VOL. 12 NO. 1,
MAY, 2026
E-ISSN 3027-0995
P-ISSN 3026-8265

African Scholar Publications & Research International
www.africanscholarpub.com

Journal of Biotechnology and Agricultural Research (JBAR)

Socio-Economic Determinants of Farmers' Willingness to Participate in Tomato Production in Apa Local Government Area, Benue State, Nigeria

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DOI: https://doi.org/10.70382/ajbar.v12i1.034

Abstract

Tomato production is an important agricultural enterprise that contributes to household income, employment generation, and food security in Nigeria. Despite its economic importance, farmers' willingness to participate in tomato production varies due to differences in socio-economic characteristics and production conditions. This study examined the socio-economic determinants of farmers' willingness to participate in tomato production in Apa Local Government Area of Benue State, Nigeria. Primary data were collected from 110 tomato farmers selected through a multistage sampling technique using a structured questionnaire. Data were analyzed using descriptive statistics and binary logistic regression. The dependent variable was farmers' willingness to participate in tomato production, while the explanatory variables included sex, age, educational level, marital status, household size, occupation, labour source, market access, extension access, credit access, and access to production inputs. The results of the binary logistic regression revealed that occupation was the only variable that significantly influenced farmers' willingness to participate in tomato production ($p < 0.05$). Farmers whose primary occupation was farming were more likely to participate in tomato production than those engaged mainly in non-farm occupations. Other variables, including sex, age, educational level, marital status, household size, labour source, market access, extension access, credit access, and access to production inputs, did not significantly influence willingness to participate. The study concludes that livelihood orientation plays a crucial role in shaping farmers' participation decisions. Strengthening agriculture as a viable livelihood option and

improving farmers' access to productive resources and support services will contribute to sustainable tomato production and improved rural livelihoods in the study area.

Keywords: Tomato Production, Willingness to Participate, Binary Logistic Regression, Socio-Economic Determinants, Farmers, Benue State.

Introduction

Agriculture remains a critical sector in Nigeria's economy, contributing significantly to food security, employment generation, rural livelihoods, and poverty reduction among smallholder farming households. In many rural communities, agricultural production serves as the principal source of household income and sustenance, particularly where alternative livelihood opportunities are limited (FAO, 2012). Within the agricultural sector, vegetable production occupies an important position because of its contribution to dietary diversity, nutritional security, and income generation among rural farmers (WVC, 2023). Compared with several staple crops, vegetables often generate higher economic returns per unit area and provide faster income turnover due to their relatively short production cycles (Ajah & Ameh, 2023).

Tomato (Solanum lycopersicum) is one of the most important vegetable crops cultivated globally and ranks among the most widely consumed horticultural commodities because of its nutritional, medicinal, and industrial importance (FAO, 2023). The crop is rich in vitamins A, B, and C, antioxidants such as lycopene, and essential minerals that contribute significantly to human health and nutrition (Beeior et al. 2024). Beyond household consumption, tomato serves as an important industrial crop used in the production of tomato paste, puree, sauces, ketchup, and other processed food products, thereby contributing to agro-industrial development and employment generation (Opata et al. 2020).

Global tomato production has expanded considerably over the last few decades due to increasing urban demand, dietary changes, and growth in food processing industries. According to FAO (2023), global tomato production exceeds 180 million metric tonnes annually, with China, the United States, Turkey, and India among the leading producers. In Sub-Saharan Africa, tomato production constitutes an important source of livelihood for smallholder farmers and contributes substantially to household income and agricultural commercialization (Naika et al. 2005). Despite this importance, tomato productivity across many African countries remains below global averages because of poor access to improved technologies, pest and disease infestations, weak market systems, and limited institutional support (FAO, 2012; Singh et al., 2014).

Nigeria is recognized as one of the largest tomato producers in Africa, with annual production estimated at over 3.6 million tonnes (FAO, 2023). However, domestic tomato production still falls below national demand due to low productivity, high post-

harvest losses, poor storage facilities, inadequate processing infrastructure, and inefficient marketing systems (NBS, 2025; Yami et al., 2025). Tomato farming in Nigeria is dominated largely by smallholder farmers operating under rain-fed conditions with limited access to improved production resources. Consequently, tomato supply remains highly seasonal, resulting in price instability and continued dependence on imported processed tomato products.

Several studies have shown that farmers' participation in tomato production is strongly influenced by socio-economic characteristics and livelihood conditions. Factors such as age, educational level, household size, occupation, labour availability, farming experience, and income level significantly shape farmers' production decisions and willingness to adopt labour-intensive agricultural enterprises (Ozor, 2010). Educational attainment has been identified as a particularly important determinant because educated farmers are more likely to access agricultural information, adopt improved technologies, and efficiently manage production risks (Amao & Egbetokun, 2018). Similarly, household labour availability influences farmers' capacity to engage in vegetable production, especially among rural households that rely heavily on family labour for farming activities (Ayodele et al. 2021).

In addition, livelihood structure and occupational dependence on agriculture play important roles in determining farmers' willingness to participate in tomato farming. Mathenge and Tschirley (2008) observed that income diversification and off-farm earnings often influence farmers' capacity to invest in relatively capital-intensive crops such as tomato. Where access to stable income sources and productive resources is limited, farmers may avoid enterprises perceived as risky or requiring high production costs. Such conditions are particularly common among rural smallholder farmers in developing countries where access to agricultural finance and production support remains weak (Korie et al. 2023).

Benue State, popularly referred to as the "Food Basket of the Nation," possesses favourable climatic and soil conditions suitable for tomato cultivation (Ayoola, 2014). Despite this comparative advantage, tomato farming remains relatively limited in several rural communities within Apa Local Government Area, where farmers predominantly cultivate staple crops such as cassava and yam. This production pattern suggests that socio-economic conditions may significantly influence farmers' willingness to engage in tomato farming despite the crop's recognized market and nutritional potential.

Although previous studies have examined agricultural productivity, technology adoption, and tomato production in Nigeria, limited empirical evidence exists on the socio-economic determinants influencing farmers' willingness to participate in tomato production in Apa Local Government Area of Benue State. Most existing studies have focused on productivity, profitability, or technology adoption among farmers already engaged in tomato cultivation, with relatively little attention given to the factors influencing farmers' willingness to participate in tomato production. This gap limits the development of evidence-based interventions aimed at encouraging greater participation in tomato farming, particularly in rural communities with favourable production potential.

The present study contributes to the existing body of knowledge by providing empirical evidence on the socio-economic factors influencing farmers' willingness to participate in tomato production in Apa Local Government Area of Benue State, Nigeria. Specifically, the study identifies the key socio-economic characteristics associated with participation decisions and provides information that can guide policymakers, extension agencies, and agricultural development programmes in designing targeted interventions to promote tomato production, improve farmers' livelihoods, and enhance food security. Therefore, the study assessed the socio-economic determinants influencing farmers' willingness to participate in tomato production in Apa Local Government Area of Benue State, Nigeria.

Materials and Methods

Study Area

The study was conducted in Apa Local Government Area (LGA) of Benue State, Nigeria. Apa LGA is one of the twenty-three Local Government Areas in Benue State and is predominantly rural, with agriculture serving as the major occupation of the inhabitants. Crop production, particularly food and vegetable farming, constitutes the principal source of livelihood for most households. The study covered all the eleven council wards in the LGA: Ugbokpo, Edikwu I, Edikwu II, Ojope, Ojantelle/Akpete, Ikobi, Oiji, Auke, Igoro, Iga Okpaya, and Oba.

Research Design

The study adopted a cross-sectional survey research design. Primary data were collected through the administration of a structured questionnaire to tomato farmers. The design was considered appropriate because it enabled the collection of quantitative data on farmers' socio-economic characteristics, institutional factors, and willingness to participate in tomato production at a single point in time.

Population, Sample Size and Sampling Procedure

The study population comprised all identified tomato farmers in Apa Local Government Area. Records obtained from the Local Government Agricultural Department identified approximately 110 tomato farmers across the study area. Since the target population was relatively small and manageable, all identified tomato farmers were included in the study, making the survey a census of the target population. This approach ensured adequate representation of tomato farmers and eliminated sampling error associated with respondent selection.

Data Collection

Primary data were collected using a structured questionnaire administered through face-to-face interviews with the respondents. The questionnaire elicited information on respondents' socio-economic characteristics, institutional factors, and tomato production activities. To ensure content and face validity, the instrument was reviewed by experts in Agricultural

Extension and related fields, and necessary modifications were made before field administration. The questionnaire was also pre-tested among tomato farmers outside the study area to identify ambiguous questions and improve its clarity and consistency before the final survey.

Measurement of Variables

The dependent variable was farmers' willingness to participate in tomato production. This was measured as a dichotomous variable based on respondents' stated willingness to engage in tomato farming. Farmers who expressed willingness to participate were coded as 1, while those who indicated unwillingness were coded as 0.

The independent variables comprised socio-economic and institutional factors, including age, sex, marital status, educational level, household size, primary occupation, labour availability, cultivation of other crops, access to credit, access to extension services, market access, and access to production inputs.

Data Analysis

Completed questionnaires were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 25 for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' socio-economic characteristics and other study variables. Binary logistic regression analysis was employed to determine the socio-economic and institutional factors influencing farmers' willingness to participate in tomato production. The dependent variable was coded as 1 for farmers willing to participate and 0 for those unwilling. The results were interpreted using regression coefficients (B), Wald statistics, significance levels (p-values), odds ratios [Exp(B)], and 95% confidence intervals.

The logistic regression model is specified as:

$$\ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n$$

where:

P = probability of willingness to engage in tomato farming,

β_0 = constant term,

$\beta_1 \ldots \beta_n$ = coefficients of independent variables,

$X_1 \ldots X_n$ = explanatory variables.

Table 1: Operational Definition and Coding of Variables

Variable	Category (SPSS Label)	Interpretation	Reference Category
Dependent Variable	Willingness	1 = Willing	Not willing (0)
Sex	Sex(1)	Male	Female
Age Group	Age Group(1)	≤ 30 years	
	Age Group(2)	31–45 years	
	Age Group(3)	46–60 years	
	Age Group(4)	> 60 years	Reference age group*
Education	Education(1)	Primary education	
	Education(2)	Secondary education	
	Education(3)	Tertiary education	No formal education*
Marital Status	Marital Status(1)	Married	
	Marital Status(2)	Single	
	Marital Status(3)	Divorced	
	Marital Status(4)	Widowed	Reference marital status*
Household Size	Household Size(1)	Small household	
	Household Size(2)	Medium household	Large household*
Occupation	Occupation(1)	Crop farming	
	Occupation(2)	Livestock farming	
	Occupation(3)	Business	
	Occupation(4)	Civil service	Others*
Labour Source	Labour Source(1)	Family labour	
	Labour Source(2)	Hired labour	
	Labour Source(3)	Family and hired labour	
Market Access	Market Access(1)	Yes	No
Extension Access	Extension Access(1)	Yes	No
Credit Access	Credit Access(1)	Yes	No
Input Access	Input Access(1)	Yes	No

Results and Discussion

Socio-Economic Characteristics of Respondents

Table 2. Socio-Economic Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Sex	Male	72	65.5
	Female	38	34.5
Age (years)	<30	15	13.6
	31–41	25	22.7
	42–52	30	27.3
	53–63	25	22.7
	>63	15	13.6

Variable	Category	Frequency	Percentage (%)
Education Level	No formal education	50	45.5
	Primary education	40	36.4
	Secondary education	15	13.6
	Tertiary education	5	4.5
Marital Status	Single	10	9.1
	Married	85	77.3
	Divorced	5	4.5
	Widowed	7	6.4
	Separated	3	2.7
Household Size	1–3	10	9.1
	4–6	50	45.5
	>6	50	45.5
Primary Occupation	Crop farming	70	63.6
	Livestock farming	10	9.1
	Business	15	13.6
	Civil service	5	4.5
	Others	10	9.1
Source of Labour	Family labour	60	54.5
	Hired labour	20	18.2
	Both family and hired	25	22.7
	Self labour	5	4.5
Growing Other Crops	Yes	90	81.8
	No	20	18.2

The socio-economic characteristics of the respondents are presented in Table 2. The result showed that 65.5% of the respondents were male, while 34.5% were female. This indicates that tomato production in the study area was dominated by male farmers. The predominance of males in tomato farming may be attributed to the labour-intensive nature of vegetable production and men's relatively greater access to land and productive resources in rural communities. This finding is consistent with the reports of Omolayo et al. (2025) who observed that vegetable and tomato production in many African rural communities are predominantly male-oriented enterprises because men often control productive assets and commercial farming decisions.

The marital status distribution revealed that 77.3% of the respondents were married. The high proportion of married farmers suggests the importance of household labour contribution in agricultural production activities. Married households are often associated with larger family sizes capable of supplying labour for farm operations, thereby reducing dependence on hired labour. This finding agrees with Osebeyo & Aye (2014), who reported that family structure significantly influences labour availability and agricultural productivity among smallholder farmers in Nigeria. Similarly, Eboh et al. (2012) noted that household composition plays a major role in determining labour allocation decisions in rural agricultural systems.

The educational distribution showed that a considerable proportion of the respondents possessed formal education. Education is an important socio-economic variable because it enhances farmers' ability to access agricultural information, understand improved production techniques, and adopt innovations. The implication is that educated farmers are more likely to participate in commercial agricultural enterprises such as tomato production. This observation corroborates the findings of Ngbede et al. (2021) who reported that educational attainment positively influences agricultural technology adoption and participation in improved farming activities among rural farmers.

The result further showed that 63.6% of the respondents identified crop farming as their primary occupation. This indicates that agriculture remains the dominant livelihood activity in the study area. Farmers whose major occupation is farming are likely to devote more time, labour, and financial resources to agricultural production compared to farmers engaged mainly in non-farm activities. This finding supports the work of Amao and Egbetokun (2018), who found that occupational dependence on agriculture significantly influences farmers' willingness to invest in crop enterprises. Similarly, Ogundeji and Ogunwande (2024) observed that livelihood dependence on agriculture positively affects farmers' participation in commercial farming activities.

The findings also revealed that family labour constituted the major source of labour among respondents. This suggests that farming operations in the area are largely dependent on traditional household labour systems. The reliance on family labour agrees with the findings of Afolami et al. (2020), who reported that rural smallholder farming systems in developing countries rely heavily on household labour due to limited financial capacity for hired labour utilization.

Overall, the socio-economic profile of respondents suggests that participation in tomato production is strongly influenced by demographic characteristics, educational attainment, household labour structure, and livelihood dependence on agriculture.

Table 3. Logistic Regression Analysis of Socio-Economic Factors Influencing Participation Variables in The Equation

		B	S.E	Wald	df	Sig.	Exp(B)	95% C.I for EXP (B)	
								Lower	Upper
Step 1[a]	Sex (1)	.090	.508	.031	1	.860	1.094	.404	2.963
	Age Group			.329	4	.988			
	Age Group (1)	-.102	.856	.014	1	.905	.903	.169	4.828
	Age Group (2)	.124	.777	.026	1	.873	1.132	.247	5.190
	Age Group (3)	-.056	.857	.044	1	.947	.945	.178	5.012
	Age Group (4)	.338	.913	.137	1	.711	1.402	.243	8.390
	Education			.186	3	.980			
	Education (1)	.181	.610	.088	1	.767	1.198	.362	3.961

	B	S.E	Wald	df	Sig.	Exp(B)	95% C.I for EXP (B)	
							Lower	Upper
Education (2)	.280	.765	.134	1	.714	1.323	.295	5.925
Education (3)	-.081	1.127	.005	1	.942	.922	.101	8.399
Marital Status			6.550	4	.162			
Marital Status (1)	2.250	1.281	3.084	1	.079	9.486	.770	116.837
Marital Status (2)	2.185	1.646	1.764	1	.184	8.894	.354	223.736
Marital Status (3)	.199	1.713	.013	1	.908	1.220	.042	35.040
Marital Status (4)	3.620	1.975	3.358	1	.067	37.322	.777	1791.948
Household Size			1.064	2	.588			
Household Size (1)	.309	.969	.101	1	.750	1.362	.204	9,101
Household Size (2)	.730	.944	.598	1	.439	2.075	.326	13.209
Occupation			7.249	4	.123			
Occupation (1)	1.766	.869	4.132	1	.042	5.848	1.065	32.106
Occupation (2)	-.587	.751	.611	1	.434	.556	.128	2.421
Occupation (3)	.628	1.152	.297	1	.586	1.874	.196	17.934
Occupation (4)	-.924	.875	1.116	1	.291	.397	.071	2.204
Labour Source			3.801	3	.284			
Labour Source (1)	1.211	.634	3.652	1	.056	3.357	.969	11.622
Labour Source (2)	.326	.605	.290	1	.590	1.395	.423	4.531
Labour Source (3)	-.051	1.432	.001	1	.971	.950	.057	15.734
Market Access (1)	-.114	.739	.024	1	.878	.893	.210	3.796
Extension Access (1)	.013	.634	.000	1	.984	1.013	.292	3.508
Credit Access (1)	.873	.567	2.365	1	.124	2.393	.787	7.276
Input Access (1)	-.558	.589	.899	1	.343	.572	.180	1.814
Constant	-3.700	1.859	3.960	1	.047	.025		

The binary logistic regression analysis revealed that sex did not significantly influence farmers' willingness to participate in tomato production ($p > 0.05$). This suggests that willingness to engage in tomato production was comparable among male and female respondents in the study area. A plausible explanation is that tomato production in Apa Local Government Area is largely a household-based enterprise in which both men and women contribute to different stages of production, marketing, and post-harvest handling. Consequently, participation decisions may depend more on household livelihood strategies and available production resources than on gender alone. The finding is consistent with Korie

et al. (2023), who reported substantial participation of both male and female farmers in tomato production in Kaduna State. However, it differs from the findings by Omolayo et al. (2025) who appraised the Participation in Contract Farming among Tomato Farmers in Kuje Area Council of Abuja where male farmers were found to participate more actively in tomato contract farming. The variation may be attributed to differences in institutional arrangements and the nature of participation examined.

Similarly, age did not significantly influence farmers' willingness to participate in tomato production ($p > 0.05$). Although younger farmers are generally expected to be more innovative and willing to take production risks, the result indicates that tomato production attracted farmers across all age categories in the study area. This may be because tomato cultivation is already a well-established enterprise in Apa Local Government Area, making participation decisions depend more on perceived profitability than on age. The finding agrees with Adesiyan et al. (2021), who reported that age did not significantly influence farmers' willingness to engage in tomato processing in Ogun State. However, it contrasts with Tafida et al. (2025), who found that age significantly influenced the adoption of tomato post-harvest technologies among farmers in Katsina State. This difference may be explained by the fact that technology adoption often requires additional investment and technical knowledge, whereas willingness to cultivate tomato is influenced primarily by livelihood opportunities.

Educational level also did not significantly influence farmers' willingness to participate in tomato production. This suggests that respondents' level of formal education did not determine their willingness to cultivate tomato. Practical farming experience and indigenous knowledge may have played a greater role than formal education in shaping production decisions. The finding agrees with Orikpe, & Orikpe, (2013) who similarly observed that educational attainment did not significantly affect willingness to process tomato in Ogun State. However, it differs from Mignouna et al. (2011), who found that higher educational attainment enhanced farmers' adoption of improved agricultural technologies. The difference is likely because the present study examined willingness to participate in tomato production rather than the adoption of a specific innovation.

Marital status was also not a significant determinant of farmers' willingness to participate in tomato production. This indicates that respondents' marital status did not substantially influence their decision to cultivate tomato. Regardless of whether farmers were married, single, divorced, or widowed, the economic benefits associated with tomato production appeared to provide sufficient motivation for participation. This finding is consistent with Bonabana-Wabbi (2002), who observed that demographic characteristics such as marital status often have limited influence on agricultural decision-making where strong economic incentives exist.

Likewise, household size did not significantly influence willingness to participate in tomato production. Similar observations were reported by Abdulai and Huffman (2014), who found that household size was not always a significant predictor of agricultural participation after controlling for other socio-economic factors. Although larger households are often expected

to provide more family labour, the result suggests that household size alone was insufficient to explain participation decisions. Farmers with smaller households may compensate by hiring labour during peak production periods, while larger households may face greater consumption demands that offset the benefits of additional family labour.

In contrast to the preceding variables, occupation significantly influenced farmers' willingness to participate in tomato production ($p < 0.05$). Farmers whose primary occupation was crop farming were more willing to participate than respondents in the reference occupational category. This finding suggests that individuals whose livelihoods depend mainly on agriculture are more committed to investing their time, labour, and resources in tomato production because farming constitutes their principal source of income. The result agrees with Opata et al. (2020), who reported that livelihood dependence significantly influences participation in crop production enterprises. Similarly, Amao & Egbetokun (2018) found that farmers whose primary occupation is agriculture are generally more willing to invest in high-value crop production. The finding highlights the need for policies that strengthen the productive capacity of farming households through improved extension support, affordable credit, quality inputs, and reliable market opportunities.

Source of Labour did not significantly influence farmers' willingness to participate in tomato production. This suggests that reliance on family labour, hired labour, or a combination of both did not determine participation decisions. Farmers appeared to adopt labour arrangements that suited their available resources and production requirements. The finding differs from Asante et al. (2017), who reported that labour availability significantly influenced vegetable production because timely labour improved farm operations. In the present study, however, farmers were able to adjust their labour sources according to production needs.

Similarly, market access did not significantly influence willingness to participate in tomato production. This may be because tomato enjoys a ready market in Benue State through local markets, wholesalers, and farm-gate buyers, reducing the importance of market access in farmers' initial participation decisions. While Barrett (2008) argued that improved market access promotes commercialization, Opata et al. (2020) noted that where market demand is already strong, access to markets may have a limited influence on farmers' decision to participate.

Extension access was also not statistically significant. Adebisi-Adelani & Akeredolu, (2020) reported that farmers' willingness to cultivate tomato was not determined by extension contact alone. Since tomato production has been practised in the area for many years, respondents may have relied more on their farming experience and knowledge shared among fellow farmers than on formal extension advice. However, Anderson and Feder (2007), emphasized that effective extension services improve farmers' decision-making and encourage participation in improved agricultural practices. The disparity may be attributed to differences in the effectiveness and frequency of extension delivery across locations. Nevertheless, strengthening extension services remains important for improving production efficiency, pest management, and post-harvest handling (Oripke & Oripke, 2013).

Access to credit also did not significantly influence willingness to participate in tomato production. Omalade, (2019) highlighted that credit to farmers is essential for agricultural investment. Many respondents may have financed production through personal savings or informal sources, reducing the observed effect of formal credit access. Similarly, access to production inputs was not statistically significant, this result differs from Beeior et al. (2024) who reported that rural farmers remained willing to cultivate tomato despite challenges in obtaining improved seeds, fertilizers, and agrochemicals. While these institutional factors did not significantly influence willingness, improving access to affordable credit and quality production inputs would likely enhance productivity, profitability, and the long-term sustainability of tomato production in the study area.

Conclusion

This study examined the socio-economic determinants of farmers' willingness to participate in tomato production in Apa Local Government Area of Benue State, Nigeria. The findings revealed that occupation was the only socio-economic variable that significantly influenced farmers' willingness to participate in tomato production. Farmers whose primary occupation was farming were more willing to engage in tomato production than those whose major livelihood activities were outside agriculture. In contrast, sex, age, educational level, marital status, household size, labour source, market access, extension access, credit access, and access to production inputs did not significantly influence willingness to participate.

The findings suggest that livelihood orientation plays a critical role in farmers' production decisions. Individuals who depend mainly on agriculture for their income are more likely to commit their time, labour, and resources to tomato production because of its potential economic benefits. Although the other socio-economic and institutional variables were not statistically significant in the model, they remain important components of the production environment and may indirectly affect farmers' productivity and capacity to sustain tomato production.

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