



FACTORS INFLUENCING ADOPTION OF IMPROVED TOMATO (*SOLANUM LYCOPERSYCON* L.) PRODUCTION TECHNOLOGIES AMONG TOMATO FARMERS IN BARKIN-LADI AND PANKSHIN LOCAL GOVERNMENTS AREAS OF PLATEAU STATE, NIGERIA

¹Matawal, O. M., ²Makwin, F. M., ¹Zarmai, D. U., ¹Dashik, C. L. and ¹Jwanya, B. A.

¹Department of Agricultural Extension and Management, Plateau State College of Agriculture, Garkawa. Plateau State, Nigeria.

²Department of Agricultural Economics and Extension, Faculty of Agriculture, University of Jos, Nigeria

Corresponding Author's E-mail: obedmatawal100@gmail.com

ABSTRACT

The study examined the adoption of improved tomato production technologies among tomato farmers in Barkin-ladi and Panskhin Local Government Areas of Plateau State. Multistage sampling procedure was employed to select 183 tomato farmers from the study area. Primary data were collected through the use of structured questionnaire and analysed using descriptive statistics, adoption index and logit regression. The result of the adoption index showed that land preparation, chemical application and date of sowing were the technologies adopted with a mean score of 4.78, 4.33 and 4.13, respectively. Furthermore, the result of the logit regression revealed that educational status (0.6539), household size (0.8249) and access to credit (0.4661) were the factors influencing the adoption of improved tomato production technologies. The major constraints to the adoption of improved tomato production technologies were access to clean and certified seeds (74.9%), high cost of herbicides (73.2%), high cost of improved seeds (72.7%) and inadequate storage facilities (72.1%). The study concluded that educational status, household size and access to credit were the factors influencing the adoption of improved tomato production in the study area. The study recommended that relevant stakeholders should be involved in seed multiplication and distribution to make clean and certified seeds accessible and affordable to farmers for production.

Keywords: Adoption, Improved, Technologies, Tomato

INTRODUCTION

Agriculture plays a fundamental role in economic growth, enhancing food security, poverty reduction and rural development. To meet the demand of growing population, agricultural growth should be in line to meet the food requirements of the country. Availability of modern inputs like certified seeds, mechanization, agricultural credit, adequate and proper use of fertilizers and strong linkage between research and extension enabled the community to shift from old agricultural practices with greater ease and productivity (GDP, 2016). Consequently, additional sustainable agricultural technologies such as improved technologies remain an important part of the efforts to boost food availability, crop production and improved soil quality in a bid to reduce food and nutrition insecurity which is currently threatening humans right to food accessibility in developing countries (Sennuga and Fadiji, 2020). Improved Agricultural Technologies (IATS) are collections of principles of on-farm production and post-production processes, aimed at delivering safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability (Sennuga, *et al.*, 2020). IATs enable farmers to increase their productivity and it covers a range of areas including improved seeds, crop protection, modern inclusion practices, crop land management, integrated fertilizer management and conservation agriculture (Sennuga, *et al.*, 2020).

Technology is one of the resources for agricultural production. Technology adoption refers to the acceptance of a group or an individual to use a new product or innovation. The process of adopting an idea or new innovation does not happen as a single unit act, but rather a mental process that consists of at least five stages namely; the awareness stage, the interest stage, the evaluation stage, trial stage and finally, the adoption stage (Rogers, 2013; Cheteni *et al.*, 2014; Sennuga and Oyewole, 2020). At



the awareness stage, an individual becomes aware of the idea but lacks detailed information about it. At the interest stage, an individual gets more information about it and wants to know more about how it works, what it is and its affordances. At the third mental stage, when the user has obtained more information from the previous stages. At the fourth mental stage, the individual makes a small-scale trial of the idea, and requests for more specific information to answer questions. The last mental stage, adoption, is characterized by a large-scale adoption of the idea, and most importantly its continued use (Cheteni *et al.*, 2014). Increasing agricultural productivity is critical to meet expected rising demand and, as such, it is instructive to examine recent performance in case of modern agricultural technologies (Challa, 2013). A new agricultural technology that enhances sustainable production of food and fiber is therefore critical for sustainable food security and development. This has made the dynamics of technical change in agriculture to be an area of intense research since the early part of the Twentieth Century (Loevinsohn *et al.*, 2013).

Tomato is vital part of our cooking, and nearly have all essential minerals, vitamins and other trace elements of vital importance, and a dish is incomplete without its addition. Tomato is the richest source of vitamin C, iron, and phosphorous. A ripened tomato of 135mg contains about 94% water, 25 calories of energy, 0.07mg thiamine, 28mg ascorbic acid, 33mg phosphorous, 0.6mg carbohydrates, 0.6mg iron, 0.8-0.9mg lycopene, 1.0mg water soluble protein, 4mg sodium, 300mg potassium, 0.2mg fat, 16mg calcium, 0.9 mg niacin, and 0.05mg riboflavin. It is consumed fresh, as well as in processed form (Uroaba, 2018). Maximum potential of yield can be achieved through introduction of high yielding varieties of seed, improved production technology and sound knowledge of tomato farming (GDP, 2016). Hence, the need for a study to examine the adoption of improved tomato production technologies among tomato framers in Barkin-ladi and Panskhin Local Government Areas of Plateau State.

For the fact that change is the only permanent phenomenon the world over, rural farmers due to their ignorance and conservative nature find it difficult to embrace it. Also, despite the fact that improved innovations/ technologies aim at increasing productivity and reducing food insecurity are made available by researchers, farmers have not been able to adopt it. Adebisi and Okuntola (2013), reported that adoption of technologies in farming practices is affected by certain factors such as farmers' attitude towards change, source of information, educational level and farmer's income. Also, in Nigeria, most of the farmers do not have the opportunity to opt for modern technology because of high risk and cost associated with such technologies (Odoemlam and Nzeakor, 2020). These have resulted to low productivity and food insecurity in most developing countries including Nigeria, because of their subsistent nature, characterized by poor and low level of production that cannot satisfy their needs talk more of the entire populace. It has led to lack of food self – sufficiency, malnutrition, nutrition related diseases and poverty among rural dwellers. This study therefore, seeks to explore those factors influencing the adoption of improved agricultural technologies among tomato farmers in the study area. The broad objective of the study is to examine the factors influencing the adoption of improved agricultural technologies among tomato farmers in Barkin-Ladi and Pankshin Local Governments Areas of Plateau State, Nigeria. while the specific objectives were to;

- determine respondents' awareness and adoption of improved tomato production technologies;
- determine the factors influencing adoption of improved tomato production technologies; and
- identify the constraints to adoption of improved tomato production technologies.

METHODOLOGY

The Study area

The study was conducted in Barkin Ladi and Pankshin Local Government Areas (LGAs) of Plateau State. Plateau State is located in the North central zone of Nigeria and lies between latitude 8⁰ 30' and 10⁰ 30'N, longitude 7⁰ 30' and 3⁰37'E with a land mass covering 30,913 square kilometers. The State has population figure as at 2006 census 3,178,712 and projected to be 4,900,442 million as at 2022 projection. It is bounded by the states of Kaduna and Bauchi on the north, Taraba on the east,



and Nasarawa on the southwest. The Jos Plateau rises to about 5,250 feet (1600m) above sea level and has an annual rainfall of 1,324 mm. In the States, North central part and the Benue River valley stretches along the south east border. Although there are wooded valleys in the southeast, the vegetation is mostly open grassland which is used for grazing and farming. The State is classified into three distinct agro ecological zones, namely; the lowland moist savannah which falls within the southern Guinea, Savannah which falls within the southern Guinea and savannah rain forest, having extensive low lying flat land with high water holding capacity, is favourable for the production of rice, yam, cassava, melon and groundnut. The mid- altitude zone which falls within 500-1500 meters above sea level, with soils which are sandy clay and heavy rains, while predominantly maize, potato and assorted vegetables are produced; and the sub-Sudan and northern Guinea savannah zones falls within 100-350 meters above sea level with high concentration of livestock and production of crops like millet, groundnuts, sorghum and cowpea.

Sampling Technique and Sample size

A multi-stage sampling technique was used in the selection of tomato farmers for the study. The first stage involves the purposive selection of Barkin-Ladi and Pankshin LGAs due to predominance tomato production. The second stage involved a simple purposive selection of three (3) districts in each of Barkin Ladi and Pankshin LGAs namely: Fan, Ropp and Foron, Wokkos, Pankshin and Fier, respectively. The third stage involves random selection of farmers from the selected villages based on intensity of tomato production in each village. A total number of 183 farmers were used for the study.

Table 1: Sample Frame and Sample Size

LGA	District	Village	Sample Frame	Sample size (10% of sample frame)	
Barkin-ladi	Fan	Ntaduk	109	11	
		Fan-loh	89	9	
	Roop	Ladura	132	13	
		Kassa	78	8	
		Dorowa Babuje	121	12	
	Foron	Ganandaji Foron-	111	11	
		mission Bisichi	78	8	
		Bak	119	12	
			132	13	
Pankshin	Wokkos	Tazuk	78	8	
		Towalk	108	11	
	Pankshin	Jimin	118	12	
		Bwarak	98	10	
		Wulim	74	7	
		Tambes	78	8	
		Fier	Yiti	121	12
			Timir	104	10
		Posat	83	8	
	Total			1,830	183

Source: Field Survey, (2025)

Method of Data Collection

Primary Data were collected through the use of structured questionnaire which were administered to the 183 respondents randomly drawn from the study area.

Methods of Data Analysis

Data were analysed using both descriptive and inferential statistics. Descriptive statistics used include frequency distribution percentage and mean which were used to achieve objective I and iii.



Inferential Statistics

Logit regression was used to achieve objective ii. Adoption index through the use of sigma scoring method was used to achieve objective ii. The Logit regression model was used to determine relationship between the socioeconomic characteristics and the likelihood of adopting improved tomato production technologies. The application of it in explaining relationships between dependent variable and a set of explanatory variables is well demonstrated. Likelihood of adoption is usually dichotomous in nature and thus binary, with the farmers having the options of adopting potato planting materials or not.

$$Y = \begin{cases} 1 & \text{if access} \\ 0 & \text{otherwise} \end{cases}$$

For binary models to regress the dependent variable on the independent variables using ordinary least squares would produce nonsensical results as the disturbances are not normally distributed, hence a nonlinear probability function with special limiting properties is employed (Gujarati, 2009). Model specification for objective iv is given as:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \dots e$$

... (1) Y = Adoption of improved tomato technology (adoption= 1, non- adoption=0).

where;

β_0 = Intercept,

$\beta_1 - n$ =Regression coefficients,

X_1 =Age of respondents, (years),

X_2 =Farm size (hectares),

X_3 =Educational status (years of formal education),

X_4 =Household size (number of persons),

X_5 =Access to credit (yes=1, no=0),

X_6 = Alternative income (yes=1, no=0)

E= Error term

RESULTS AND DISCUSSIONS

Awareness and Adoption Index of Improved Tomato Production Technologies

The result in Table 2 below revealed that majority (87.0%) of the respondents were aware of tomato production technologies available in the study area, while 13.0% of the respondents were not aware of the production technologies available. This implies that majority of the tomato farmers in the study area, were aware of the tomato production technologies available in the study area, and this greatly influence adoption, as awareness is the first stage of adoption.

Table 2: Distribution of Respondents Based on their Awareness of Technologies

Awareness	Frequency	Percentage (%)
Yes	162	87.0
No	21	13.0
Total	183	100

Source: Field survey, (2025)

Adoption Scores of Improved Tomato Production Technologies

The results in Table 3 represents the adoption index of improved tomato production technologies. Adoption index was obtained through the use of sigma scoring method involves converting frequency counts to normal scores, as depicted in Table 3. The results revealed that more than half (54.1%) of the respondents adopted land preparation technology with an adoption score of 4.78, 40.4% of the respondents adopted chemical application technology with an adoption score of 4.33



while 35.0% of the respondents adopted date of sowing technology with an adoption score of 4.13. Furthermore, the results revealed that 30.0% of the respondents adopted fertilizer application technology with a mean score of 3.93, while 29.5% and 27.9% of the respondents adopted sowing depth and seed dressing technology with a mean score of 3.90 and 3.84, respectively. The summative mean adoption score was 4.07. This implies that land preparation, date of sowing and chemical application technologies were the most adopted technologies in the study area with adoption scores greater than the mean (4.07). This could be because these technologies are readily available in the study area.

Table 3: Adoption Scores of Improved Tomato Production Technologies

Technology	Number of Adopters	Percentage of Adopters (n=183)	Adoption Score
Land preparation	99	54.1	4.78
Seed Dressing	51	27.9	3.84
Date of Sowing	64	35.0	4.13
Seed Rate	54	29.5	3.90
Plant Sampling	47	25.7	3.75
Fertilizer application	53	30.0	3.93
Sowing Depth	54	29.5	3.90
Chemical Application	74	40.4	4.33
Total Score = 32.56			
Mean Score = 4.07			

Source: Field Survey, (2025)

Factors Influencing the Adoption of Improved Tomato Production Technologies

The result in Table 4 shows the logit regression model for the adoption of improved tomato production technologies. The result showed that educational status, household size and access to credit significantly influenced the adoption of improved tomato production technologies in the study area. The coefficient of educational status (0.6539) was positive and significant at ($P < 0.1$). This implies that the more years of education acquired by the respondents the more the probability of adoption of the improved production technology in the study area. This result agrees with that of Sezgin *et al.* (2011) which revealed that educational status was significant in influencing the adoption of artificial insemination in the study area. Also, the coefficient of household size (0.8249) was positive and significant ($P < 0.01$). This implies that larger household size increases the probability of the adoption of improved tomato production technology in the study area. This result is line with Melesse (2018), which noted that a large family size mostly translates to family labour, also the availability and amount of family labour plays a vital role in determining adoption of agricultural technologies. Furthermore, the coefficient of access to credit (0.4661) was positive and significant ($P < 0.01$). This implies that availability of credit favours the adoption of improved tomato production technology in the study area. This result corroborates with that of Ogada *et al.* (2014) who opined that financial resources were necessary to finance the uptake of new technologies. Also, the coefficient of age (-1.867) was negative and not significant. This implies that as farmers in the study area get older, they tend to want to stay away from adopting improved tomato production technologies in the study area. However, this is contrary with the study of Bello *et al.* (2012), who reported that farmers' coefficient of age was negative and significant. Stating that older farmers find it difficult to adopt new technologies because they are less likely to bear the risk of trial associated with the technologies. Furthermore, the coefficient of farm size (0.1210) was positive and not significant. This result is contrary to that of Idirisa *et al.* (2012), which revealed that farm size had a negative and significant influence on the adoption of improved soya bean variety in Borno State, Nigeria.

Table 4: Logistic Estimates of Factors Influencing Adoption of Improved Tomato Production Technologies

Variable	Coefficient	Standard error	T-value
Constant	-14.981	11.3709	-1.3175**
Age (X1)	-1.867	1.6112	-1.1593 ^{NS}
Farm size (X2)	0.1210	0.0592	2.04 ^{NS}
Educational status (X3)	0.6539	3.7188	1.7583*
Household size (X4)	0.8249	3.7618	0.2192***
Access to credit (X5)	0.4661	0.1319	0.3534**
Alternative income (X6)	1.4118	0.2094	6.7421 ^{NS}
Numbers of observation		216	
Log likelihood ratio test		-162.555	
F-distribution		0.397	
McFadden R-square		0.537	

***P<0.001, **P < 0.01 and *P < 0.1 Source: Field Survey, 2025

Constraints to the Adoption of Improved Tomato Production Technologies

The findings in Table 5 shows constraints faced by farmers in the adoption of improved tomato production technologies. The result revealed that poor access to clean seeds 74.9% ranked 1st, high cost of herbicides (73.2%) ranked 2nd, high cost/inaccessibility to improved seeds (72.7%) ranked 3rd, inadequate storage facilities 72.1% (4th), inadequate technical skills (70.5%) ranked 5th, poor transportation facilities 65.6% (6th), low selling price/high cost of production (63.4%) ranking 7th, inadequate accessibility to credit (59.6%) ranked 8th, high cost of labour (37.7%) ranked 9th and poor extension services (24.6%) ranked 10th were the major constraints in the adoption of improved tomato production technologies in the study area. This finding agrees with Sani *et al.* (2015) who conducted a study on economic analysis of production under irrigation system in Katsina metropolis, Katsina State which revealed that the major constraints militating against the production were poor storage facilities, as first problem, inadequate herbicides and inadequate extension personnel among others. This finding also agrees with Ugbajah and Uzuegbuna (2012) who opined that pest and disease, inadequate chemical fertilizer, inadequate extension personnel and inadequate capital were responsible for the decline in cocoyam production in Ezeagu Local Government Area of Enugu State and its implications for sustainable food security.

Table 5: Constraints to Adoption of Improved Tomato Production Technologies (n = 183)

Constraints	Percentage*	Ranking
Poor access to clean and certified seeds	74.9%	1 st
High cost of herbicides	73.2%	2 nd
High cost/ inaccessibility to improved seeds	72.7%	3 rd
Inadequate storage facilities	72.1	4 th
Inadequate technical skills in using modern technologies	70.5%	5 th
Poor transportation facilities	65.5%	6 th
Low selling price/high cost of production	63.4%	7 th
Inadequate accessibility to farm credit	59.6%	8 th
High cost of labour/tractor	37.7%	9 th
Poor extension services	24.6%	10 th

*Multiple responses Source: Field Survey, (2025)

CONCLUSION AND RECOMMENDATIONS

It was concluded that educational status, household size and access to credit were the factors influencing the adoption of improved tomato production technologies in the study area. Also land preparation, application of chemicals and sowing date were the most adopted improved tomato production technologies among the respondents in the study area.



- Based on the findings of this research work the following recommendations were made:
- Government/NGOs involved in seed multiplication and distribution should ensure to make clean and certified seeds accessible and affordable to farmers for production
 - Farm inputs such as herbicides and fertilizers should be made available and affordable to farmers by input dealers.
 - Government through the extension workers should educate farmers on the availability of diffuse light storage technology.

REFERENCES

- Adebiyi, S. A., & Okuntola, B. O. (2013). Factors affecting adoption of agricultural technologies among smallholder farmers in Nigeria. *Journal of Agricultural Extension and Rural Development*, *5*(4): 78–85.
- Bello, M. A., Umar, A., & Jibrin, S. A. (2012). Factors influencing adoption of improved agricultural technologies among farmers in Borno State, Nigeria. *Journal of Agricultural Extension and Rural Development*, *4*(6): 148–153.
- Challa, M. (2013). Determine factors and impact of modern agricultural technology adoption in West Munich. Grin Publishing GMBH.
- Cheteni, P., Mushunje, A., & Taravinga, A. (2014). Barriers and incentives to potential adoption of biofuels crops by small holder farmers in the Eastern Cape Province, South Africa. Munich Personal RePEc Archive (MPRA) Paper No. 59029.
- FAO. (2010). Human energy requirement, food and nutrition technical report*. Food and Agriculture Organization of the United Nations, Rome.
- GDP (2016). Agricultural growth and development report.
- Gujarati, D. N. (2009). **Basic econometrics** (5th ed.). McGraw-Hill.
- Idirisa, A., Mohammed, S. T., & Ahmed, B. (2012). Factors influencing adoption of improved soybean variety in Borno State, Nigeria. *Journal of Agricultural Science*, *4*(3): 45–52.
- Loevinsohn, M., Sumbery, J., & Diagne, A. (2013). Under what circumstances and conditions does adoption of technology result in increased agricultural productivity? Protocol. EPPI Centre, Social Science Research Unit, Institute of Education, University of London.
- Melesse, B. (2018). A review on factors affecting adoption of agricultural new technologies in Ethiopia. *Journal of Agricultural Science and Food Research*, *9*(3): 226. <https://doi.org/10.4172/2593-9173.1000226>
- Odoemlam, C. N., & Nzeakor, F. C. (2020). Adoption of modern agricultural technologies among smallholder farmers in Nigeria: Challenges and prospects. *Journal of Agricultural Science and Technology*, *22*(3): 112–125.
- Ogada, M. J., Mwabu, G., & Muchai, D. (2014). Farm technology adoption in Kenya: A simultaneous estimation of inorganic fertilizer and improved maize variety adoption decisions. *Agricultural and Food Economics*, *2*: 12. <https://doi.org/10.1186/s40100-014-0012-3>
- Rogers, E. M. (2003). **Diffusion of innovations** (4th ed.). Free Press.
- Sani, U., Abdullahi, Z. A., & Zekeri, M. (2015). Economic analysis of Irish Potato (*Solanum tuberosum*) production under irrigation system in Katsina metropolis, Katsina Local Government Area, Katsina State. *Journal of Agricultural Science and Environment*, *15*(1): 35–47.
- Sennuga, S. O., & Fadiji, T. O. (2020). Agricultural technologies and food security in developing countries: A review. *Journal of Agricultural Extension*, *24*(2): 67–79.
- Sennuga, S. O., & Oyewole, S. O. (2020). Exploring the effectiveness of agricultural technologies training among small holder farmers in Sub-Saharan African communities. *European Journal of Training and Development Studies*, *7*(1): 1–15.
- Sennuga, S. O., Oyenole, S. O., & Akinbode, S. O. (2020). Improved agricultural technologies and sustainable food production in Sub-Saharan Africa. *Journal of Agricultural Science and Technology*, *22*(4): 891–903.



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- Sezgin, A., Kaya, T. E., Kulekei, M., & Kumbasaroglu, H. (2011). Factors affecting the adoption of agricultural innovations in Erzurum Province, Turkey. *African Journal of Business Management*, **6**(3): 777–782.
- Ugbajah, M. O., & Uzuegbuna, C. O. (2012). Causative factors of decline in cocoyam production in Ezeagu Local Government Area of Enugu State, Nigeria. *World Journal of Agricultural Sciences*, **4**(3): 290–296.
- Uroaba, P., Abdus, S., Dawoodjan, A. K., & Mahmood, I. (2018). Adoption constraints of improved technology regarding tomato cultivation in District Mardan, KP. *Sarhad Journal of Agriculture*, **34**: 428-437.