International Journal of Agriculture, Environment and Bioresearch

Vol. 3, No. 02; 2018

ISSN: 2456-8643

DETERMINANTS OF ADOPTION OF IMPROVED SOYBEAN VARIETIES IN BAKO AREA, WEST SHEWA ZONE, OROMIA REGION ETHIOPIA

Abdulaziz Teha[1] and Berhanu Nega Wasihun[2]

[1]Bako Agricultural Research Center, P.O. Box 03, Bako, Ethiopia,[2]Rural Development, Oromia Agricultural Research Institute,

[2]Rural Development And Agricultural Extension, Hawassa University, Ethiopia

ABSTRACT

Soybean is one of the most important pulse crops categorized under oil crop. Ethiopia has an enormous potential for production of pulse crops in general and soybean in particular and it is also among the most important export crops. Despite the high production potential and the economic importance of the crop, soybean producers particularly small scale farmers did not economically benefited significant amount from its production, as such low production and productivity, which is mainly associated with poor adoption of improved technologies and poor marketing system. To this end, the objectives of this study were: to examine and document the experience of adoption of improved soybean varieties, analyze the determining factors that affect the adoption of improved soybean production. Two stage sampling procedure were followed to select rural peasant association and households for the study. Four rural peasant associations were selected purposively and 120 household heads were selected randomly using probability proportional to size sampling. Semi-Structured interview schedule were developed, pre-tested and used for collecting the essential quantitative data for the study from the sampled households. A focus group discussion on soybean production was used to generate qualitative data. In addition, secondary data were collected from district office of agriculture and rural development on the production of soybean. The focuses of the study was the importance of demographic, socio economic and institutional factors that affect the adoption of improved soybean varieties in Bako areas. Therefore, taking the specific characteristics of farmers into account in introducing and promoting soybean varieties may help policymakers and development interventions to come up with solution that can addresses farmers' varieties adoption problems.

Keywords: Soybean, adoption determinants, Bako.

INTRODUCTION

Agriculture has been the foundation of Ethiopian economy and part of the history, culture, knowledge system and way of life for centuries. It contributes a great proportion to the gross national product (GNP) and, thus the improvement of agriculture stabilizes the economy, society and politics of the country. Almost 80% of the country's population are living in rural areas and

Vol. 3, No. 02; 2018

ISSN: 2456-8643

are directly or indirectly linked to agriculture for their livelihood. According to recent data, agriculture accounts for 41% of the gross domestic product (GDP) and contributes to nearly 90% of Ethiopia's export earnings. Agricultural export economy is, however; subjected to the caprices of the weather; therefore, agricultural production is geared towards domestic consumption (FDRE, 2010).

As far as the main challenge of Ethiopia is food insecurity and malnutrition in the rural areas, mainly because of a low level of understanding of a balanced diet and lack of capacity to purchase animal source proteins to come out of the food insecurity problem and low export earnings from agricultural commodities. The country need to focus on increasing of agricultural production, high value commodities production for export and adoption of appropriate production technologies. Soybean is a multipurpose crop, which can be used for different kinds of foods, animal feed, soy milk, raw material for the processing industry, and it counter the effects like depletion of plant nutrients in the soil resulting from continuous mono-cropping of cereals increases soil fertility reduce malnutrition and decrease the risk of pest and diseases(Hailegiorgis, 2010).

Generally Soy-foods are considered to be nutritious and healthy based on their nutrient composition which includes protein, fat, carbohydrates, dietary fibers as well as minerals and phytoestrogenes (or isoflavones). (E.g. Asian diets rich in soybeans - with a lower risk of coronary heart diseases, osteoporosis, hormone-dependent forms of cancer and menopausal symptoms) (Global database on children growth and malnutrition, 2003). Apart from its nutritive purposes, soybean oil is used industrially for paints, linoleum, printing inks, soaps, insecticides, and disinfectants. Soybean meal and soybean protein are used for synthetic fibre (artificial wool), adhesives, textiles, waterproofing, and firefighting foam (O. Coulibaly, 2009).Agricultural research innovations have no value if they are not taken by the end users, Hence this study is aimed at providing research, extension, and development institutions with valuable information that assists in improving the efficiency of communication and agricultural research, technology transfer by analyzing adoption of soybean varieties and identify socioeconomic and institutional factors that influence the adoption of improved soybean varieties at Bako-Tibe district of West Shewa Zone.

MATERIALS AND METHOD

The study was carried out in the rural areas of Bako district, central Ethiopia located in the west shewa zone of Oromia regional state. The district was selected based on the potential of the production of soybean crop and also out of 28 peasant association; Gambela Tare, Ongobo Bakanisa, Dambi Gobu and Dambi Dima were selected using purposive sampling technique. From the total of adopters and non-adopters of households of selected peasant association, 62 adopters and 48 non-adopters were selected based on proportion to the number of users and non–users of the technology. In the study area both primary and secondary data were utilized. For this study, binary logit model was used to analyze factors which affect farmers' decision to adopt

Vol. 3, No. 02; 2018

ISSN: 2456-8643

soybean varieties In this study, dependent variable representing adoption of the improved soybean varieties was a dummy variable that takes a value of one if sample farmers used improved soybean varieties during the survey period and zero otherwise. This binary dependent variables are related to several sets of explanatory variables (continuous and/or dummies) that are believed to influence adoption decision of the improved soybean varieties in the study area.

Following Maddala (1983) and Gujarati (1995) the logistic distribution function for the adoption of improved varieties can be specified as:

$$P_i = \frac{1}{1+e^{-zi}} = \frac{e^{zi}}{1+e^{zi}} ------------------------(1)$$

Where, Pi = is the probability of adoption of improved soybean varieties for the ith farmer and it ranges from 0-1 (i.e., the binary variable, P = 1 for an adopter, P = 0 for a non-adopter).
e^{zi} = stands for the irrational number e to the power of Zi.
Zi = a function of n-explanatory variables which is also expressed as

Zi = B0+B1X1+B2X2+…+BnXn.. (2)

Where, *X1*, *X2*, *Xn* = explanatory variables. B0- is the intercept, *B1, B2 ... Bn* are the logit parameters (slopes) of the equation in the model. The slopes tell how the log-odds ratio in favour of adoption changes as an independent variable changes. The unobservable stimulus index *Zi* assumes any values and is actually a linear function of factors influencing adoption decision. It is easy to verify that *Zi* ranges from -∞ to ∞, Pi ranges between 0 and 1 and that Pi is non-linear related to the explanatory variables, thus satisfying two requirements: As *Xi* increases Pi increases but never steps outside the 0 and 1 interval; and The relationship between *Pi* and *Xi* is non-linear, i.e., one which approaches zero at slower and slower rates as Xi gets small and approaches one at slower and slower rate as Xi gets very large. But it seems that in satisfying these requirements, an estimation problem can be created because *Pi* is not only nonlinear in *Xi* but also in the *B*'s as well, as can be seen clearly below

$$P_i = \frac{1}{1+e^{-(B0+B1x1+B2x2+\cdots+Bn)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

This means the familiar OLS procedure cannot be used to estimate the parameters. But this Problem is more apparent than real because this equation is intrinsically linear. If Pi is the probability of adopting given improved soybean varieties then (1-Pi), the probability of not adopting, can be written as:

$$1 - P_i = \frac{1}{1+e^{zi}} = ------------------------(4)$$

Vol. 3, No. 02; 2018

ISSN: 2456-8643

Therefore, the odds ratio can be written as:

$$\frac{p_i}{1-pi} = \frac{1+e^{zi}}{1+e^{-zi}} = e^{zi} \quad \text{----------} \quad (5)$$

Simply the ration in favour of adopting improved varieties$\frac{pi}{1+pi}$. It is the ratio of the probability that the farmer would adopt the improved soybean varieties to the probability that he/she would not adopt it.

Finally, taking the natural log of equation 5, the log of odds ratio can be written as

$$Li = \ln\left(\frac{pi}{1-pi}\right) = \ln\left(e^{B0+\sum_{i=0}^{n} BiXi}\right) = Z_i = B_0 + \sum_{i=1}^{n} B_iX_i \quad \text{----------} \quad (6)$$

Where, Li is log of the odds ratio in favour of improved varieties adoptions, which is not only linear in Xi, but also linear in the parameters. Thus, if the stochastic disturbance term, (Ui), is introduced, the logit model becomes

Zi =B0+B1X1+B2X2+…+BnXn+Ui ---------- (7)

This model can be estimated using the iterative maximum likelihood (ML) estimation procedure. In reality, the significant explanatory variables do not have the same level of impact on the adoption decision of farmers. The relative effect of a given quantitative explanatory variable on the adoption decision is measured by examining adoption elasticity purposely, defined as the percentage change in probabilities that would result from a percentage change in the value of these variables.

RESULTS AND DISCUSSION

Determinants of Adoption of Soybean Varieties

Socio-economic characteristics of household

Table 1: Summary Statistics and Distribution of Continues Variables (N=120).

Variables	Adopters		Non-adopters		Total		t-value
	Mean	SD	Mean	SD	Mean	SD	
Education	5.82	2.76	2.48	1.29	3.63	3.47	11.48***
Labour	3.55	1.45	1.50	0.81	2.56	1.56	17.95***
Social part	1.56	0.84	2.81	1.32	2.17	1.26	18.85***
Off-farm income	0.61	0.49	0.35	0.14	0.49	0.38	8.60***

*******, significant at less than 1% probability level respectively.

Source: Own survey result/2013

Vol. 3, No. 02; 2018

ISSN: 2456-8643

The average Educational level of sample households was 3.63 with standard deviation of 3.47. Independently, the mean for adopters and non-adopters households were found to be 5.82 and 2.48 respectively, which implies that the educational level of the household increases the probability of the farmer to be in adopter category increases. The statistical t-test analysis revealed that there is significant the difference between the adoption groups with regard to education was found to be statistically significant at less than 1% probability level. The implication is that adopters of soybean have better education than non-adopters. The labour availability of the sampled households' was found to be within the range of 1 to 12 years. While, the average labour availability was 2.56 with standard deviation of 1.56. When the sample households considered independently into adopters and non-adopters of soybean varieties, the average labour availability of adopters was higher 3.55 in man equivalent ratio than that of non-adopters 2.81.

The average social participation of the sampled households was 2.17 with standard deviation of 1.26. When the sample households considered independently into adopters and non-adopters of soybean varieties, the average social availability of adopters was higher 1.56 than that of non-adopters 2.81. The statistical t-test analysis revealed that there is significant difference in labour availability between soybean varieties' adopters and non-adopters group at probability level of less than 1%. Off-farm income was found to have different value for the adopters and non-adopters. The average off-farm income was 0.49 with standard deviation of 0.38. When the sample households considered independently into adopters and non-adopters of soybean varieties, the average off- farm income of adopters was higher (0.61) than that of non-adopters (0.35).

RESULTS OF ECONOMETRIC MODEL

In the Logit model, a farmer who used any type of soybean varieties is considered to be "an adopter". In a discrete adoption, a farm household has either adopted soybean varieties or has not adopted. Dependent variable is either adopter or non-adopter. In order to explain this binary variable, it is necessary to construct a model that relates the dependent variable to a vector of independent variables. The logit model was employed in this study to estimate the effects of the hypothesized independent variables on adoption of soybean varieties.

Table 2: The Maximum Likelihood Estimates of the Binomial Logit Model (N=120).

Variables	Estimated Coefficient (B)	Odds Ratio (S.E)	Wald Statistics	Sig. Level	Exp(B)
Age	-.049	.060	.677	.411	.952
Education	.443	.141	9.855	.002***	1.557
Farm exp	.116	.081	2.079	.149	1.123
Farm size	.158	.303	.271	.603	.854
Labour	1.724	.535	10.374	.001***	5.607

Social prt	-1.380	.483	8.163	.004***	.252
Access credit	1.768	1.155	2.341	.126	6.527
Off-farm inc	1.963	1.082	3.293	.070*	7.119
Constant	-4.087	2.317	3.110	.078	.017

Pearson- $\chi 2$ value = 127.50***
-2 Log Likelihood = 19.36
Correctly Predicted (%) = 92.5
Significant at 1% probability level ***
Significant at 10% probability level *
Source: Model output

Level of education of household heads: As expected, education level of household head has a positive and significant relationship at 1% probability level of adoption of improved soybean varieties. The odds-ratio 0.141 in favor of adopting improved soybean varieties, other factors kept constant increases by a factor of 1.557 for the farmer whom assumed household heads become literate than that who did not. This implies that the educated farmers are more likely to adopt improved soybean varieties than those who are not educated. This may be due to relatively educated farmers have more access to information and they become aware to new technology, and this awareness enhances the adoption of technologies. This result is consistent with finding of Asfaw et al. (1997), Bekele et al. (2000) and Tesfaye and Alemu (2001).

Labour availability: Labour availability was found statistically significant at less than 1% probability level with the expected value and positively related with adoption soybean production technology. The model result confirms that households with high labour availability in man equivalent are more likely to adopt soybean production varieties than households with low labour availability in adult equivalent. With the assumption of constant influences of other factors, the odd ratio 0.535 indicates that the probability of using soybean technology increases by a factor of 5.607 as labour availability increases by one man equivalent unit. The result of this study was consistent with the finding of many other researches which were conducted in different parts of the world, as well as agrees with the ideas mentioned in the hypothesis part of this thesis. Molla (2005) mentioned availability of labour as an important factor for adoption, Dejene (Ethiopia) and Tanzania, respectively.

Social participation: Contrary to our expectation this variable took a negative sign but found statistically significant. The result of the Logit Model showed that having responsibility in a local administration was negatively related with adoption of soybean production technology. The coefficient of this variable is significant at less than 1% probability level implying that as a given farmer become members of local administration such as PA administration Council, peasant association leader, informal institutions and religious leader, etc, the probability of adopting decrease. Based on the model result, holding all other factors constant, the odds of adopting soybean varieties are 48.3% lower for farmers who had position in local administration than

Vol. 3, No. 02; 2018

ISSN: 2456-8643

those who had not. The rationale behind this fact lies perhaps because of more responsibilities and tasks to be done among leaders in the administration than on their farms.

Off-farm income: Additional income earned from agricultural activities outside the farm increases the farmers‟ financial capacity and increases the probability of investing on new technologies here is the finding that off-farm income has positive relationship with adoption of soybean production technology, and found statistically significant at less than 10% level. For instance, the frequent meeting in peasant association as administration could be one of the factors that hinder political elicited and religious leaders from being intensively cultivate their farmlands.

CONCLUSION AND RECOMMENDATIONS

Soybean contributes to households' nutrition, income and food security. However, the emphasis given nationally to the sector is relatively low compared to other food crops. As a result of this, institutional support provided to this sector, such as credit service, research and extension were not to the expected level. These factors together with several household personal, demographic and socio-economic factors greatly affected the adoption of improved soybean varieties and consequently production and productivity of the sector. Based on the research findings of this study, the following points are recommended to improve farmers' adoption of improved soy bean production package so as to enhance its production and productivity.

Based on the finding of the study, the following points are recommended to increase adoption of soybean varieties.

- ✓ Educational level of the household was significant at less than 1% probability level. This implies that the educated farmers are more likely to adopt improved soybean varieties than those who are not educated. This may be due to relatively educated farmers have more access to information and they become aware to new technology, and this awareness enhances the adoption of technologies. Strengthening educational capacity of household heads and the whole community leads to acceptance of important new technology that increases household income and food security. Therefore, strengthening both formal and informal education and vocational or skill training should receive due attention

- ✓ Labour availability is the other key variable affecting the decision of farmers to participate in soybean production technology. It is significant at 1% significance level and positively related with adoption of soybean production technology, which indicated that availability of labour is an essential element to implement and adoption soybean production technology. Encouraging farm community to share labour to produce soybean as it is lobour demanding Moreover, introducing labor saving technologies and assisting local institutions through farmers groups need to be considered

Vol. 3, No. 02; 2018

ISSN: 2456-8643

- ✓ Social participation, contrary to our expectation this variable took a negative sign but found statistically significantly associated with adoption of soybean varieties at 1% probability level. The result of the study showed that having responsibility in a local administration was negatively related with adoption of soybean varieties. Implying that as a given farmer becomes members of local administration such as Peasant association administrator Council, leader of informal institutions, religious leader etc. the probability of adopting decrease.

- ✓ Off-farm income is significant at 10% probability level and positively influence adoption soybean .This implies that a farmer who has better income will be more likely to adopt improved soybean varieties. This may be due to the resource demanding nature of soybean production activity particularly when the production purpose is beyond the home consumption and for the commercial purpose.

REFERENCE

Asfew Negassa, K.,Gungal, W. Mwangi and Beyene Seboka, 1997. Factors Affecting Adoption of Maize Production Technologies in Ethiopia. Ethiopian Journal of Agricultural Economics. 2: 52-69.

Central Statistical Agency [CSA] (2010) Reports on area and crop production on forecasts for major grain crops The FDRE Statistical Bulletins (1990–2010), CSA, Addis Ababa, Ethiopia

Coulibaly O.et.al.,(2009) *Situation and Outlook for Cowpea and Soybean in Sub-Saharan Africa*

Food Agricultural Organization [FAO] World Bank Country Memorandum for Ethiopia; Central Statistical Agency (2008/09) Central Statistics Agency.

Global database on children growth and malnutrition. (2003):Available at [htt://who.int/nutgrwhdb] Retrieved March 13, 2007.

Gujarati, D.N. (1995): Basic econometrics.3rd edition. Mc Graw-hill, Inc., New York.

Hailegiorgis, B. (2010): Export performance of oilseeds and its determinants in Ethiopia. Haramaya University, College of Agriculture and Environmental Science, Department of Agricultural Economics.

Maddala, G.S., (1992): Introduction to Econometrics. 2ndEdition. New York: Macmillan Publishing Company.

Vol. 3, No. 02; 2018

ISSN: 2456-8643

Molla Tafere, (2005): Farmers' Response and Willingness to Participate in Water Harvesting Practices: a case study in Dejen district/East Gojam zone M.Sc Thesis. Alemaya University, Alemaya, Ethiopia.