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SOCIO-ECONOMIC ANALYSIS OF THE ADOPTION OF SELECTED IMPROVED SOYBEAN (*Glycine max*) VARIETIES IN TOFA LOCAL GOVERNMENT AREA OF KANO STATE, NIGERIA

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ABSTRACT

Adoption of improved production practices is the key to higher production of crops by farmers. The technical knowledge of farmers appears to be the key link to higher level of adoption. This study aimed at socio-economic analysis of the adoption of improved soybean (*Glycine max*) varieties in Tofa local government area of Kano state. Multistage sampling technique was used to select 98 soybean farmers; which were interviewed with the use of structured questionnaire. Descriptive statistics and logit regression model were used for data analysis. The finding of the study revealed that majority of the farmers were males (99%) and married (96.9%) that have 1hectare farm size average devoted for soybean production and 43% of them have farming as their major occupation also about 81% of them have different levels of formal education. Adoption level of soybean varieties was on the average for the two varieties in the study area, the socioeconomic factors that positively affected the adoption of the TGX-1448-2E Soybean variety were income level ($P < 0.1$), farm size ($P < 0.05$), and extension contact ($P < 0.1$). While for TGX-1448-2E Soybean variety none of the socio-economics factors were significant, Improved soybean variety adoption was due to the major characteristics of the variety, however major constraint's to both varieties technology adoption include high cost of labor and inputs. Hence, improving farmer's access to financial support or credit will enhance soybean adoption in the study area.

KEY WORDS: Adoption; Varieties; logit regression, socio-economic, and farmers

INTRODUCTION

Soybean (*Glycine max*) is a leguminous crop belongs to the family *Fabaceae* formerly *Legumesnosae* that grows in tropical, Sub-tropical and temperate climates . Soybean popularly known and nicknamed as 'Poor man's meat' is a vital pulse crop that is highly adaptable to varied climates (USDA, 1934). The first successful cultivation in Nigeria was in 1937 around Benue state. Soybean cultivation in Nigeria has expanded as a result of its nutritive and economics importance and diverse domestic usage. It is also a prime source of vegetable oil in the international market. Soybean is generally considered as highly versatile grain which has about 365 Applicable use in the human and animal foods other industrial uses (Mahama, et al; 2020; Ugbabe *et al*, 2017). Soybean is consumed as food (milk), used for production of edible oils, animal feeds, edible protein and for industrial purpose (Abdullahi, 2004). Thus, the demand for soybean products is expected to be high in Nigeria especially among commercial consumers in the food, paint, pharmaceutical and confectionaries industries (Omotayo *et al*., 2007; Mahama et al., 2020). these industries utilize soybean in various forms such as bean, meal, cake and oil. However, cake and oil forms are the most significant economically in the country. The cake serves as livestock feed component (protein concentrates) while oil is consumed locally and used in the manufacture of skin lotions, magerines and infant foods.

According to FAOSTAT (2021), Nigeria is the second- largest producer of soybean in Africa after South Africa however their yield average of <1 ton/ha, is below the potential yield of over 3 tons/ha (Ronner et al., 2016). Research efforts to improve the existing soybean varieties to expand and increase production in Nigeria were initiated in different research institutes from the mid 1970's to date (Misari & idowu, 1995; Vanlauwe *et al*., 2019). Notably among the various research institutes was the international Institute for Tropical Agriculture (IITA) whom initiated research work on soybean in the 1970's and had made substantial effort to improve the output of the crop (Abdullahi, 2004). Idrisa (2020) reported that, with the development of Soybean improved varieties (TGX1987-62F, TGX1987-10F, TGX1835-10E,TGX1448-2E and TGX1485-2E-ID), commercial production of soybean has expanded beyond its ''traditional home''(Benue, Kaduna, Niger, and Plateau) states. It is now produced in other states, such as Bauchi, Borno, Jigawa, Kano, Kebbi, Lagos, Nasarawa, Oyo, Sokoto, Taraba, Zamfara, and Federal capital Territory.

A technology transfer program would be considered effective if there is minimal or no gap between the potential and realized impact of the technology. It means that monitoring of adoption or adaptation of

technologies is an integral part of the technology system. Therefore, transfer of technology must be preceded and succeeded by technology assessment, reasserting that technology transfer and assessment are complimentary process. Adoption of improved production practices is the key to higher production of crops and higher of farmers. The technical knowledge of farmers appears to be the key link to higher level of adoption. Once farmer acquire knowledge, they begin to use and apply improved practices in their field. Even among farmers, there is a great variation in their levels of knowledge, as well as their readiness to accept, try new methods and adopt improved production practices. Some need more time to grasp and get convinced and hence need longer sustained support from extension (Snehal *et al*., 2015).

One of the ways of improving agricultural productivity, in particular and rural livelihood in general, is through the introduction of improved varieties to farmers. Also the adoption of improved varieties is an important means to increase the productivity of smallholder farmers there by fostering economic and improved well-being for millions of the poor households. Low adoption of improved varieties that can increase farmer's productivity is generally known to lead reduction of agricultural output. The low rate of adoption of improved varieties could be due to other factors such as farmers' characteristics or variety factors which may not encourage the adoption of technologies by farmers (Kamara *et al*., 2022). Use of local crop varieties is also recognized as major impediments to the growth of African agriculture. This is evidence by low and declining yield per hectare of major crops in Nigeria. It's in recognition of this situation that, the use of improved varieties will continue to be a critical input for improved farm productivity (Idrisa et al, 2010; Ronner *et al*., 2016).

Naing & Praderm (2009) and Kamara *et al*. (2022) posit that very few researches has been done to understand the adoption behavior of farmers and problems encountered in the adoption of soybean innovation, different extension activities used with farmers and available sources of information. Therefore the need to study the adoption behavior of soybean farmers in order to help improve planning for research and development. Consequently, knowing the factors which have determined the adoption in the past and social characteristics of farmers will assist in obtaining quick and wide adoption in the future. Consequently this study aimed at socio-economic analysis of improved soybean (*Glycine max*) varieties adoption in Tofa LGA of Kano state.

METHODOLOGY

Description of the study Area

The study was carried out in Tofa Local Government Area (LGA), Tofa LGA. is one of the 44 local government areas in kano state situated in the Sudan savannah agro- ecological zone of kano state. It lies between latitudes $12^{o}03$'N $8^{o}16$'E and longitudes $12^{o}050$'N. It borders Bagwai LGA to the west, DawakinTofa LGA to the North and Rimin gado & Kumbotso LGAs to the south and East respectively (KINSG, 2006).The Tofa LGA has a land of about $202.2KM^2$. A tropical wet and dry climate prevails over the Tofa LGA and it has two distinct seasons; the wet season and dry season. The wet season lasts between May and early October while the dry season lasts between November and April. The estimated population census of Tofa LGA Population was at 342,500 (NBS, 2017). Tofa local government area is known as a prominent agricultural center. A number of crops produced in the area includes: maize, millet, sorghum, cowpea, soybean, groundnut among others. Farmers in the study area also engaged in livestock production specifically sheep, cattle, goat, and poultry which serve as an income diversification alternatives.

Sampling Procedure

A multistage sampling technique was used for this study. Purposive sampling technique was used in selecting four communities out of the 16 communities of the LGA base on the intensity of cultivation of the targeted crop. The second stage was the generating a list of registered farmers' cooperative societies and random selection of 10% of the total farmer cooperative societies from each of the selected communities. In stage three, there was random selection of 30% of the total number of farmers from each community, which made a total of 98 farmers for the study.

Table 1: Sampling summary

Communities selected	Number of farmer cooperatives	10% Number of farmer cooperatives	Farmers in selected groups	Sample size selected
Doka	40	4	100	30
Dan Saudu	25	2	75	23
Lambu	38	4	100	30
Wangara	18	2	50	15
Total	**121**	**13**	**325**	**98**

Method of Data Collection

Primary data was used for this study. The primary data was generated through the use of structured questionnaires. Data collected includes information's on socioeconomic characteristics of farmers such as age , marital status , education level, years of experience, household size etc., The type of improved soybean varieties, the level of adoption, the various sources of agricultural information and the constraints to the adoption in the study area.

Analytical Technique

The analytical tools used in the data analyses were descriptive statistics and logit regression model. Descriptive statistics such as frequency percentage and mean were used to describe socioeconomic characteristics while logit regression model was used to determine socioeconomic factors influencing soybean variety adoption.

Logit regression model specification

$y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots B_8X_8+ u$

Where Y= Adoption=1 if farmer adopt 50% of technology package and Non-adoption= 0 if farmers adoption was below 50% of the technology package or other wise

β_0 = Constant

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ and β_8= Coefficient

X_1 = Annual Income (Naira)

X_2 = Gender (Male=1 and Female=2)

X_3 = Marital status (Single= 1, Married=2, widow=3, divorced=4

X_4 = Household size (number of members)

X_5 = Education Status (years)

X_6 = farming experience (years)

X_7 = Farm Size (hectares)

X_8 = Extension contact (contact=1 and No contact=0)

U = Error term.

RESULT AND DISCUSSION

Socio-economic characteristics of the farmers

Result for Socio-economic characteristics of the farmers was shown in Table 2. It reveals that 99% the soybean farmers interviewed are male. This showed that women were not mostly participating soybean production in the study area because of the culture and traditions this similar to what was found among soybean farmers in Taraba State by Mustapha, et al., (2012) that majority of the farmers were males. Result also showed that 96.9% were married. The study further revealed that the sampled farmers attained various level of education with 21.4% attaining primary level education, 34.7% attaining secondary level education, 22.4% attaining tertiary level education and 2% attaining adult education. The findings also revealed that only 19.4% of the respondents had no formal education. This implies that formal education is becoming of interest to the farmers. This is similar to what was found by Ahmadu, (2011) that majority of farmers have formal education. Therefore, education plays an important role in agricultural development. Ojuekaiye (2011) also reported that education is an essential socio-economic factor that influences farmer's decision because of its effect on the awareness, perception, reception and quick adoption of innovation that can increase productivity. The distribution of the respondents in table 1 based on their primary occupation showed that 42.9% of the respondent were 17.3% were civil servants, 14.3% are traders, 7.1% were tailors, drivers, mechanics and vulcanizer.

Table 2 further shows that average household sizes was 14; Average annual income was N710,561.22; The mean of the respondent farming experience was 30 while their average experience in soybean production was 8years This implies that adoption of soya bean in the area is less than 20 years. The table 2 further shows that the average farm size was 4 hectares with the average farm size devoted to soybean production was 1 hectare. This is similar to 0.98ha average found by Shalma (2014) among soybean farmers in Kaduna state Nigeria.This analysis showed that not up to half of the land by proportion was devoted to soybean production. This was in agreement with that of Oriole (2009) who indicated that most of the soybean farmers in Nigeria were small scale farmers. Table 2 also revealed that 82.7% of the farmers are practicing mixed cropping while 17.3% were practicing sole cropping. Findings of this research in table 2 further indicated that 55.1% of the farmers were members of a farmer group while the remaining 44.9% are not. Membership of cooperative organization is important because it affords the farmers the opportunities of sharing information on modern agricultural production practices. With respect to extension services, the study showed that 91.8% of the responded to have access to extension services and this indicates that there was good extension contact in the area.

Table 2: Socio-economic Characteristics of the farmers

Quantitative variables	Min	Max	Mean	Standard Deviation
Household	01	37	14	7.504
Annual income(NGN)	45,000	2,000,000	71,0561.22	406937.28
Farming Experience	8	50	30	11.457
Experience in soybean	3	13	08	1.928
Number of farms	1	10	5	1.781
Total Farm size	0.7	13	4	2.345
Farm size devoted for soybean	0.3	4	1	0.773
Qualitative Variables	**Frequency**		**Percentage**	
Gender				
Male	97		99	
Female	01		01	
Marital status				
Single	03		3.1	
Married	95		96.9	
Educational Status				
No formal education	19		19.4	
Primary	21		21.4	
Secondary	34		34.7	
Tertiary	22		22.4	
Adult education	02		2.0	
Major Occupation				
Farming	42		42.9	
Civil service	17		17.3	
Trading	14		14.3	
Tailoring	7		7.1	
Driving	6		6.1	
Mechanic	6		6.1	
Vulcanizer	6		6.1	
Production System				
Sole cropping	17		17.3	
Mixed cropping	81		82.7	
Cooperative Membership				
Member	54		55.1	
Non-member	44		44.9	
Access to Extension service				
Access	90		91.8	
No access	09		8.2	

Distribution of farmers according to awareness and sources of awareness of improved soybean variety

Table 3 showed that the awareness level of improved soybean was set at 91.1% making the adopted varieties very popular within the community. The sources of the awareness were through cooperative, friends, extension contact, and neighbors.

Table 3: Distribution of farmers according to awareness and sources of awareness of improved soybean variety

Variable	Frequency	Percentage
Awareness		
Aware	91	91.9
Not aware	07	7.1
Source of awareness		
Cooperative	27	27.6
Friends	09	9.2
Extension contact	48	49
Neighbors	05	5.1
Radio	01	10
Total	**98**	**100**

Distribution of farmers according to sources of improved soybean variety

Table 4 show the farmer's major sources of soybean seeds. It revealed that 51% of the farmers sourced their seed through agro-input suppliers. About 28% of farmers obtained their inputs through ADP, those who got their seed through extension agents are 9.2% and 4.1% of the farmers obtained their adopted varieties at local markets. Table 4 also revealed 76.5% of the farmers to be using recommended improved practices in the study area. Also 63.3% farmers preferred to use organic fertilizer, with 36.7% of them using inorganic manures in their farms. Regarding sources of information on improved soybean varieties as revealed also in table 4, 43.90% of the farmers were getting most of their information from demonstration plot. Other sources were through friends (11.2%), newspaper (3.1%), radio (9.2%), television (4.1%), fellow friends (15.3%) and extension contact (12.2%).

Table 4: Distribution of farmers according to sources of improved soybean variety

Variables	Frequency	Percentage
Source of Soybean Seed		
ADP	27	27.6
Agro-input suppliers	50	51
Extension agents	09	9.2
Farm	08	8.2
Local markets	04	4.1
Use of improved recommended practice		
Yes	75	76.5
No	23	23.5
Type of fertilizer		
Organic	62	63.3
Inorganic	36	36.7
Source of Information		
Demonstration plot	43	43.9
Friends	11	11.2
Newspaper	03	3.1
Radio	09	9.2
Television	04	4.1
Fellow friends	15	15.3
Extension agents	12	12.2
Total	**98**	**100**

Distribution of Farmers According to Proportion of land size Allocated for Soybean Production

Proportion of land allocation among the respondents was also investigated in Figure 1. The Allocation of land for improved soybean was only by 35% of respondents whiles the remaining 65% was allocated for other crops production. This implies that the level of adoption for the improved soybean is marginally good.

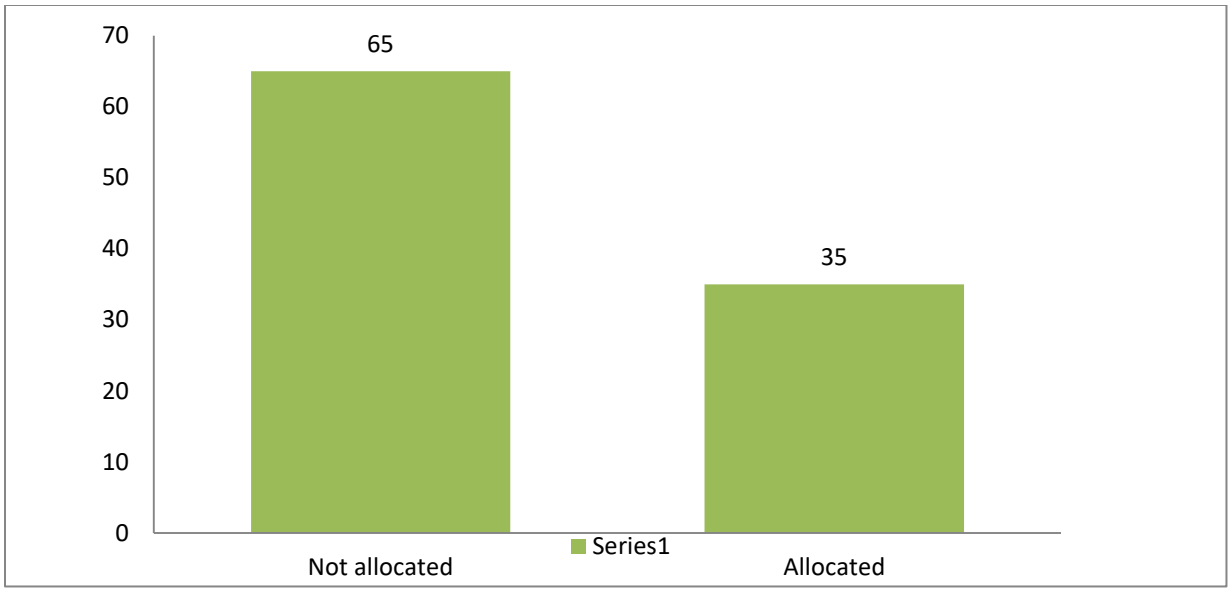

Figure 1 land allocation for improved soybean variety

Soybean Varieties Adoption by farmers

The result in figure 2 showed that for variety A (TGX1448-2E), was adopted by 33.7% of the farmers. However 76.5% of the respondents adopted variety B (TGX1835-10E). This implies that TGX1835-10E was adopted most by the farmers in the study area.

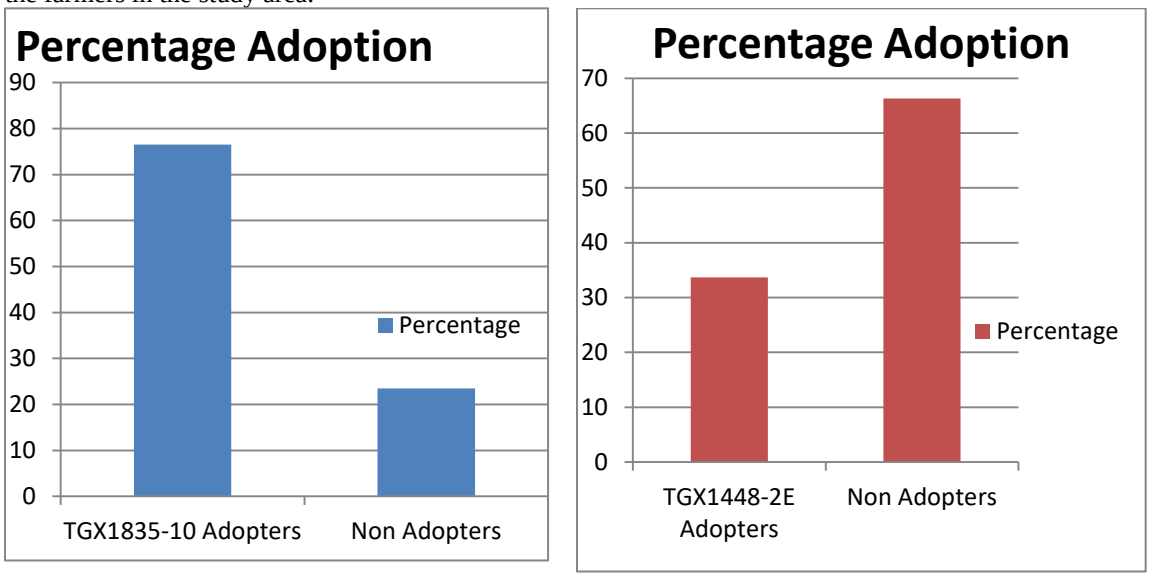

Figure 2: Soybean Varieties Adoption

Socio-Economic Analysis of Factors Influencing Adoption of Improved Soybean Varieties

The independent variables included in analysis are gender, household size, education status, annual income, soybean production experience, Farm size, cooperative membership and access to extension services. The dependent variable is adoption of soybean variety. Findings in table 5 indicated that annual income, farm size and access extension services were significant at 5% level of probability. The model statistics revealed that significant -2Log likelihood of 114.074, implying the statistical validity of the estimated model.

The coefficient of annual income was positive and significant on influencing adoption of TGX-1448-2E variety. This implies that increase in farmers annual income result to an increase in adoption in the improved variety. Farmers with higher annual income are more likely to adopt improved technologies considering input requirement of agricultural innovation.

The coefficients of farm size were positive and significantly influence adoption of TGX-1448-2E variety. This implies that increase in farm size result to an increase in adoption in the improved variety. Farmers with larger farm size are more likely to adopt improved varieties. Small farm size is an impediment to agricultural mechanization because it will be difficult to used farm machines on small and fragmented farms. This is in conformity to the study of Rasaki et al. (2020) and Ekong (2003) who opined that most Nigerian farmers are small sized family farms in which family members contribute the required labour.
The coefficient of extension contact was also positive and significant on influencing adoption of TGX-1448-2E variety. This implies that increase in extension contact result to an increase in adoption in the improved variety. This is in line with the finding of Mustapha et al. (2012) among soybean farmers in Taraba state Nigeria.

Table 5 also revealed socioeconomic analysis of factors influencing adoption of improved soybean variety (TGX-1835-10E) in the study area. The model statistics revealed significant -2Log likelihood of 96.777, this implies the statistical validity of the estimated model. The independent variables included in analysis are gender, household size, education status, annual income, soybean production experience, farm size, cooperative membership and access to extension services. Findings indicated that the socioeconomic variables are not significant and they do not have direct influence on adoption of soybean (TGX-1835-10E) variety. This connotes to what was found in Ethiopia by Tesfay (2019) that none of the socio-economic characteristics of the farmers is significant on adoption of improve soybean variety but factors such as nearness to market and access to training which were not captured in the model used.

Table 5. Logit Regression Model for Socioeconomic Factors Influencing Adoption of Improved Soybean Variety (TGX-1448-2E) and (TGX-1835-10E) in the study area.

Variable	**Soybean variety (TGX-1448-2E)**				**Soybean variety (TGX-1835-10E)**			
	B	**Exp(B)**	**S.E.**	**P-Value**	**B**	**Exp(B)**	**S.E.**	**P-Value**
Sex	-20.08	0.000	4.019	1.0	20.120	5.472	4.019	1.00
Household size	-0.005	0.995	0.034	0.894	-0.009	0.991	0.038	0.809
Education	-0.376	0.687	0.238	0.115	0.432	1.540	0.279	0.122
Income	-0.000	1.000	0.000	0.077	0.000	1.000	0.000	0.201
Farming Experience	-0.010	0.990	0.138	0.944	0.212	1.236	0.155	0.171
Farm size	0.271	1.311	0.138	0.050	0.016	1.016	0.172	0.926
Cooperative membership	-0.079	0.929	0.471	0.866	0.036	1.037	0.526	0.945
Access to extension	1.903	0.149	1.152	0.099	1.318	3.734	1.163	0.257
Constant	22.488	5.841	0.0004	1.00	-2.406	0.000		1.00
Model Summary								
-2Loglikelihood	114.07						96.77	
Snell & cox estimate	10.7						9.70	
Neglekere estimate	14.9						14.6	
Chisquare	11.139						10.021	

Constrains to adoption of improved soybean in the study area

It was shown in Table 6 that 68.4% of the sample farmers were faced with the problem of labour cost which was ranked first among the major constraint faced by farmers on adoption of soybean varieties in the study area. Similar result was obtained by Ogundsri, *et al* (2006) that Labour cost was positively significant at 1% level of probability. This is also in conformity with finding of Dauda, *et al* (2009) whom asserted that the major factor that inhibit or limit agriculture activities as perceived by farmers was unavailable of labour. Table 6 further revealed that 64.5% of farmers were face with input cost constraints. The sampled soybean farmers ranked insufficient credit as their 3rd constraint. About 40.8% of the respondents identified this as a problem. This constraint was also identified by Kibwika and Semana, (2002) and Mustapha *et al*., (2012) where they state that lack of access to capital impedes investment in important agricultural technologies such as improved seeds agro-chemical and irrigation; whereas these are keys to modernization of agriculture.

Table 6: constraints to adoption of improved soybean in the study area

Constrains	Frequency	Percentage	Ranking
Labour cost	67	68.4	1st
Input Cost	64	64.5	2nd
Capital	40	40.8	3rd
Disease	36	36.7	4th
Market Price	35	35.7	5th
Input Availability	24	24.7	6th
Inadequate Training	17	17.3	7th
Drought	16	16.3	8th
Poor Technical Know how	15	15.3	9th

CONCLUSION

The adoption level of soybean varieties was on the average in the study area, the socioeconomic factors that positively affected the adoption of TGX-1448-2E Soybean variety were income level, farm size, and extension contact. While for TGX-1448-2E Soybean variety none of the socio-economics factors were significant, adoption was due to the major characteristics of the variety, however major constraint's to both varieties technology adoption include high cost of labor and inputs. Hence, improving farmer's access to financial support or credit will enhance soybean adoption in the study area.

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