

Determinants of Adoption of Improved Wheat Varieties by Smallholder Farmers: - In Case of Angacha Woreda, Kembata Tembaro Zone, SNNPR

Abera Abebe*

Department of Agricultural Economics, Wolaita Sodo University, Ethiopia

***Corresponding Author:** Abera Abebe, Department of Agricultural Economics, Wolaita Sodo University, Ethiopia.

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Abstract

Adoption of improved technologies is one of the most promising ways to reduce food insecurity in Ethiopia. However, adoptions of these technologies are constrained by various factors. This study examined the main determinants of farmer adoption decision of improved wheat varieties and its intensity using 120 sample households (106 male and 14 female) selected from 6 kebeles in Angacha Woreda, Kembata Tembaro zone. In this area, wheat is an important crop, which serves as a source of both food and cash. Qualitative data were collected using group discussion and field observation. The results of descriptive analysis indicated that among 12 identified explanatory variables 7 of them significantly determined adoption of improved wheat varieties; such as farming experience, household head age, and cultivated land size, number of oxen and livestock, input delivery institutions (market distance) and extension contact. The results of the econometric model indicated that the relative influence of different variables on probability and intensity of adoption of improved wheat varieties. Cultivated land size of the household, extension contact, farming experience of the household, was affected adoption positively: whereas market distance and age of the household head, negatively influenced adoption and intensity of adoption of improved wheat varieties. Farmers' evaluation and selection criteria of improved wheat varieties in the study area in order of importance were high yielding, market demand, time of maturity, grain color, grain size, disease resistance and storability. The overall finding of the study underlined the high importance of institutional support in the areas of extension contact service to insist farmer-to-farmer knowledge sharing and market to enhance adoption of improved wheat varieties. There is also need to consider road construction; new weather roads and improving the existing one which connect kebele to kebele.

Keywords: Adoption, Wheat, Improved Varieties, Intensity

Introduction

Background of the Study

Agriculture is a core driver of Ethiopia's economy, supporting 85 percent of the population's livelihoods, and accounting for 46 percent of gross domestic product, and 80 percent of export value [1]. Increasing agricultural production at the household level is vital to achieve food security [2]. As one of the approaches to ensure households food security, the Ethiopian rural development policy and strategy document has given weight to follow diversification and specializations in production systems along with improved access and use of agricultural technologies [3]. The improved wheat varieties (together with improved agronomic practices) have been introduced and disseminated to wheat farming communities in different parts of the country through the extension system operated by the government [4].

Wheat is used for the manufacture of flour for different purposes; such as Bread, Biscuits, Enjera and Pasta are some of the manufacturing products. The straw wheat crop is good source for animal feed and is also used for hatching roofs for house for rural and urban people. There are different stakeholders participating in the regional improved wheat varieties or seed system for implementation of farmer. The adoption and intensity of use of improved wheat varieties are not yet assessed in the study area. In order to solve the less production and productivities of the wheat crop, continual identification of the best and the most suitable to adopt improved wheat varieties appeared to be used as essential. Therefore, this study is initiated in identifying determinates of the adoption of the high yielding varieties with particular reference to wheat crop in Angacha woreda of the southern nation's nationalities and peoples regional.

Statement of the Problem

Majority of Ethiopia's farmers have been using traditional way of agricultural practices. This has contributed for low productivity of the agricultural sector. To solve these problems, governmental and non-governmental bodies have made restless efforts to bring about change in agricultural production system of farmers. They have introduced improved agricultural technologies like use of fertilizers, high yielding varieties of seeds, improved farm implements, etc. in relation to crops which seem better in yield. This indicates that there are different factors directly or indirectly influencing the adoption of technologies that are believed to bring change in farmers' productivity [5].

Wheat is a staple food crop for most households in rural and urban areas. However, wheat yield is low and unstable due to several technical and socio-economic constraints. Limited supply of seeds of improved varieties, low level technology adoption; high price and unavailability of augmenting technologies and inadequate cash or credit for purchase of inputs are the major socio-economic constraints [6].

There are two sources of seed in the SNNPR to renew the seed stock. The formal one, which is dominantly, supplied by Ethiopian Seed Enterprise for cereals and different types crop seeds. The informal seed sources that include a seed retained by the farmers from current harvest and obtained through farmers-to-farmers exchange. In the study area, for more than ten years they have prompted the new wheat varieties; but farmers did not adopt the improved wheat

varieties at full package of practices suggested by the research organization. Their intensity of adoption as well as the adoption of the new wheat varieties among farmers is not known in the study area. This study is designed to examining the adoption situations of the high yielding crop varieties as well as identifying the major factors influencing the adoption of improved wheat varieties in Angacha woreda, KT Zone of the Southern Nation, Nationalities and Peoples' Regional State (SNNPR).

Objectives of the Study

The general objective of this study was to identify determinates of adoption of improved wheat varieties by smallholder farmers in Angacha woreda.

The specific objectives of the study are:

- to identify factors affecting adoption of improved wheat varieties among farmers in the study area;
- to identify factors affecting intensity of adoption of improved wheat varieties in the study area

Research Methodology

Research Design

Descriptive survey and both qualitative and quantitative techniques for data collection were employed.

Description of the Study Area

The Kembata Tembaro (KT) zone is one of the zones in SNNPR. The zone covers a total area of 1523.6 sq. km. and for administrative purpose it is divided 7 woredas. Durame, Administrative center of Kembata Tambaro Zone is located at a distance of about 350 km away from Addis Ababa. Angacha Woreda is found in Kembata Tembaro Zone with a distance of 157 km from south of Hawassa, capital city of the region.

Sampling Technique and Sample Size

A sampling procedure was used to select farmers for the survey. The survey has focused on farmers from one woreda (Angacha woreda) in Kembeta Tambaro Zone; where wheat is one of the major crops grown. Angacha woreda have 17 *kebeles*. From 17 *kebeles* 6 *kebeles* were selected based on wheat production potential and accessibility. The sample size for this research was determined using the formula, as indicated in (Bartlett and Higgins, 2001). This study uses the following formula to calculate sample size:

$$n = \frac{N}{1+N(e)^2} \quad \text{Where,}$$

n= Designates the sample size.

N= Designates the total number of households in six *kebeles* = 3,722.

e= 0.09 was taken as margin error.

$$n = \frac{3722}{1+3722(0.09)^2} = \frac{3722}{31.15} = \underline{120}$$

Tools of Data Collection

Both primary and secondary data sources were employed. to collect primary data a pre-tested and semi-structured schedule or questionnaire were designed to collect data and secondary data tools such as published and unpublished materials was used.

Data Analysis Methods

Descriptive analysis

Descriptive statistics such as means, and percent, were used to characterize the agricultural system of the study area. The comparison of different characteristics of farm households was employed t-test and χ^2 -test. Descriptive analysis is used to explain the different socio-economic characteristics of the sample households.

Econometric Model

The econometric model employed to analyze the data on farmers' participation in wheat varieties adoption. There is broad class of model that has both discrete and continuous parts. One important model in this category is Tobit. Tobit is an extension of the probit model and it is really one approach to dealing with the problem of censored data. Some authors call such model limited dependent variable model because of the restriction put on the value taken by regressed [7].

Data Analysis and Interpretation

Descriptive Results

This study was intended to identify factors affecting adoption of improved wheat varieties in the study area Angacha woreda as well as to know the effect of hypothesized independent variables on the dependent variables. In this section of analyses descriptive statistics such as mean standard deviation, percentage, t-test and chi-square test will be employed.

Socio-demographics characteristics of Sample households

Table 1: Experience and extension contact of the sample households heads

No	Variable	Adopter		Non adopter		χ^2	Total	
		No	%	No	%		No	%
1.	Experience					43.04***		
	<5 years	9	11.25	21	52.5		30	25.0
	5-10 years	27	33.75	13	32.5		40	33.3
	>10 years	44	55.0	6	15.0		50	41.7
2	Extension contact					18.13***		
	Once a week	11	13.75	9	22.5		20	16.7
	Twice per week	46	57.5	6	15.0		52	43.3
	Every three week	18	22.5	18	45.0		36	30.0
	Once a month	5	6.25	7	17.5		12	10.0

*** Significant at 1 percent.

Source: - Own survey

Table 2: Age, family size, livestock, cultivated land size; oxen owned and market distance of the sample households

No	Variable	Adopter		Non adopter		t-value	Total	
		No	Mean	No	mean		No	mean
1	Age (year)	80	41	40	43	-3.80**	120	41
	S.D		2.80		2.60			2.78
2	Family size (no)	80	7	40	6	1.30	120	7
	S.D		.99		.63			0.89
3	Livestock(Tlu)	80	5.1	40	4.6	7.13*	120	4.8
	S.D		.96		.31			0.89
4	Cultivated land (ha)	80	1.65	40	1.38	5.85***	120	1.50
	S.D		.178		.092			0.17
5	Oxen owned (no)	80	1.8	40	1.0	5.60*	120	1.5
	S.D		.80		.31			0.796
6	Market distance (km)	80	2.4	40	3.0	-5.97***	120	2.66
	S.D		.55		.49			0.6

***, **, *, represents 1%, 5% and 10% level of significance Source: Own survey

Table3: Education of the household head, access to credit, availability of fertilizers and off-farm income of the sample households.

No	Variable	Adopter		Non adopter		X ² -value	Total	
		No	%	No	%		No	%
1	Access to credit					0.831		
	Yes	37	46.25	15	37.5		52	43.3
	No	43	53.75	25	62.5		68	56.7
2	Fertilize on time					2.31		
	Yes	77	96.25	36	90		113	94.2
	No	3	3.75	4	10		7	5.8
3	Off-income					0.018		
	Yes	49	61.25	27	67.5		76	63.3
	No	31	38.75	13	32.5		44	36.7
4	Education					3.6		
	Illiterates	18	22.5	10	25		28	23.3
	Literate	62	77.5	30	75		92	76.7

Source: Own survey

Results of the Econometric Model

Identification of these factors alone is however not enough unless the relative influence of each factor is known for priority based intervention. In this section, tobit econometric model was

used to see the relative influence of different variables on adoption and intensity of adoption of improved wheat varieties.

Estimates of the parameters of the variables expected to determine the adoption and intensity of adoption of improved wheat varieties in Table 4. Once, the analytical procedure of the study is known, identifying potential explanatory variables become necessary. The variables hypothesized to influence improved wheat varieties has been analyzed using the censored regression model of the tobit analysis, explained below.

Factors influencing adoption

Among the variables included in the analysis, indicated in table 4 showed that farm and farmer specific variables such as, farming experience and market distance from the inputs and output market are highly significant (at less than 1% significance level) in influencing the probability of adoption and intensity of use of improved wheat varieties.

The results indicated in table 4 showed that there was a positive relationship between cultivated land size and adoption and intensity of use of improved wheat varieties. As the tobit model indicates cultivated land size positive and significant influence on the adoption of improved wheat varieties at 10% significance level. This shows that large cultivated land size have better access to adoption of improved wheat varieties and are more likely to adopt improved wheat varieties than small cultivated land size and also increase their wheat production. Small cultivated land size have not better access to on improved wheat varieties and are not more likely to adopt wheat varieties than large cultivated land size.

The results in table 4 showed that frequency of extension service by extension agent to farmers was positively related to improved wheat varieties and statistically significant at 10% probability level in the study area. This is the number of cycle per period of time a farmer contacts an extension agent for technical guidance. The higher the linkage between farmers and development agents, the more the information flow and the technological (knowledge) transfer from the latter to the former. Those farmers with frequent contact with extension workers are likely to have up-to-date information on production technologies that would help them to better adaptation and usage of new technology.

As the tobit model indicates as table 4, age of the household has negatively related to the adoption of improved wheat varieties at 5% significance level. The farmers' age on adoption and intensity of use of improved wheat varieties can decrease confidence in new technology. The negative sign shows that as the age of the household increase, the probability of the household to adopt improved wheat varieties will decrease.

Farming experience significantly affected the probability of adoption and intensity of use of adoption of improved wheat varieties at 1% significance level as indicated in table 4. This implies that farmers who have longer years of experience in wheat crop production or farming have adopted improved wheat varieties than those who have the lower years of experience in wheat crop production. This may be due to relatively farmers who have longer years of

experience may develop the confidence in handling the risk lovers, skills in technology application. Many studies supported this argument. Hence it was hypothesized to affect adoption positively. Market distance has negative and significantly affected by at 1% significance level on the adoption of improved wheat varieties as indicated in table 4. Market access result indicated that as market distance decrease, adoption by among the household increase. This indicates that farmers nearer to the input and output markets have more access to input, technology and output market and also getting information about improved technology than those who are in distant areas and can make early decision of adoption.

Table4: Maximum-Likelihood estimates of the tobit model

Variable	β	Standard error	t-ratio
Constant	0.9085	0.7918	1.15
Cultivated land	0.0415*	0.0213	1.95
Family size	0 .0407	0.0416	0.98
Access to credit	0.0083	0.0717	0.12
Education	0 .0017	0.0289	0.06
TLU	0 .0599	0.0468	1.28
Number of oxen	0.0501	0.0545	0.92
Extension contact	0.0385*	0.0192	2.01
Age of house hold	-0.0328**	0.0131	2.51
Farming experience	0.3758***	0.0634	5.93
Market distance	-0.5003***	0.0906	5.52
Off- income	-0.0602	0.0774	0.78
Availability of fertilizers.	0.1472	0.2184	0.67
Sigma	0.3467	0.0296	
***, **, * represents 1%, 5% and 10% level of significance Source: model output Log likelihood = -52.41578 Number of obs = 120 Prob = 0.0000 Pseudo R ² = 0.5233 40 left-censored observations at proportional area utilized for improved wheat varieties 80 uncensored observations 0 right-censored observation			

Effects of changes in explanatory variables

All variables that were found to influence the adoption and intensity of use of improved wheat varieties might not have similar contribution in influencing the decision of farm household. Changes in farming experience, cultivated land size, and extension contact positively influenced the probability of adoption and intensity of use of improved wheat varieties. On the other hand,

marginal changes in market distance and age of the household are negatively influenced the adoption and use intensity of improved wheat varieties.

Table 5: Changes in probability of adoption and intensity of use due to changes in explanatory variables

no	Variables	Change in the probability of adoption*	Change in the intensity of use*	Total change
1	CULS	0.0373	0.0415	0.0788
2	EXCON	0.0289	0.0385	0.1214
3	AGHH	-0.0295	-0.0328	-0.0628
4	EXPR	0.3374	0.3758	0.7132
5	MKDIS	-0.4490	-0.5001	-0.9491

*Computed using mean values Source: Based on model output

The results computed indicate that if farming experience increased by one percent adoption and intensity of use of improved wheat varieties would increase by about 0.337% of which 0.375% is attributed to the increase in the intensity of use of improved wheat varieties by those farmers already adopted new wheat varieties. One percent increases in age of the household decreases the probability of adoption and intensity of use of improved wheat varieties by about 0.029% and 0.032%, respectively. A marginal change in extension contact increases of the probability of adoption and intensity of use of improved wheat varieties by about 0.028% and 0.038%, respectively. A one percent increase in the distance from input and output market center to reduce the probability of adoption and intensity of use of improved wheat varieties by about 0.449% and 0.500%, respectively. The estimated increase in the probability of adoption and intensity of use of improved wheat varieties resulting from a one percent change in the cultivated land size owned is 0.037% and 0.041%, respectively as indicated in table 5.

Conclusions and Recommendation

Conclusions

This study has identified key factors that influence adoption process in the study area. This insight is also useful to rethink about the barriers of adoption of new technologies such as improved wheat varieties. Therefore, the result can be used by policy makers to promote technological change that is direly needed for the economic development of the country.

Wheat contribution to households' nutrition, income and food security is very high. It also provides job opportunities for youth and the landless poor and for merchants and poor urban dwellers who are engaged in its processing activities. Regardless of its contribution, 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 research and extension was not to the expected level. These factors together with several household personal, demographic and socio-economic factors greatly affected the adoption of improved wheat 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 wheat varieties so as to enhance its production and productivity [8-12].

Recommendation

One of the major bottle necks to the adoption of improved wheat seed varieties in the study area is market distance problem. Distance from market centre obviously increases transportation and other transaction costs related to the sale of farm output and acquisition of critical inputs that would reduce farmer's incentives to engage in agricultural production activities using improved technologies. The Distance of nearest marketing centre from farmers' house has a negative and significant impact on the household adoption of improved wheat varieties. Therefore, the construction of new all weather roads and improving the existing one which connect *kebele* to *kebele* and even *kebele* to district's town in the locality should be given proper attention by the regional Road Construction Authority to increase the household adoption statues.

Extension contact was found to have a positive relationship with the adoption and intensity of use of improved wheat seed varieties. Suitable strategies for better extension service are another important issue that should get proper attention. Agricultural information and extension communication are powerful and crucial to achieve better adoption and intensity of adoption of improved agricultural innovations like improved wheat varieties in this case. Appropriate and timely information should reach to the intended farmers group to achieve better adoption and intensity of adoption of improved agricultural technologies In the study area as observed and the survey data showed, the extension service is at lower and weak position due to various reasons such as low motivation, and poor credit service low educational background of extension workers This indicates that extension contact would be widening by establishing additional development centers and increasing the number of extension workers and addition to salary give other incentives for DA workers.

Ethiopia's food insecurity problem that were caused mainly by rapid population growth and low productivity could be solved only through high investment in agriculture technology and expansion of modern improved seed which could exploit the maximum yield on existing cultivated land. The possibility of expanding cultivable land is almost exhausted. Hence, the cultivated land size on the farmer's adoption decision is significant; there is a need to minimize constraints that hinder farmers from adopting the improved wheat varieties. These include developing the awareness about the agricultural technology to farmers and providing appropriate training to farmers.

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