

**IMPACT OF DEMOGRAPHIC CHARACTERISTICS OF RURAL WOMEN
FARMERS ON SOYBEAN PRODUCTION IN SABON GARI LOCAL
GOVERNMENT AREA OF KADUNA STATE**

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ABSTRACT

This study examined the impact of demographic characteristics of rural women farmers on soybean production in Sabon Gari Local Government Area, Kaduna State, Nigeria. Specifically, the study assessed how age, marital status, household size, educational attainment, and farming experience influence soybean productivity. Primary data were collected from 256 rural women farmers using structured questionnaires and analyzed with descriptive statistics and Ordinary Least Squares (OLS). The descriptive results indicate that most respondents were within the economically active age bracket, married, and possessed moderate levels of education and farming experience. However, the regression results show that the demographic variables jointly exerted no statistically significant effect on soybean production ($R^2 = 0.016$, $F = 0.826$, $p > 0.05$). Although farming experience exhibited a positive coefficient, the effect was statistically insignificant, suggesting only limited explanatory power. The findings therefore indicate that demographic characteristics are weak predictors of soybean output among rural women farmers in the study area. The study recommends that policy interventions should prioritize improving women's access to productive resources, strengthening cooperative participation, and expanding gender-responsive agricultural training programmes to enhance productivity.

Keywords: Demographic characteristics, Rural women, Soybean

1. Introduction

Global soybean production has expanded markedly over the past two decades, driven by rising demand for food, livestock feed, and industrial applications. According to the Food and Agriculture Organization (FAO, 2023, 2024), global output increased substantially between 2010 and 2024, with major growth recorded in Brazil, the United States, and Argentina. Emerging producers such as

Russia and Ukraine also experienced notable expansion, while countries like Australia and Uganda recorded modest but steady gains. This trend reflects the increasing global importance and geographical diffusion of soybean production. Despite this global momentum, Africa's soybean sector has not kept pace with worldwide productivity gains, even though the crop possesses significant nutritional and economic value for the continent.

Nigeria remains one of the leading soybean producers in Sub-Saharan Africa, with Kaduna State recognized as a major production hub (John et al., 2020). Nevertheless, soybean productivity in the country remains relatively low compared with global benchmarks. Existing studies attribute this gap to limited research investment, weak adoption of improved technologies, and suboptimal land allocation for the crop (Vanger et al., 2021). Beyond these structural constraints, the role of farmer-specific characteristics particularly among women as received comparatively less rigorous empirical attention, despite the growing policy emphasis on gender-inclusive agricultural development.

In Kaduna State, soybean cultivation constitutes an important livelihood activity for rural women, contributing significantly to household income, food security, and welfare outcomes (Olagunju et al., 2025). The crop is widely recognized as a viable pathway for women's economic empowerment because income derived from soybean sales enhances women's capacity to invest in children's education, healthcare, and household improvements (Nater et al., 2021). However, the productivity performance of rural women farmers may be shaped not only by access-related constraints but also by their demographic characteristics, including age, marital status, educational attainment, household size, and farming experience. These factors can influence managerial ability, labor availability, decision-making autonomy, and responsiveness to improved production practices.

Empirical evidence from Sabon Gari Local Government Area (LGA) indicates that small-scale soybean farmers operate at an average technical efficiency of about 80% (Yusuf et al., 2022), suggesting the presence of efficiency gaps that could be addressed through improved resource use and institutional support. At the same time, adoption of recommended technologies remains moderate due to constraints such as inadequate credit, high labour costs, limited access to

threshing machines, and weak extension support (Yusuf et al., 2021). While these constraints are well documented, the extent to which the demographic profiles of rural women farmers independently explain variations in soybean production remains insufficiently examined at the micro level. Most prior studies in Nigeria and Sub-Saharan Africa either aggregate male and female farmers or focus primarily on technology adoption rather than directly modelling production outcomes for women farmers.

Furthermore, despite the implementation of major agricultural initiatives including the National Agricultural Technology and Innovation Policy (NATIP, 2022-2027), the Anchor Borrowers' Programme (ABP), and the Kaduna Agricultural Development Project (KADP) rural women continue to face persistent structural barriers. Evidence suggests that extension services and input distribution programmes often disproportionately favour male farmers, thereby constraining women's access to modern production technologies (Yusuf et al., 2021). In addition, land tenure restrictions and stringent credit requirements continue to limit women's effective participation in commercial agriculture (Ihunwo et al., 2023). These institutional challenges raise an important empirical question: to what extent do observable demographic characteristics, independent of structural constraints, actually explain variations in soybean production among rural women farmers?

Addressing this question is important for both policy design and resource targeting. If demographic attributes are significant productivity drivers, interventions may need to be differentiated across farmer groups. Conversely, if their effects are weak, greater emphasis should be placed on structural and institutional constraints. The key gap in the literature is the limited localized, gender-disaggregated empirical evidence that directly estimates the production effects of rural women's demographic characteristics in specific high-producing zones such as Sabon Gari LGA.

Accordingly, this study investigates the impact of selected demographic characteristics age, marital status, household size, educational attainment, and farming experience on soybean production among rural women farmers in Sabon Gari Local Government Area of Kaduna State using primary survey data and

Ordinary Least Squares (OLS) estimation. The novelty of the research lies in its micro-level women-centered production analysis in a major soybean-producing area, which generates context-specific evidence on the significance of demographic attributes for explaining output variation among rural women farmers. By isolating the explanatory power of these characteristics, the study contributes to the gender and agricultural productivity literature and offers evidence-based insights for designing more targeted, gender-responsive agricultural policies.

2. Literature Review and Theoretical Framework

2.1 Conceptual review

2.1.1 Soybeans Production

Soybean production has been conceptualized in diverse ways within the agricultural literature. Shurtleff and Aoyagi (2009) describe soybean production as a complex agricultural system involving the selection of appropriate varieties, soil fertility management, pest and disease control, and the application of proper harvesting techniques to maximize both yield and product quality. Similarly, Graham and Vance (2000) define soybean production as the cultivation of *Glycine max*, a legume native to East Asia, emphasizing key agronomic operations such as soil preparation, planting, pest management, and harvesting with the objective of optimizing yields. Earlier, Sinclair and de Wit (1975) conceptualized soybean production as an integrated process of planting, growing, and harvesting soybean crops, highlighting the critical roles of environmental conditions and varietal genetic potential in determining production efficiency and sustainability.

In the context of this study, the definition proposed by Toomer et al. (2023) is adopted. They conceptualize soybean production as a comprehensive system encompassing agronomic, environmental, and post-harvest processes involved in the cultivation of *Glycine max*, including soil management, planting, pest control, and harvesting practices aimed at sustainably maximizing yield and quality.

2.1.2 Rural Women Farmers

Nyirongo (2019) emphasizes the pivotal role of rural women in advancing sustainable development while underscoring the persistent constraints they face, particularly limited access to productive resources and participation in decision-making processes. Similarly, the UN Women (2025) recognizes rural women as critical agents of transformative economic, environmental, and social change necessary for sustainable development. However, the agency notes that their contributions are often constrained by restricted access to credit, healthcare, and education, challenges that are further intensified by global food and economic crises as well as climate change pressures.

In the context of this study, rural women are defined as women residing in rural areas who often perform traditional gender roles, typically manage larger household sizes, and frequently encounter structural constraints such as limited social support and comparatively lower participation in formal labour markets.

2.1.3 Demographic Characteristics

Fiveable (2024) defines demographic characteristics as the statistical features that describe a population, such as age, gender, race, ethnicity, income, education level, and other socioeconomic factors. These characteristics are crucial for understanding and predicting human behaviour, as they shape individuals' and groups' attitudes, preferences, and decision-making processes.

2.2 Theoretical Review

2.2.1 Malthusian Theory

The Malthusian Theory was formulated by the British economist Thomas Robert Malthus in the late 18th century. He argued that human populations tend to grow exponentially, while food production increases only arithmetically. As a result, population growth would eventually outpace food supply, leading to scarcity of resources and triggering checks on population size such as famine, disease, and war, which Malthus called "positive checks." He also identified "preventive

checks," including delayed marriage and other factors that reduce birth rates, which could help manage population growth.

2.2.2 Diffusion of Innovation Theory

The Diffusion of Innovation Theory, advanced by Everett Rogers (2003), posits that the adoption of new technologies is shaped by individual characteristics and the flow of information within a social system. In agricultural contexts, farmers' demographic attributes such as education, age, farming experience, and exposure to extension services significantly influence both the likelihood and the speed of adopting innovations, including improved soybean varieties and modern production techniques (Rogers, 2003; Feder et al., 1985). Empirical evidence generally shows that younger and more educated farmers tend to respond more readily to new technologies, while accumulated farming experience enhances effective utilization. Consequently, demographic characteristics indirectly affect farm productivity through their influence on technology adoption processes.

2.2.3 Agricultural Household Model

The Agricultural Household Model, developed by Inderjit Singh, Lyn Squire, and John Strauss (1986), conceptualizes the farm household as an integrated unit that simultaneously makes production and consumption decisions, particularly under conditions of imperfect markets. Within this framework, household demographic characteristics such as household size, age structure, marital status and gender roles shape labour supply, resource allocation, and decision-making authority. Because family labour constitutes a critical input in smallholder agriculture, the demographic composition of the household directly affects farm operations and the adoption of improved technologies. Accordingly, variations in soybean production among rural women farmers may be explained not only by market conditions and technological factors but also by household structure and intra-household dynamics (Singh et al., 1986; Udry, 1996).

2.2.4. Human Capital Theory

Human Capital Theory, propounded by Gary Becker (1964), posits that individuals' investments in education, skills, training, experience, and health enhance their

productivity and overall economic performance. Within this framework, knowledge and skills are treated as forms of capital that generate returns through increased efficiency, improved decision-making, and higher output. In agricultural settings, farmers with higher educational attainment and greater practical experience are more likely to adopt improved technologies, utilize resources efficiently, and achieve superior production outcomes (Becker, 1964; Schultz, 1961).

For rural women farmers, demographic characteristics such as age, educational attainment, farming experience, and household size directly influence their human capital and capacity to maximize soybean production. Education strengthens managerial ability and responsiveness to innovation, while farming experience enhances technical competence through learning-by-doing. Household size also affects labour availability and the intra-household allocation of tasks. Consequently, Human Capital Theory provides a strong theoretical basis for linking demographic attributes with agricultural productivity.

This study adopts Human Capital Theory as its principal analytical framework because it explicitly explains how variations in demographic characteristics translate into differences in productivity. The theory also informs the methodological design by guiding the measurement of demographic variables as key determinants of soybean output. Although the Agricultural Household Model (Singh et al., 1986) and the Diffusion of Innovation Theory (Rogers, 2003) offer complementary insights into household dynamics and technology adoption, Human Capital Theory remains central to understanding the direct influence of demographic factors on rural women's agricultural productivity in Sabon Gari Local Government Area.

2.3 Empirical Review

Empirical evidence consistently identifies demographic characteristics as key determinants of agricultural technology adoption and productivity outcomes. Across methodological approaches and contexts, variables such as age, education, gender, household size, land tenure, and access to credit significantly influence farmers' adoption behaviour and farm performance.

In Nigeria, Abdullahi et al. (2025), using a probit regression model in North-East Nigeria, found that age, extension contact, and land tenure significantly determine improved soybean management adoption, with notable gender-differentiated effects among female farmers. Similarly, Adetomiwa et al. (2025) applied a recursive bivariate probit model combined with a selectivity-corrected OLS regression in North-Central Nigeria and reported that adoption of improved soybean varieties and rhizobium inoculants significantly increased yield and farm income after correcting for selection bias. These findings underscore both the productivity-enhancing effect of adoption and the importance of accounting for demographic and unobserved heterogeneity.

Using panel data regression, Ogundari et al. (2024) further demonstrated that education, age, household size, and access to credit significantly influence innovation uptake, highlighting the role of human capital in strengthening productivity. Likewise, Adebayo et al. (2023), through logit estimation among smallholder farmers in Northern Nigeria, confirmed that gender, education, farming experience, and household size significantly affect improved input utilization. Beyond Nigeria, Mwangi and Kariuki (2019), in a systematic review of Sub-Saharan Africa, identified age, education, gender, and household size as persistent determinants of adoption behaviour.

Despite this strong empirical consensus, existing studies are largely geographically broad or gender-neutral. There remains limited location-specific and women-focused evidence on soybean production. Addressing this gap, the present study provides localized insights into how demographic characteristics influence soybean productivity among rural women in Sabon Gari Local Government Area, Kaduna State.

3. Methodology

3.1 Research Design

This study adopted a descriptive design. The design was chosen because it allows for the collection of primary data through structured questionnaires from a cross-section of rural women farmers involved in soybean production in Sabon Gari Local Government Area of Kaduna State. The analytical aspect consists of the use

of statistical tools to examine the influence of demographic characteristics, such as age, marital status, education, household size, and years of farming experience, on soy bean production.

3.2 Study Area

The study was conducted in Sabon Gari Local Government Area of Kaduna State, located in the northern part of Nigeria. Sabon Gari is one of the major agricultural zones in Kaduna State and is known for the cultivation of various crops, including maize, soybeans, groundnuts, and sorghum. The area has a predominantly agrarian population, with a significant proportion of rural women participating in farming activities either as smallholders or subsistence farmers. The climate of the area is tropical, characterized by a wet and dry season, which supports soybean cultivation.

3.3 Population and Sample Size of the Study

The target population consists of rural women involved in soybean farming in Sabon Gari LGA. These women differ in socio-economic background, farming experience, and access to resources. Records from the Kaduna State Ministry of Agriculture and Forestry (2024) indicate that the total number of soybean farmers in Sabon Gari Local Government Area is 2,625. Out of this total, 709 are female soybean farmers, while the remainder are male farmers. However, this study focuses solely on female farmers in the study area because most existing studies examine both genders, with only a few concentrating specifically on female farmers in the area; hence, the need for this research.

With a total population of 709 female farmers in the study area, the sample size was determined using Taro Yamane's formula (1967). The Yamane's formula is given as:

$$n = \frac{N}{1+N(e)^2} \dots \dots \dots (1)$$

Where:

n = sample size

N = population size (709)

e = margin of error (0.05)

Therefore, the sample size for the study is calculated as:

$$n = \frac{709}{1 + 709(0.05)^2}$$

$$= \frac{709}{1 + 709(0.005)}$$

$$n = 1 + 709(0.005)709 = 255.7 = 256$$

Hence, a sample size of 256 soybean farmers was used in this study.

3.4 Sampling Procedure

A survey method using a structured questionnaire and informal interviews of respondents was used to obtain relevant information for the study. The study employed a multi-stage sampling technique to ensure a representative selection of respondents from the rural women engaged in soybean farming in Sabon Gari Local Government Area. In the first stage, Kaduna State, consisting of 23 Local Government areas, was divided into three geo-political zones, which are the Northern, the Central, and the Southern senatorial districts. The second stage involves purposive selection of Sabon Gari Local Government Area from the Northern senatorial district. The third stage involves purposive selection of communities with significant soybean production. The fourth stage involves a stratified sampling approach to categorize respondents based on farm size, experience, and access to agricultural resources. This stratification ensures diversity and captures variations in production levels and economic conditions.

Table 1: Sampling procedure

State	Geo-political Zone	Selected LGA	Selected Communities	Farm Size
Kaduna	Northern Senatorial District	Sabon Gari	Shika	Large
			Bomo	Large
			Bassawa	Large
	Central Senatorial District		Samaru	Medium
			Sakadadi	Medium
			Hayin Sambo	Medium
	Southern Senatorial District		Chikaji	Small
			Hayin Ojo	Small

Note. Constructed by the Researcher (June 2025)

3.5 Sources and Method of Data Collection

The study utilized primary data collected through structured questionnaires administered to soybean farmers in the study area. Additionally, the researcher facilitated open-ended interactions, allowing respondents to freely share their experiences, views, and expectations related to soybean production.

3.6 Method of Data Analysis

Data collected were analyzed using both descriptive and inferential statistical techniques with the aid of the Statistical Package for Social Sciences (SPSS version 25).

Descriptive statistics such as frequency distributions and percentages were used to summarize the demographic characteristics of the respondents, as shown in the study. This provided insights into the socio-economic profile of the rural women engaged in soybean farming. At the same time, inferential statistics were employed to test the relationship between demographic characteristics and soybean production. The main analytical tool used was the Ordinary Least Squares (OLS) regression model, which examined the impact of demographic factors on soybean production (proxied by average income from soybean sales).

3.7 Model specification

The study employed the Ordinary Least Squares (OLS) multiple regression technique to estimate the impact of demographic characteristics of rural women on soybean production in Sabon Gari Local Government Area of Kaduna State. The model is based on the assumption that soybean production (Y) is a function of several demographic characteristics (Age), such as age, marital status, household size, educational qualification, and years of farming experience.

This functional relationship can be expressed as:

$$Y = f(Age, Mar, Edu, Hou, Exp) + \mu$$

Transforming the functional form into a linear econometric model yield:

$$Y_i = \beta_0 + \beta_1 Age_i + \beta_2 Mar_i + \beta_3 Edu_i + \beta_4 Hou_i + \beta_5 Exp_i + \mu_i$$

Where:

Y_i = Soybeans production for the i^{th} respondent (measured by average income earned from soybeans sales or farm size in hectares)

Age_i = Age of respondent (years)

Mar_i = Marital status (coded: 1 = Single, 2 = Married, 3 = Divorced, 4 = Widowed)

Edu_i = Household size (number of persons)

Hou_i = Educational qualification (coded by level attained)

$Expi$ = Years of farming experience (years)

β_0 = Intercept (constant term)

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Coefficients of the explanatory variables

μ_i = Random error term assumed to be normally distributed with mean zero and constant variance

The model was estimated using the Ordinary Least Squares (OLS) estimation technique in SPSS version 25, which minimizes the sum of squared residuals to obtain the best linear unbiased estimators (BLUE) of the parameters.

4. Results and Discussions

4.1 The Descriptive Statistics

Table 2
Demographic Characteristics of the Respondents

Variable	Category	Frequency (f)	Percentage (%)
Age Group	Less than 25 years	83	32.4
	26-45 years	121	47.3
	46-65 years	48	18.8
	Above 66 years	4	1.6
	Total	256	100.0
Marital Status	Single	72	28.1
	Married	103	40.2

Variable	Category	Frequency (f)	Percentage (%)
	Divorced	50	19.5
	Widowed	31	12.1
	Total	256	100.0
Household Size	1-3	59	23.0
	4-6	131	51.2
	7-8	57	22.3
	9-10	9	3.5
	Total	256	100.0
Educational Qualification	No formal education	33	12.9
	Primary	94	36.7
	Secondary	125	48.8
	Others	4	1.6
	Total	256	100.0
Years of Farming Experience	Less than 2 years	47	18.4
	3-5 years	113	44.1
	6-8 years	67	26.2
	9 years and above	29	11.3
	Total	256	100.0

Note. Researcher's Field Survey, 2025; N = 256

Table 2 shows the distributions of the socio-demographic characteristics of respondents in Sabon Gari Local Government Area of Kaduna State. The first panel of the Table shows respondents' age group distribution, of which 83 (32.4%) were less than 25 years of age, 121(47.3%) were between 26-45 years, 48(18.8%) were between 46-65 years, and 4(1.65) were above 66 years of age. The results indicate that nearly half of the respondents (47.3%) fall within the 26-45years age bracket, suggesting that soybean production is dominated by women in their economically active and productive age group. This implies a favorable demographic composition for agricultural productivity and innovation adoption.

The second panel of the Table shows respondents' marital status, of which 72(28.1%) were single, 103(40.2%) were married, 50(19.5%) were divorced, and 31(12.1%) were widowed. This indicates that the majority of the respondents (40.2%) were married, reflecting the prevalence of family-based farming systems in the area. Married women are more likely to have access to family labour and decision-making support, which can enhance soybean output.

The third panel of the Table shows respondents' household size, of which 59 (23.0%) have a household size between 1-3, 131(51.2%) have between 4-6, 57(22.3%) have between 7-8, while 9(3.5%) have between 9-10. Thus, more than half (51.2%) of the women had household sizes ranging from 4-6 persons, indicating that most households have a moderate labour supply that can be mobilized for soybean farming activities such as planting, weeding, and harvesting.

The fourth panel of the Table shows respondents' educational qualification distribution, of which 33(12.9%) had no formal education, 94(36.7%) have primary certificates. 125(48.8%) has secondary certificates, while 4(1.6%) indicated others. Therefore, education levels show that the majority (48.8%) attained secondary education. This relatively high literacy rate among respondents implies that most rural women have the potential to understand improved agricultural practices, extension messages, and new soybean production technologies — factors that positively influence productivity.

The fifth panel of the Table shows the distribution of respondents' years of farming experience, of which 47(18.4%) had spent less than 2 years, 113(44.1%) had spent 3-5 years, 67(26.2%) had spent 6-8 years, and 29(11.3%) had spent 9 years and above. Therefore, 44.1% of respondents had 3-5 years of farming experience, and another 26.2% had 6-8 years of experience, showing that a large proportion of the women possess considerable practical knowledge in soybean cultivation. Experience enhances skill, efficiency, and the ability to cope with production risks, which collectively contribute to improved soybean output.

Largely, the demographic composition suggests that soybean production in Sabon Gari LGA is primarily driven by active, moderately educated, and experienced rural women farmers, whose socio-economic characteristics have a strong

potential to influence their level of soybean production and poverty reduction outcomes.

4.2 Post Estimation Results

4.2.1 Result of the impact of demographic characteristics of rural women farmers on the production of soybean

Table 3
Demographic Characteristics of Rural Women Farmers and Soybeans Production

Variable	(β)	Std. Error	Beta	t	Sig. (p-value)	Tolerance	VIF
(Constant)	2.467	0.307	—	8.043	0.000	—	—
Age Group	-0.128	0.067	-0.120	-1.899	0.059	0.986	1.014
Marital Status	-0.004	0.052	-0.005	-0.072	0.942	0.986	1.014
Household Size	-0.002	0.066	-0.002	-0.032	0.975	0.990	1.010
Educational Qualification	-0.038	0.069	-0.035	-0.551	0.582	0.997	1.003
Years of Farming Experience	0.020	0.056	0.023	0.364	0.716	0.991	1.009

Note. Researcher's SPSS Simple Regression (OLS) Analysis Output, 2025

Table 3 is the regression result of the impact of demographic characteristics of rural women farmers on the production of soybean. The table shows that the coefficient of age group is negative and statistically insignificant at 5% level ($\beta = -0.120$, $p = 0.059$). Therefore, older women appear to have less production of soybean, but the effect is weak and insignificant. In the same vein, Marital Status ($\beta = -0.005$, $p = 0.942$) has no significant relationship and does not impact soybean production. Likewise, household size has a negative and insignificant relationship with soybean production ($\beta = -0.002$, $p = 0.975$), implying that family size does not affect production. Similarly, educational qualification revealed a negative and insignificant relationship ($\beta = -0.035$, $p = 0.582$). Thus, education level does not significantly impact soybean production, which may imply that both educated and less educated women face similar production conditions.

Lastly, years of farming experience show a positive but insignificant relationship with soybean production ($\beta = 0.023$, $p = 0.716$), suggesting that years of practice alone do not necessarily increase production.

4.2.2 Test of Goodness of Fit

Table 4: Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.127	0.016	-0.003	0.803

Source: Researcher's SPSS Simple Regression (OLS) Analysis Output, 2025

Table 4 shows the model summary of the simple regression analysis carried out in this study. The table revealed that the analysis returned a coefficient of correlation (R) of 0.127, indicating a very weak positive relationship between the demographic characteristics (age, marital status, household size, education, and farming experience) and soybean production (measured by average income earned from soybean sales).

Table 4 also shows that the coefficient of determination (R Square) value is 0.016 and the adjusted R-squared of -0.003. This implies that 1.6% of the variation in soybean production is explained by the combined demographic characteristics of the rural women farmers. The Adjusted R^2 (-0.003) slightly decreases after adjusting for the number of predictors, confirming that these demographic variables collectively do not significantly explain variations in soybean income among respondents. The Table also reveals that the analysis returned a standard error of 0.803 for the model, which indicates a moderate average deviation of the observed values from the regression line.

These results indicate that demographic factors such as age, education, household size, marital status, and farming experience explain less than 2% of the differences in soybean production levels, suggesting that other non-demographic factors (like access to inputs, land size, credit, or market access) likely play a stronger role.

4.2.3 Model Overall Statistical Significance

Table 5: ANOVA Result

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.662	5	0.532	0.826	0.532
Residual	161.116	250	0.644		
Total	163.777	255			

Source: Researcher's SPSS Simple Regression (OLS) Analysis Output, 2025

Table 4 is the ANOVA Table for the simple regression analysis, which tests for the overall statistical significance of the regression model. The ANOVA result indicates that the F-value (0.826) tests whether the regression model explains a significant amount of variance in soybean production, the p-value ($0.532 > 0.05$), indicating that the regression model is not statistically significant. This means that, jointly, the demographic characteristics of rural women do not have a significant influence on soybean production in the study area. Thus, the overall model failed to establish a statistically significant relationship between the combined demographic characteristics and soybean production. Therefore, these demographic variables do not jointly predict soybean production outcomes in the study area.

4. 3 Discussion of Findings

The study examined the impact of demographic characteristics on soybean production among rural women farmers in Sabon Gari LGA using OLS regression. The results show that age, marital status, household size, education, and farming experience have a statistically insignificant impact on soybean production. The overall model was not significant and exhibited very low explanatory power ($R^2 = 0.016$), indicating that demographic variables account for only a small share of output variation.

The negative but insignificant effect of age contrasts with Abdullahi et al. (2025) and Ogundari and Bolarinwa (2024), who found age to be a significant determinant of technology adoption. Similarly, the insignificant roles of education and

farming experience differ from Adebayo et al. (2023) and Mwangi and Ariuki (2019), who reported positive productivity effects through human capital and experience. The lack of significance for household size and marital status further suggests that family structure does not automatically translate into higher production among women farmers in the study area.

Overall, the findings imply that demographic characteristics alone are weak predictors of soybean production among rural women in Sabon Gari LGA. This aligns with evidence from Adetomiwa et al. (2025), which shows that productivity gains are more strongly driven by technology adoption and input access than by farmer demographics. The results, therefore, point to the greater importance of structural and resource-related factors such as access to improved inputs, credit, extension services, and land in explaining production outcomes.

5. Summary, Conclusion and Recommendations

The study showed that demographic characteristics account for only a minimal proportion of the observed variation in production outcomes. The results therefore suggest that, within the study area, demographic attributes are not the primary determinants of soybean productivity among rural women farmers. Rather, the evidence points toward the stronger influence of structural, institutional, and resource-related factors. By providing localized and gender-focused empirical evidence, the study contributes to the existing agricultural economics literature by clarifying that productivity outcomes among rural women farmers are more closely associated with access-related constraints than with personal demographic profiles. Therefore, Policy interventions aimed at improving soybean production among rural women farmers should prioritize resource access and institutional support mechanisms rather than demographic characteristics alone. There is a need for targeted programs that enhance access to improved seed varieties, fertilizers, and other critical farm inputs through subsidized and well-coordinated distribution systems. Financial institutions and government agencies should develop inclusive agricultural credit schemes specifically designed for rural women farmers to ease capital constraints. Extension services should be strengthened and made more gender-responsive, with regular field-based training on improved soybean production and management practices. Furthermore,

promoting cooperative associations and strengthening market linkages would improve both input procurement and produce marketing efficiency. Future research should extend the analytical framework by incorporating variables such as input use intensity, farm size, technology adoption, credit access, and extension contact, and by applying more comprehensive econometric models to deepen understanding of productivity drivers and poverty reduction outcomes among rural women farmers.

Reference

- Abdullahi, M. A., Yusuf, S. U., & Bello, T. (2025). Determinants of adoption of improved soybean management practices among rural farmers in North-East Nigeria. *Journal of Agricultural Extension and Development*, 12(1), 45-59.
- Adebayo, F. O., Chukwuemeka, E. C., & Okoli, I. C. (2023). Socio-economic and demographic determinants of technology adoption among smallholder farmers in Northern Nigeria. *Journal of Rural Studies and Development*, 9(2), 112-130.
- Adelakun, A. A. (2023). *Performing power in Nigeria: Identity, politics, and Pentecostalism*. Cambridge University Press.
- Akande, A., & Bello, A. (2024). Impact of access to cash remittances on cocoa yield in Southwestern Nigeria. *Sustainable Futures*, 7, 100168.
- Aremu, T., Chukwuma, O. V., Ezeani, E. I., & Evelyn, O. (2024). Toward evidence-informed policymaking in Nigeria? A systematic review of agricultural evidence syntheses. *Frontiers in Sustainable Food Systems*, 8, 1465214. <https://doi.org/10.3389/fsufs.2024.1465214>
- Arejiogbe, O. E., Moses, C. L., Salau, O. P., Onayemi, O. O., Agada, S. A., Dada, A. E., & Obisesan, O. T. (2023). Bolstering the impact of social entrepreneurship and poverty alleviation for sustainable development in Nigeria. *Sustainability*, 15(8), 6673. <https://doi.org/10.3390/su15086673>
- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.

- Cornelius, M., & Goldsmith, P. D. (2020). Soybeans yield in Africa. *African Journal of Food, Agriculture, Nutrition and Development*, 19(5), 15169-15172. <https://doi.org/10.18697/ajfand.88.SILFarmDoc12>
- Eze, I., et al. (2023). Amino acid profiles and sucrose content in developing soybean seeds. *Journal of Biotechnology*, 231(10), 41-42.
- Eti, H., & Odeniyi, O. O. (2022). The impact of World Bank-assisted projects on poverty alleviation. [Journal Name], Volume(Issue), Pages.
- FAO (Food and Agriculture Organization of the United Nations). (2023). *FAOSTAT statistical database: Crops and livestock products (soybeans production by country)*. FAO. <https://www.fao.org/faostat/>
- FAO (Food and Agriculture Organization of the United Nations). (2024). *Agricultural production statistics 2010-2024*. FAO Statistics Division. <https://www.fao.org/statistics/highlights-archive/>
- Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change*, 33(2), 255-298.
- Fiveable. (2024, August 1). *Demographic characteristics - Intro to political science*. <https://fiveable.me/key-terms/intro-to-poli-sci/demographic-characteristics>
- Ganiyu, L., Abdulkareem, S. B., Babasanya, B., Oladele, G. O., Yahaya, U. F., Olumuyiwa, S., & Olowohunwa, J. I. (2016). Socio-economic factors influencing the adoption of social forestry practices by farmers in Birnin Gwari Local Government Area of Kaduna State. In *Proceedings of the 21st Annual National Conference of the Agricultural Extension Society of Nigeria (AESON)*, Ibadan, 16th-21st April (pp. 193-200).
- Ganiyu, L., Ademola, T. O., Aaron, J. A., Ushie, F. T., Faisal, M. T., Oni, B. O., ... & Anamayi, R. M. (2023). Determinants of the contribution of non-timber forest products (NTFPs) to rural household food security in Kajuru Local Government Area of Kaduna State, Nigeria. *Journal of Community & Communication Research*, 8(1), 64-74.

- Graham, A., & Vance, Z. (2000). Effect of cooking on protein digestion and antioxidant activity of different legume pastes. *Foods*, 10(1), 47.
- Ibrahim, M. A., & Abdullahi, L. K. (2023). Financial inclusion as a paradox for economic growth in Nigeria. *Malet Journal of Accounting and Finance*, 4(1), 100-114.
- Kaduna State Bureau of Statistics. (2021). *Kaduna state GDP report 2021 [Report]*. Kaduna State Bureau of Statistics. <https://kdbns.ng/publications/kaduna-state-gdp-report-2021/>
- Kehinde, A. D. (2022). Access to trade credit and its impact on the use of European Union (EU) approved pesticides among smallholder cocoa farmers in Ondo State, Nigeria. *Heliyon*, 8(12).
- Mwangi, W., & Kariuki, S. (2019). Factors determining adoption of agricultural technologies in developing countries. *Journal of Economics and Sustainable Development*, 10(6), 45-58.
- Malthus, T. R. (1798). *An Essay on the Principle of Population*. J. Johnson.
- Ndondo, J. T. K. (2023). Review of the Food and Agriculture Organisation (FAO) strategic priorities on food safety 2023. In *Food Safety-New Insights*.IntechOpen.
- Ogbanje, E. C. (2023). Financial performance of soybean farmers in Vandeikya Local Government Area of Benue State, Nigeria. *Journal of Agriculture and Food Sciences*, 21(1), 128-146.
- Ojiako, I. A., Manyong, V. M., & Ikpi, A. E. (2007). Determinants of rural farmers' improved soybeans adoption decisions in northern Nigeria. *Journal of Food, Agriculture and Environment*, 5(2), 215-223.
- Okeke, N. O., & Ani, J. K. (2023). The impacts of climate change on agricultural production in Nigeria (Master's thesis, Norwegian University of Life Sciences).
- Olalekan Abioye, S. O., Oyedele, L. O., & Akanbi, O. O. (2024). Rural entrepreneurship in the digital age: A systematic review. *International Journal of Sustainable Rural Development*, 1(1), 1-5.

- Olagunju, O. E., Olagunju, O. S., Agunbiade, M. O., & Amos, O. (2025). Contributions of rural women's livelihood activities towards household food security in Kajuru Local Government Area of Kaduna State. *Nigeria Agricultural Journal*, 55(2), 789-796.
- Ogunfolaju, M. O., & Oyesola, O. B. (2025). Socioeconomic factors influencing agricultural productivity among rural crop farmers in Osun State, Nigeria. *African Journal of Agricultural Science and Food Research*, 21(1), 55-66. <https://doi.org/10.62154/ajasfr.2025.021.01014>
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- Sanginga, P. C., Adesina, A. A., Manyong, V. M., Otite, O., & Dashiell, K. (2019). Social impact of soybean research in Nigeria's agricultural sector. *Agricultural Research Journal*, 45(3), 215-230.
- Schultz, T. W. (1961). Investment in human capital. *American Economic Review*, 51(1), 1-17.
- Shurtleff, W., & Aoyagi, A. (2021). History of cooperative soybeans processing in the United States (2013-2021): Extensively annotated bibliography and sourcebook. SoyinfoCenter.
- Toomer, O. T., Oviedo, E. O., Ali, M., Patino, D., Joseph, M., Frinsko, M., Vu, T., Maharjan, P., Fallen, B., & Mian, R. (2023). Current agronomic practices, harvest & post-harvest processing of soybeans (*Glycine max*) — a review. *Agronomy*, 13(2), 427. <https://doi.org/10.3390/agronomy13020427>
- Udry, C. (1996). Gender, agricultural production, and the theory of the household. *Journal of Political Economy*, 104(5), 1010-1046.
- United States Department of Agriculture (USDA). (2024). *Oilseeds: World markets and trade*. USDA Foreign Agricultural Service. <https://www.fas.usda.gov/data/oilseeds-world-markets-and-trade>
- Vanger, N. M., Usman, A. K., & Mohammed, H. (2021). Land suitability mapping for optimum soybean production in Konshisha Local Government Area, Benue State, Nigeria. *Journal of Agricultural Economics, Environment and Social Sciences*, 7(2), 234-245. <https://www.jaeess.com.ng/index.php/jaeess/article/view/126>

Yusuf, H., Omokore, D. F., Olawoye, R., & Yusuf, H. A. (2022, November). Analysis of production efficiency among small-scale soybean farmers in Sabon Gari Local Government Area of Kaduna State, Nigeria. Institute for Agricultural Research, Ahmadu Bello University.

UN Women. (2025). *Rural women*. UN Women.
<https://www.unwomen.org/en/what-we-do/economic-empowerment/rural-women>