E-05	1.050512	0.2935
Access to credit	-2.104702	2.401926	-0.876256	0.3809
Monthly expenditure	8.12E-06	2.26E-05	0.358302	0.7201
Financial situation	-3.129744**	1.863083	-1.679873	0.093
Farm size	-1.09812	2.939263	-0.373604	0.7087
Adoption of CMS	4.713687***	1.836343	2.566888	0.0103

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Table 7: Goodness-of-Fit Statistics of the Binary Logit Model on the Effect of Certified Maize Seed Adoption on Household Food Security

Statistic	Score
McFadden R-squared	0.66838
S.D. dependent variable	0.503382
Akaike information criterion	1.034682
Schwarz criterion	1.597541
Hannan-Quinn criterion	1.250469
Restricted Deviance	71.77931
LR statistic	47.97585
Mean dependent variable	0.461538
S.E. of regression	0.312748
Sum squared residuals	3.619018
Log likelihood	-11.90173
Deviance	23.80346
Restricted log likelihood	-35.88966
Average log likelihood	-0.228879
Prob (LR statistic)	0.000013

Overall, the study found that 52.5% of maize farmers had adopted certified maize seeds. Household size and annual farm income were the major determinants of certified maize seed adoption. Households using certified maize seeds were considerably more food secure (64.9%) than households using traditional seeds (6.3%). Furthermore, adoption of certified maize seeds significantly improved household food security, while farming experience positively influenced food security and financial constraints reduced the likelihood of being food secure.

Discussion

The study finds that certified maize seed adoption improves household food security in Enugu State. Adoption decisions are mainly shaped by household resource endowments, especially household size and farm income, while food security outcomes depend on technology use, farming experience, and financial conditions. These findings support the view that productivity-enhancing agricultural technologies improve welfare when farmers have the capacity and incentives to adopt them. The results align with agricultural development literature and agricultural household theory, which emphasize that production decisions directly affect consumption and welfare outcomes (Feder et al., 1985; Singh et al.,

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1986; Rogers, 2003; Asfaw et al., 2012). Overall, certified seed adoption appears to strengthen household resilience against food shortages and production constraints.

The study highlights that farming in the study area is predominantly male-dominated. Male farmers and male-headed households formed the majority of both adopters and non-adopters, reflecting the gendered structure of agricultural systems in sub-Saharan Africa where men often control productive resources and decision-making (Doss, 2018; FAO, 2011). High marriage rates suggest reliance on family labour for farming activities and income generation. Although most farmers had some formal education, education did not significantly influence adoption decisions. This suggests that factors such as access to resources and institutional support may be more important than schooling in determining technology uptake (Mignouna et al., 2011; Simtowe et al., 2016).

Household size and income significantly drive adoption of certified maize seeds. Larger households are more likely to adopt due to greater labour availability and higher food consumption needs, which increase incentives to adopt productivity-enhancing technologies (Asfaw et al., 2012; Kassie et al., 2015). Annual farm income also plays a critical role, as financially stronger households can better afford improved seeds and complementary inputs. This supports evidence that liquidity constraints remain a major barrier to agricultural technology adoption (Feder et al., 1985; Uaiene et al., 2009). In contrast, variables such as age, education, and access to credit were not significant, likely due to contextual limitations in credit access and small farm size variation.

Certified maize seed adoption is strongly associated with improved food security outcomes. Households using certified seeds were significantly more food secure than non-users, reflecting the yield and productivity advantages of improved seed varieties. Although causality cannot be fully established due to the cross-sectional design, the findings align with evidence that improved seeds enhance food availability, income, and resilience to shocks (Shiferaw et al., 2014; Wossen et al., 2017; Erenstein et al., 2022). This supports policy arguments promoting improved seed systems as a pathway to reducing household food insecurity.

Farming experience and financial status significantly influence household food security. More experienced farmers are more likely to achieve food security due to better knowledge of production practices, risk management, and adaptation strategies (Abate et al., 2016). Conversely, households facing financial constraints are more vulnerable to food insecurity due to limited access to inputs, markets, and adequate consumption capacity (FAO et al., 2023; World Bank, 2022). These findings emphasize the combined role of human capital and economic stability in shaping food security outcomes.

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The study is limited by its cross-sectional design and reliance on self-reported food security data. These constraints limit causal inference and may introduce recall or perception bias. Additionally, the relatively small and location-specific sample may limit generalizability to other regions with different farming systems. Despite these limitations, the study contributes by jointly analyzing adoption behaviour and food security outcomes within a unified framework using both descriptive and econometric methods. This strengthens the reliability of the observed relationships.

Conclusion

This study examined the adoption of certified maize seeds and its relationship with household food security among maize farmers in Enugu State, Nigeria. The findings indicate that certified maize seed adoption is relatively widespread among the sampled farmers and that adoption is associated with improved household food security. Household size and farm income emerged as important factors influencing adoption decisions, while farming experience, household financial conditions, and certified seed use were significant correlates of food security outcomes. These findings highlight the interconnected nature of agricultural technology adoption and household welfare within smallholder farming systems.

The study contributes to the growing evidence that access to improved agricultural technologies can play an important role in addressing food insecurity in rural areas. While adoption alone cannot eliminate all dimensions of food insecurity, the results suggest that certified maize seeds may form part of a broader strategy for improving agricultural productivity and strengthening household resilience. Consequently, policies that enhance farmers' access to certified seeds, improve the effectiveness of extension services, and address financial constraints facing smallholder farmers may support both technology uptake and food security objectives.

Future research should move beyond cross-sectional analyses and employ longitudinal, experimental, or quasi-experimental approaches to establish stronger causal evidence regarding the welfare impacts of certified seed adoption. Further investigation is also needed to understand the specific pathways through which certified seeds influence household food security, including productivity gains, income generation, market participation, and adaptation to environmental risks. Ultimately, improving access to quality seed technologies, alongside complementary institutional and financial support, remains an important pathway for promoting sustainable agricultural development and improving the livelihoods of rural households.

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