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Full Length Research Paper

Factors affecting adoption and degree of adoption of soybean in Ilu-Ababora Zone; Southwestern Ethiopia

***Samuel Diro[1], Efrem Asfaw[1], Beza Erko[1] and Misganaw Anteneh[2]**

[1] Agricultural economics research process, Jimma Agricultural research center
[2] Agricultural extension and gender research process, Jimma Agricultural research center

*Corresponding Author's Email: samueldiro85@gmail.com

Abstract

Despite progress in production and productivity of agricultural produces, food insecurity and per capita calorie consumption in the world has not registered a significant improvement. Thus, adoption and diffusion of nutritious crops such as soybean may be regarded as a good option for rural smallholder farmers. This study was aimed to analyze socio economic bottlenecks related to adoption and production of soybean. Primary data was collected from 185 households of Ilu-Ababora zone; Southwestern Ethiopia. The result shows that 78.9% of respondents were soybean adopters. The adoption rate was high at Chawaka district (97%) and low at Bedele district (53.3%). This study also revealed that 54% of respondents planned to reduce soybean land coverage. Market situation was the main reason for 63% of respondents to reduce soybean production. The econometric result showed that attendance on training of soybean production and use of soy food at home affects soybean adoption positively and significantly. However, age of the household head and distance to main market has negative and significant impact. Based on the findings, the study recommends concerning bodies to encourage local industries that uses soybean as a raw material and to smooth up the tie of supply and value chain actors.

Key words: Local industries, Market situation, Soybean, Soy food, Value chain

Introduction

Agriculture, the mainstay of Ethiopian economy, directly supports about 85% of the population in terms of employment and livelihood, contributes over 41% of the country's gross domestic product; and generate about 90% of export earnings. It is also an important sector in supplying food for the population and raw material for agro-based domestic industries and in generating surplus capital to speed up the country's overall socio-economic development (CSA, 2014).

Despite progress in production and productivity of agricultural produces, food insecurity and per capita calorie consumption in the world has not registered a significant improvement in recent years. Consequently malnutrition, specific nutrient deficiencies and anemia primarily causes immune deficiency and then finally increases the risk of maternal morbidity and mortality (Domellof, 2011). The intention and capability of rural population towards regularly feeding the family with disease preventing and body building foods such as vegetables, fruits and animal products is very poor. Those food ingredients are relatively expensive among poor households of developing countries. Hence, adoption and diffusion of cheap nutritious crops such as soybean may be regarded as a good option for rural smallholder farmers.

Soybean is an annual crop that produces more protein and oil per unit of land than any other crops. It is a versatile food plant that is capable of supplying most nutrients (Franklin, 1998). Besides nutritional advantage, the crop has a great significance in improving soil fertility when grown solely or in combination with cereal crops (CDI, 2010).

Assimilation and adoption of new technology at the farm level is a function of science, economics and human behaviour. The adoption process involves an interrelated series of personal, cultural, social and institutional factors. Different studies on the adoption of new agricultural technologies has been conducted in Africa. The result of those studies showed that socio demographic, economic, institutional, and technology specific factors affects the adoption process of the technologies.

Idrisa *et al.,* (2010) explored the relationship between the likelihood of adoption of improved soybean seed and different socio economic and technology specific factors. The finding revealed that farm size of the household

head and maturity period of soybean affects the adoption of soybean seed negatively and significantly and expenditure on labour, consumption of soy food at home and yield of soybean affects the likelihood of adoption of soybean seed positively and significantly.

Yishak and Punjabi (2011) witnessed that farm experience, farm size, number of oxen, tropical livestock unit, availability of fertilizer on time, access to credit, availability of cash, attendance on demonstration and ownership of radio at home affects the adoption of improved maize technologies positively and significantly. Distance to market and input price, however, affects adoption negatively and significantly.

The study by Akudugu *et al.,* (2012) also showed that farm size, expected benefit, education level of the farmer, access to market information and gender of the household head has positive and significant effect on technology adoption of farm households. Age of the farmer has negative and significant effect.

Gregory and Sewando (2013) also revealed that number of years in schooling, number of livestock owned by the household, participation of farmers on on-farm demonstration trials and attendance of the farmers on field days affects the adoption of quality protein maize positively and significantly. Access to credit by household head affects the adoption negatively and significantly.

Samuel and Wondaferahu (2015) tried to identify factors that affects the adoption of soybean technologies. The model incorporated demographic, socio economic and institutional factors. The result showed that age of the household head, farm size, family size and distance to the market affected the adoption of soybean seed negatively and significantly, and education of the household head, training on soybean production and access to extension service affected the adoption positively and significantly.

Fitsum (2016) investigated factors that determines level of adoption of soybean. The result showed that household size, land holding, number of livestock owned by the household head, extension contact and age of the household head are the variables which were found to affect the level of adoption of soybean positively and significantly. The result of those empirical studies witnessed that adoption of improved agricultural technologies and improved agricultural practices is affected by different factors.

Southern, southwestern and western parts of Ethiopia have favorable climatic and soil conditions for soybean production which is essential both for commercial purposes as well as for subsistence farming (Center for development innovation, 2012). Despite its better adaptability, its production is very scant and limited among few smallholder farmers. The willingness and interest of production by the farmers of the study area is declining from year to year. Market problem, low productivity and production, lack of processing facilities, lack of capital to increase production and lack of market information system for effective agricultural marketing are the hindrances of soybean production (Bezabih, 2010).

The main objective of the study was to explore factors affecting adoption and degree of adoption of soybean in Ilu-Ababora zone of southwestern Ethiopia. The specific objective of the study was to analyze the bottlenecks related to adoption and production of the technology and to draw a policy recommendation that boosts its production and adoption at better level.

Material and Methods

Study Area Description

This study was conducted in Chawaka, Bedele and Darimu districts in Ilu-Ababora zone; southwestern Ethiopia. Chawaka district is located at a distance of 560 km from Addis Ababa, the capital of Ethiopia. It has 26 administrative peasant associations. The total land area of the district is 52,227 hectares. The district has climate alternates with long summer rain fall and winter dry season with mean annual rain fall of 900 mm. The altitude ranges between 1000-1800 meters above sea level. The minimum and maximum daily temperature of the district is 36°c and 41°c respectively (district's BANRD, 2015).

Darimu district is located 64 km away from Metu town and 664 km from Addis Ababa in western direction of the country. It is bordered on the south by Metu, on the west and north by the Kellem Wollega Zone and on the east by Supena Sodo. The total area of the district is 1389 square kilometers. The district lies at longitude $35^0$15' to $35^0$32' and latitude $8^0$30' to $8^0$44' north equator. The altitude of the area ranges from 792-1800 meters above sea level. The agro ecological zone of the district is sub-tropical (54%) and tropical (46%). The mean annual rainfall ranges from 1172-1740 mm and the mean annual temperature of the district ranges from 18-25^0c (district's BANRD, 2015).

Bedele district is located 480 km west of Addis Ababa at an altitude of 2060 meter above sea level. It is bordered on the south by Gechi, on the southwest by Chora, on the west by Dega and on the north by Chawaka districts. The mean annual rain fall of the area is about 1800 mm and the annual minimum and maximum temperatures are 14.5^{o}c and 30.4^{o}c respectively. The main farming system in the area is mixed farming and cattle are prominent in the area. Coffee is an important cash crop in the district; over 50 square kilometers are planted with the crop (district's BANRD, 2015).

Sampling Procedure

A multi stage sampling procedures were followed to select sample households. In the first stage, soybean potential districts were identified in collaboration with study zone technology extension experts, and pulse, oil and fiber crops research case team of Jimma agricultural research center. In the second stage, three peasant associations from each selected districts was randomly chosen. Finally, households were randomly selected using systematic random sampling technique.

Data Type and Collection

The data was cross-sectional which was collected from three districts in Ilu-Ababora zone; southwestern Ethiopia. Households were randomly selected from the list of farmers found on the peasant association's

booklet. The data was collected using structured questionnaire which was pretested.

Data Analysis

Data was analyzed using descriptive, inferential and econometric models. SPSS version 20 and STATA 12.1 was statistical software used for the analysis. Tobit model was used to identify factors affecting the degree of adoption of soybean. Fitsum (2016) used tobit model to investigate factors affected level of adoption of soybean. Tobit model is an extension of the probit model and was first developed by James Tobin. The tobit model is also known as a censored regression model or limited dependent variable regression models because of the restriction put on the values taken by the regressand (Gujarati, 2003). Statistically, we can express the tobit model as:

$Y_i = \beta_1 + \beta_2 X_i + \upsilon_i$ if right hand side >0

=0 other wise

Logit (logistic) was an econometric model used to analyze factors that affects the adoption of soybean. The use of the logit model for this analysis is consistent with the literature reviewed above on introduction (Idrisa *et al.,* (2010), Yishak and Punjabi (2011), Akudugu *et al.,* (2012), Gregory and Sewando (2013), Samuel and Wondaferahu (2015)).

Hill and Kau (1973) and Pindyck and Rubinfeld (1998) pointed out for the farmer to adopt or not to adopt a specific technology, a reaction threshold of different factors affect. As such, at a certain value of stimulus below the threshold, no adoption is observed while at the critical threshold value, a reaction is stimulated. This is modeled as:

$$Y_i = \beta X_i^* + \upsilon_i$$

Where Y_i is equal to one (1) when a choice is made to adopt and zero (0) otherwise and X^* represents the combined effects of the independent variables (X_i) at the threshold level.

The above binary choice model involves the estimation of the probability of adoption of a given technology (Y) as a function of independent variables (X). The probability of adoption and non-adoption is also modeled as:

$$prob(Y_i = 1) = F(\beta' X_i)$$

$$prob(Y_i = 0) = 1 - F(\beta' X_i)$$

Where Y_i is the observed response for the i^{th} observation of the response variable Y and X_i is a set of independent variables such as farm size among others, associated with the i^{th} individual, which determine the probability of adoption, (P). The function, F may take the form of a normal, logistic or probability function.

The empirical model for the logit model estimation is specified as:

$$z_i = \log\left(\frac{p_i}{1-p_i}\right) = \alpha + \beta' X_i + \varepsilon_i$$

Where X_i is the combined effects of X explanatory variables that promote or prevent farmers' decision to adopt modern agricultural production technologies.

$\log\left(\frac{p_i}{1-p_i}\right)$ is the log-odds in favor of farm households' decision to adopt modern agricultural technologies. Using soybean adoption as dependent variable, the model for our case, will be specified as

:

$$\log\left(\frac{p}{1-p}\right) = \alpha + \beta_1 DIST + \beta_2 HHAGE + \beta_3 HHED + \beta_4 FAMSZ + \beta_5 DMRK + \beta_6 DCOOP +$$

$$\beta_7 DEXT + \beta_8 FRMSZ + \beta_9 TRSOYPROD + \beta_{10} USESOYFOOD + \varepsilon$$

Table 1: Variables specified on the model and their hypothesized sign

Variable	Label and measurements	Expected sign	Logic behind
DIST	Districts: dummy of [1=Chawaka, 2= Bedele, 3 = Darimu]	+/-	Different adoption rate at different locations
HHAGE	Household age (in years)	+	The older the age, the more experience they have to produce and adopt
HHED	Household education: dummy of [1=non educated, 2 = read and write, 3= primary, 4=secondary and above]	+	Education can increase awareness and then adoption
FAMSZ	Family size in the household in numbers	+	The larger the family size, the more the labor they used to produce soybean
DMRK	Distance to market in km	-	The far the market, the less the likelihood to adopt
DCOOP	Distance to cooperatives in km	-	Soybean seed supply should not be far
DEXT	Distance to extension service station in km	-	Distance decreases contact frequency
FRMSZ	Farm size in hectares	+	Increase confidence of diversification
TRSOYPROD	Attendance on training of soybean production: dummy of [1=yes, 2=no]	+	Training improve knowledge and confidence to adopt the technology
USESOYFOOD	Use of soy food at home: dummy of [1=yes, 2=no]	+	Production would create consumption

Result and Discussion

Characteristics of Respondents

The result of this study showed that, Out of the total 185 respondents, 92% were male headed households and the remaining 8% were female headed households.

Socio demographic factors have several implications on the adoption of new agricultural technologies and practices. There was significant difference between adopters and non-adopters in terms of age, family size and number of years they lived in the area. Soybean adopters were younger (mean=34.75 years) and have a large family (mean=6.36 members) than non-adopter farmers who have mean age of 36.92 years and mean family size of 5.67 members. However, there was no statistically significant difference between adopters and non-adopters in farm experiences.

Table 2: Socio demographic characteristics

Description	Adopters		Non adopters		t	P Value
	Mean	S.D	Mean	S.D		
Age of the household head (years)	34.75	10.45	36.92	12.67	-1.901	0.067*
Family size of the head	6.36	1.83	5.67	2.13	2.030	0.043**
Household head farm experiences in years	21.30	11.21	20.03	12.48	0.616	0.539
Number of years the respondent has been living in this village	26.39	16.39	35.31	14.34	-3.340	0.001***

**** = statistically significant at 1%; ** = statistically significant at 5% ; * =statistically significant at 10%*

Institutional factors are also an important factor that influences the adoption process of technologies. The study result revealed that there was statistically significant difference between adopters and non-adopters in access to main market, cooperatives (input suppliers) and extension services. Adopters were more accessible and near to market, input supplying cooperatives and extension service provision stations than the no-adopter counterparts.

Table 3: Access of adopters and non-adopters to institutions

Description	Adopters		Non adopters		t	P Value
	Mean	S.D	Mean	S.D		
Distance to main market in km	4.40	4.18	8.28	5.99	-4.66	0.000***
Distance to extension service station in km	1.60	1.97	2.35	3.06	-1.84	0.067*
Distance to cooperatives in km	1.04	3.11	3.21	7.43	-1.78	0.082*
***** = statistically significant at 1%; * =statistically significant at 10%**						

Very few economic factors were considered on this study as these factors critically influence the adoption of new agricultural technologies. The survey result showed no significant difference between adopters and non-adopters regarding their land size, cultivated land size and number of separate grain storage.

Table 4: Economic characteristics of adopters and non-adopters

Description	Adopters		Non adopters		t	P Value
	Mean	S.D	Mean	S.D		
Total land owned in hectares	1.65	0.91	1.37	1.18	1.34	0.185
Total cultivated land in hectares	1.52	0.89	1.44	1.47	0.297	0.768
Number of separate grain storage	1.80	3.61	3.12	5.23	-1.49	1.42

The livestock holding of the study area showed that significant difference between adopters and non-adopters was seen on number of oxen, cows, heifer and bull. Adopters have more number of oxen, cows, heifer and bull than the non-adopter counter parts.

Table 5: Livestock holding of adopters and non-adopters

Description	Adopters		Non adopters		t	P Value
	Mean	S.D	Mean	S.D		
Oxen	1.27	1.22	0.46	0.78	4.98	0.000***
Cow	1.06	1.30	0.54	1.18	2.30	0.023**
Heifer	0.85	1.50	0.41	0.88	1.75	0.08*
Bull	0.51	1.18	0.10	0.38	3.55	0.000***
Calf	0.72	1.33	0.44	1.07	1.11	0.267
Sheep	0.59	1.71	0.72	1.53	-0.43	0.67
Goat	0.65	1.31	0.60	1.13	0.13	0.80
Donkey	0.33	0.71	0.64	2.44	-0.77	0.44
Mule	0.59	2.61	1.26	3.81	-1.03	0.31
**** = statistically significant at 1%; ** = statistically significant at 5% ; * =statistically significant at 10%*						

The education status of the household heads shows that 72% of them joined primary education and 19% are non-educated. Concomitantly, 5% have joined secondary school and only 4% of them read and write only.

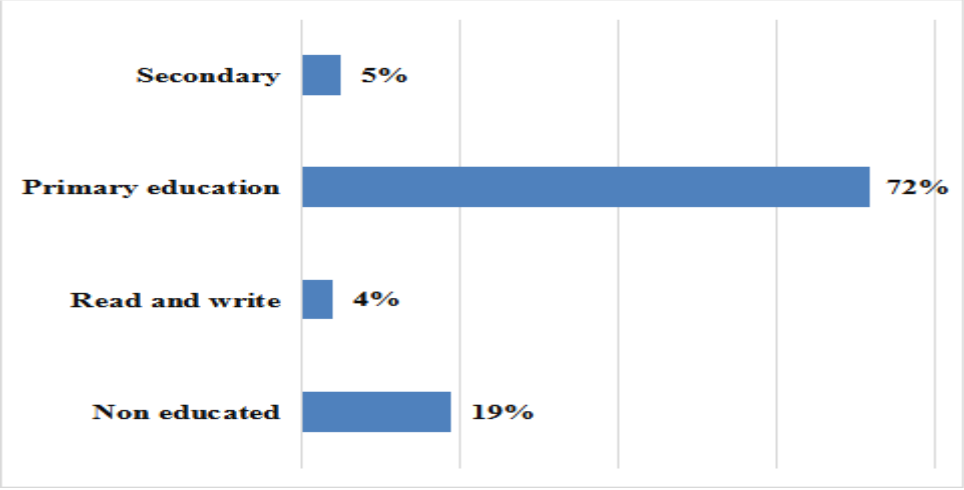


Figure 1: Education status of survey respondents

Soybean Adoption Rate

This study tried to explore the rate of adoption in different manner. The result shows that out of total respondents, 78.9% are adopters and 21.1% are non-adopters of soy bean technology. On the other hand, out of total adopters 94.5% are male headed and 5.5% of them are female headed adopters. Of the total male headed respondents, 81% are adopters and of the total female headed household respondents 53.5% were adopters of soybean seed. The chi square result showed that there was significant difference between male and female headed households in adoption of soybean seed at 5% significance level.

Table 6: Soybean adoption rate by sex of household heads

Gender	Adopters	Non adopters	Total	X^2	P Value
Male	138	32	170		
Female	8	7	15	6.423	0.011**
Total	146	39	185		

** = *statistically significant at 5%*

Soybean adoption rate by education status of the household head resulted that out of total non-educated respondents, 62.9% are adopters and of the total respondents who joined primary school, 82.8% are adopters. The chi square result shows that adoption status among education level was statistically significant at 10% significance level.

Table 7: Soybean adoption rate by education of the household heads

Education	Adopters	Non adopters	Total	X^2	P Value
Non educated	22	13	35		
Read and write	6	1	7		
Primary education	111	23	134		
Secondary	7	2	9	6.864	0.076*
Total	146	39	185		

* =*statistically significant at 10%*

The overall adoption rate of soybean on the study area was 78.9%. Out of total respondents of Chawaka district, 97% of them adopted production of soybean. Similarly, soybean adoption rate at Bedele and Darimu was 53.3% and 83.3% respectively. There was significant difference between soybean adoption rates among districts at 1% significance level.

Table 8: Soybean adoption rate by the study areas

Districts	Adopters	Non adopters	Total	X^2	P Value
Chawaka	68	2	70		
Bedele	32	28	60		
Darimu	46	9	55	38.31	0.000***
Total	146	39	185		

*** = *statistically significant at 1%*

Adopter respondents were asked the source of soybean seed to start soybean production and 48% of them responded that they bought the seed through the facilitation of district agricultural offices. Of the remaining 52% of the adopters, 12% accessed the seed from Jimma agricultural research center, 22% from early adopters or neighbor farmers and 18% from Non-Governmental Organizations.

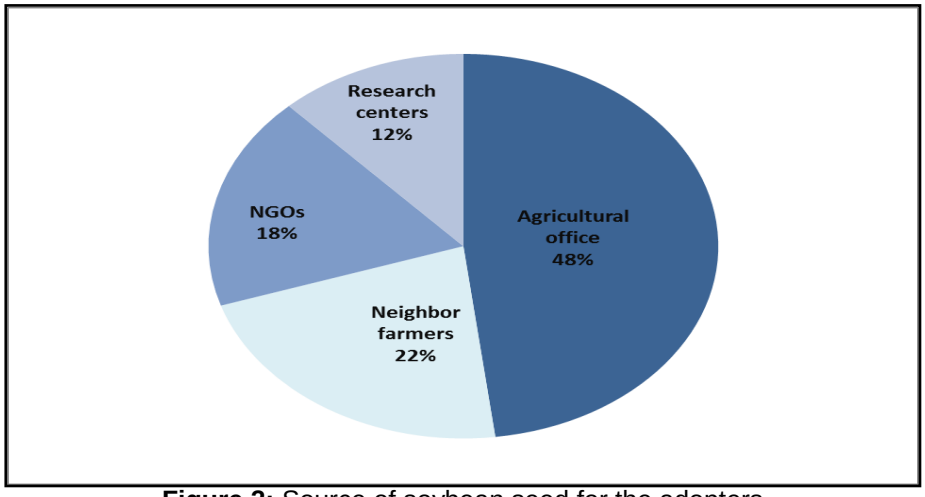
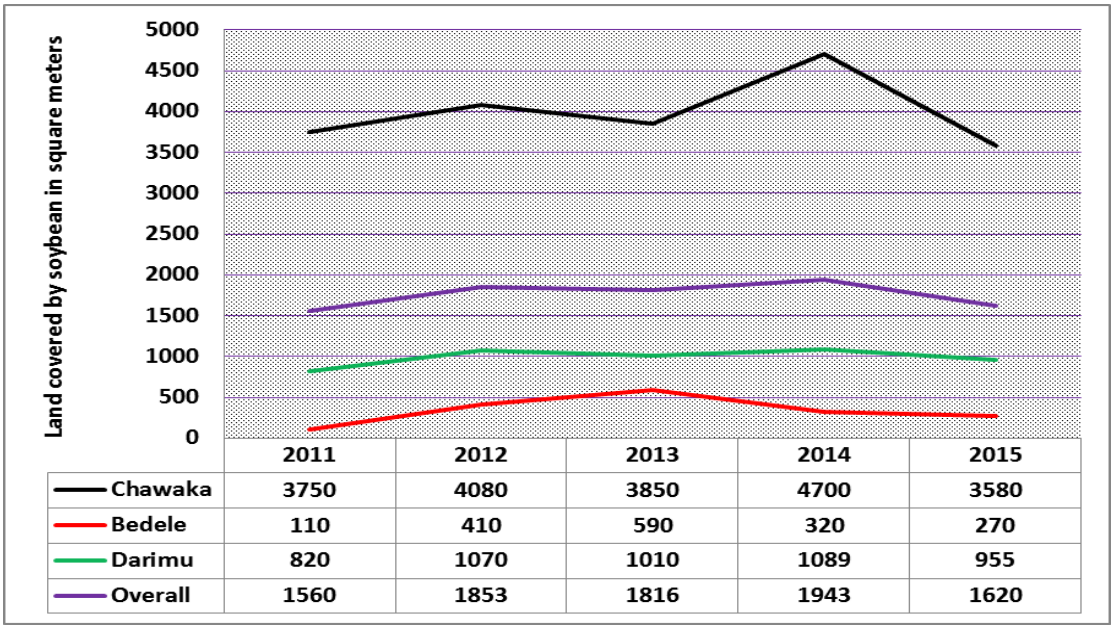


Figure 2: Source of soybean seed for the adopters

Soybean Production Trends and Problems

Soybean production is trending in diminishing order on all districts. Chawaka farmers used to produce soybean on larger land and for commercial purpose and the least was Bedele where very small piece of land was allotted to soybean.



	2011	2012	2013	2014	2015
Chawaka	3750	4080	3850	4700	3580
Bedele	110	410	590	320	270
Darimu	820	1070	1010	1089	955
Overall	1560	1853	1816	1943	1620

Figure 3: Trends of soybean production in the study area in square meters

Adopters produced soybean for different benefits on the study area. They were asked the reason for the production and adoption of soybean on their peace of land. The survey result showed that 54% of them adopted the technology to generate income and for nutrition, and 18% of adopters used soybean as an income generating, nutrition and to rehabilitate the fertility of their land. The rest 28% of them produced soybean solely for nutrition, for income and for soil fertility.

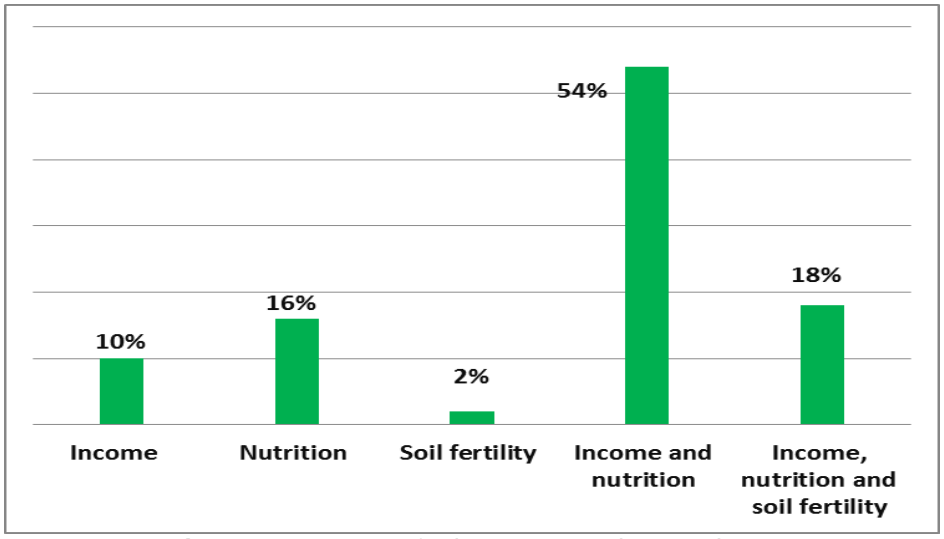


Figure 4: Reasons of adopters to produce soybean

Soybean farmers (adopters) were also asked the future plan regarding production of soybean. Out of the total adopters, 54% of them responded they are reducing land covered by soybean from year to year and 38% of them are increasing soybean land coverage (figure 5). This finding is consistent with what was seen on the descriptive result which witnessed the diminishing trend of soybean production in terms of land coverage (figure 3).

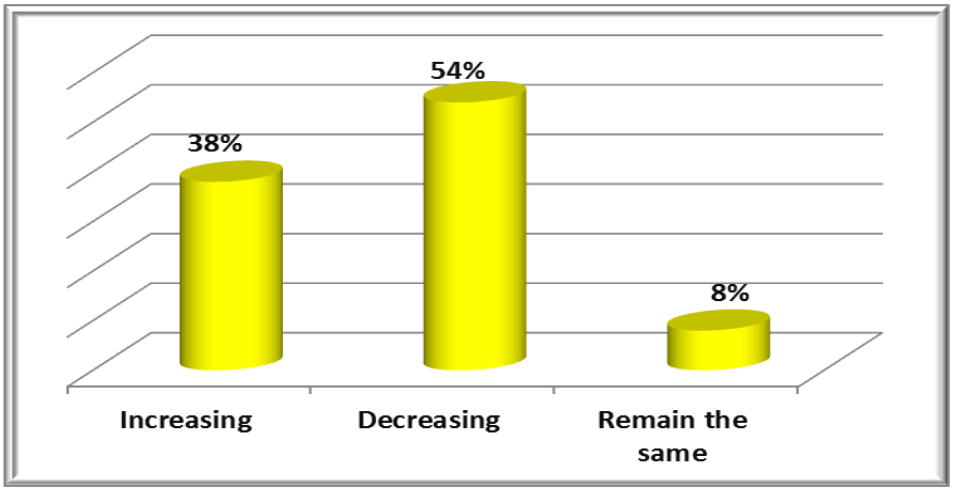


Figure 5: Future plan of soybean producer

Market situation is the main reason which drove farmers to reduce soybean production (63%). The price of soybean is reducing yearly because no nearby small industries that demand soybean as raw material. High transportation cost and low local consumption of soy foods were other reasons for low market price of soybean. On the other hand, disease and pests, year to year yield reduction and labour demanding feature of the technology were other reasons for the reduction of soybean land coverage raised by the farmers (figure 6).

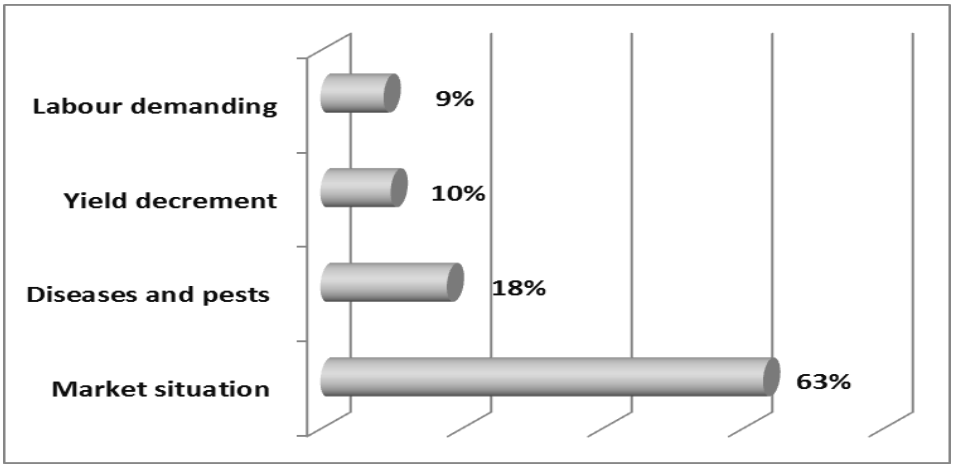


Figure 6: Reason for the reduction of soybean production on the study area

Adopters were also asked the purpose of production of soybean. The result showed that only 2% of adopters produce soybean for commercial purpose and 21% of them for home consumption merely. The dominating 77% of respondents produce soybean both for consumption and commercial purposes.

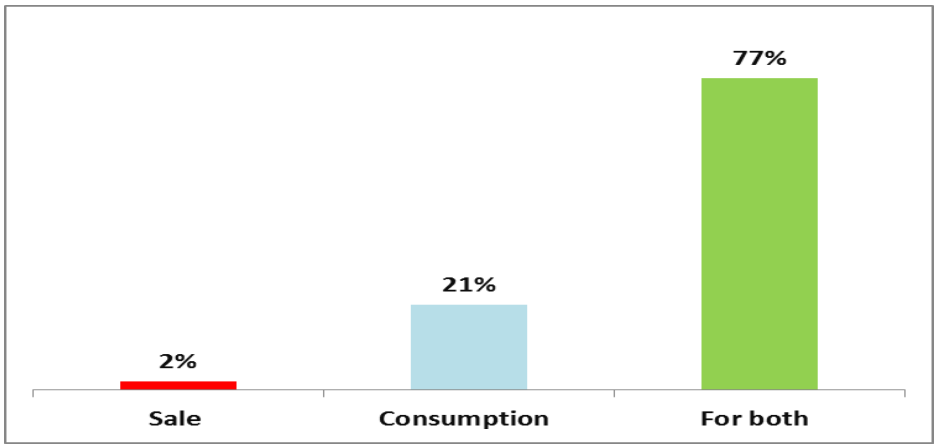


Figure 7: Reason for the production of soybean on the study area

Despite its dominance and contribution, agriculture is a sector with high risk, uncertainty and a lot of challenges. The survey tried to identify major problems that challenged soybean production in the study areas. About 57% of respondents were constrained by lack of reasonable price which was mainly caused by lack of demand for the product. Moreover, disease and pests, and lack of improved variety were other important challenges for soybean production. Constraints of soybean production in the study area are showed according to its importance on figure 8.

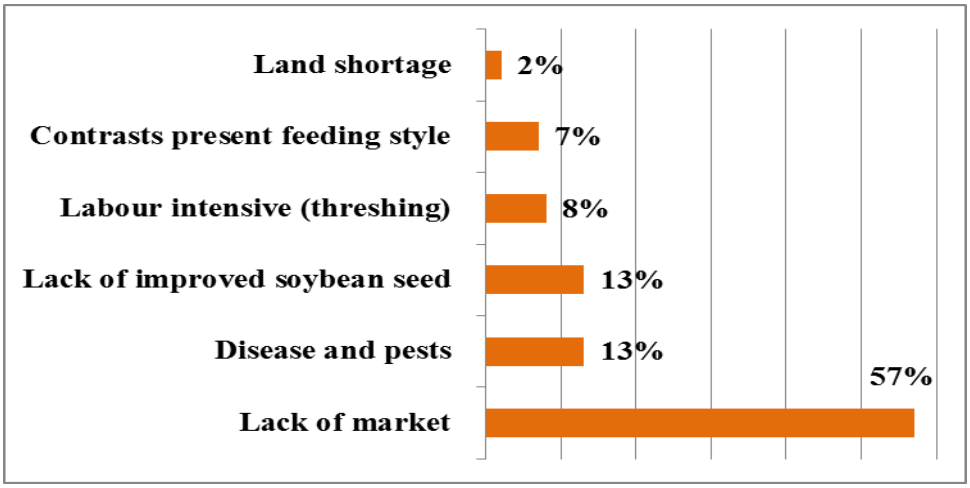


Figure 8: Soybean production problems of the study area

Training is the most important tool to boost the demand and adoption of agricultural technologies. Training on soybean production was given to farmers at different time. The survey result showed that 52% of respondents were provided training on soybean production. Different bodies participated on providing training for the respondents of the study area. About 78% of the trainees responded that agricultural office gave them training. NGOs, Jimma agricultural research center and neighbor farmers provided training for 10%, 9% and 3% of respondents respectively.

Determinants of Soybean Adoption

Identifying factors that affect adoption of agricultural technology is the main tools for policy makers to use it as a prerequisite for policy analysis. Extension system and researchers should consider mechanisms through which technology is disseminated and diffused to wider community by considering the hindrances. Logistic regression model was implemented to analyze those factors that affect adoption of soybean on the study area. The model used four categorical variables and six continuous variables. Out of the parameters used, five were statistically significant at 1%, 5% and 10% significance levels (Table 9).

Table 9: Factors affecting the adoption of soybean

Variables		B	S.E	P value
DIST	Chawaka	1.105	1.084	0.08*
	Bedele	-2.412	0.812	0.003***
HHAGE		-0.061	0.034	0.071*
HHED	Non educated	-2.275	1.421	0.109
	Read and write	0.126	2.508	0.960
	Primary education	-0.648	1.224	0.597
FMSZ		0.132	0.147	0.371
DMRK		-0.068	0.076	0.037**
DCOOP		0.071	0.120	0.551
DEXT		0.026	0.110	0.817
FRMSZ		-0.191	0.249	0.443
TRSOYPROD		3.448	1.137	0.002***
USESOYFOOD		2.665	1.191	0.025**
Constant		-3.955	8.211	0.630

-2log likelihood = 91.806
Nagelkerke R Square = 0.643
**** = statistically significant at 1%; ** = statistically significant at 5% ; * =statistically significant at 10%*

DIST [Districts]

District is the dummy of the study locations which have different signs on the model. Chawaka district farmers adopted the soybean technology positively and significantly. The result is consistent with the finding on the descriptive statistics which witnessed 97% of respondents of the district adopted the technology. However, little number of farmers of Bedele district adopted soybean described by negative sign on the model which is also consistent with the descriptive result.

HHAGE [Household head age]

Age of the household head measured in number of years have negative and significant impact on the adoption of soybean. The result is consistent with the finding on inferential result and contrasts the hypothesized sign. The reason could be due to risk adverse behavior of aged household heads. The finding corroborates with Akudugu *et al.,* (2012), and Samuel and Wondaferahu (2015) who showed negative and significant relation between age of the household head and adoption.

DMRK [Distance to market]

Distance to the market is measured in kilometers and the result of the model revealed that it is negatively and significantly related to adoption of soybean. It is consistent with the hypothesized sign and inferential result. Samuel and Wondaferahu (2015), and Yishak and Punjabi (2011) also found negative and significant relation between adoption and distance to market.

TRSOYPROD [Attendance on training of soybean production]

Attending training on soybean production has positive and significant impact on the adoption of soybean technology. The result corroborates with the hypothesized sign. It is also consistent with Yishak and Punjabi's (2011) finding who found that attendance on demonstration positively and significantly affects adoption. Gregory and Sewando (2013) also revealed positive and significant relation between attendance of farmers on field days and adoption. Samuel and Wondaferahu (2015) also found positive and significant relation between training on soybean production and adoption.

USESOYFOOD [Use of soy food at home]

Consumption of soy food at home has positive and significant impact on the adoption of soybean technology. The result is consistent with the hypothesized sign and with the finding of Idrisa *et al.,* (2010) who found that consumption of soy food at home affects the likelihood of adoption of soybean seed positively and significantly.

This study also identified factors related to level or degree of adoption of soybean using Tobit model. The model used eleven independent variables where five are categorical and six are continuous variables. The result revealed that household sex, farm size, distances to cooperatives, attendance on the training of soybean production and use of soy food at home affects the degree of adoption of soybean significantly (Table 10).

Table 10: Determinants of degree of adoption of soybean on the study area

Number of obs = 185
LR chi^2 (14) = 117.9
Prob > chi^2 = 0.000
Log likelihood = -48.086853 Pseudo R^2 = 0.5507

Variables		Coefficient	S.E	P value	dy/dx
District	[Chawaka]	0.248	0.079	0.002***	0.138***
	[Bedele]	-0.251	0.065	0.000***	-0.139***
Household sex [Male]		0.277	0.129	0.033**	0.154**
Household age		-0.003	0.003	0.186	-0.002
Education	[Non educated]	0.023	0.122	0.850	0.013
	[Read and write]	0.079	0.144	0.584	0.044
	[Primary education]	0.082	0.109	0.454	0.045
Household family size		0.011	0.014	0.418	0.006
Farm size		0.068	0.025	0.008***	0.038***
Distance to main market		-0.001	0.008	0.876	-0.0006
Distance to cooperatives		-0.022	0.012	0.071*	-0.012*
Distance to extension service		-0.009	0.011	0.401	-0.005
Training on soybean production [Yes]		0.122	0.054	0.026**	0.068**
Use of soy food at home [Yes]		-0.126	0.075	0.095*	-0.07*
Constant		-0.271	0.637	0.671	
/Sigma		0.261	0.019		

**** = statistically significant at 1%; ** = statistically significant at 5% ; * =statistically significant at 10%*

The result on table 10 shows that Chawaka district farmers allocated relatively large land for soybean production (coefficient=0.248). On other hands, Bedele district farmers produce soybean on small plots of land (coefficient= -0.251). The logical reason behind this is that Bedele district farmer's uses coffee as a cash crop and uses soybean to rehabilitate their land and just for consumption. However, Chawaka district farmers are settlers and considers soybean as one of the most important cash crop. The result is consistent with the descriptive result. Another significant variable was sex of the household head (coefficient=0.277). The marginal effect of the variable was also significant at 5% significance level. This means that male headed households allotted more land for the soybean as compared to the female counterparts. Labour intensive feature of soybean drove female headed households away from allocating more land for soybean.

Distance to cooperatives has negative and significant impact on the proportion of land allocated to soybean and the marginal effect of the variable was also significant. The logic behind this could be cooperatives are input suppliers and they also purchase the produce from farmers at fair price. Thus, the proximity of cooperatives encourages farmers to produce more.

Farm size has also positive and significant impact on proportion of land allotted to soybean. The coefficient of the marginal effect (0.012) was also significant and interpreted as a one hectare in farm size increases the land allotted to soybean by 0.012 hectares which corroborates with the finding of Fitsum (2016). Attendance on training of soybean production also has positive and significant impact on the proportion of land allocated to soybean production. The coefficient on the marginal effect was 0.068 which was also significant. This implies that a single training on soybean production increases the land allocated to soybean by 0.068 hectares. Consumption of soy food at home, surprisingly, had negative and significant impact on the proportion of land allocated to soybean production. The reason might be that those farmers who produce more soybeans on relatively large plots of land commercialize the produce rather than use it for subsistence and home consumption. This could be faced due to lack of awareness for the nutritional potential of the commodity.

Conclusions and Recommendation

This study was aimed to identify factors that hinders and promotes the adoption of soybean technologies among smallholder farmers in Ilu-Ababora zone of southwestern Ethiopia. The result of this study revealed that the overall adoption rate of soybean on the study area was 78.9% which was very high. However, descriptive result of this study showed that the per capita soybean production is decreasing at increasing rate due to different factors. The most important problem seen on this regard was problems on soybean market. The reason behind this is lack of industries on the study area which uses soybean as a raw material and poor tie of soybean traders and industries. On other hands, poor consumption of soybean at home among local community led to poor demand and then caused poor marketing of soybean. This decrease in market demand for the product led to erode farmers' willingness for soybean production. Therefore, soybean processing small and medium factories which produce feed for poultry farms, food oil, soybean recipe and food fortifiers using soybean as a raw material should be encouraged and incentivized so as to increase the demand for the produce. Concomitantly, the government should smooth up the linkage and integration of soybean supply and value chain actors.

Disease was another bottleneck for the production and adoption of soybean. Thus, researchers should undertake studies to develop disease resistant varieties and improved agronomic practices. Econometric result also revealed that training on soybean production and use of soybean at home has boosted the adoption of the technology. Thus, concerning bodies should consider

formal and non-formal information dissemination mechanisms such as training, field days and demonstration on soybean production and soy food preparation for wider adoption, production and consumption. This indirectly combats malnutrition and improves fertility soil.

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