Adoption of Improved Chickpea Production Package in East Shoa, Ethiopia

Almaz Giziew[1], Ranjan S. Karippai[2], and Teklu Tesfaye[3]

Abstract

Chickpea is one of the major pulse crops grown in Ethiopia. It plays an important role in improving household income, nutrition and food security. Despite its high production potential in Eastern Shoa in general and the study districts in particular, chickpea growers did not benefit from chickpea production. Low production, which is mainly associated with non-adoption and unwillingness of farmers to adopt the recommended chickpea production package were among the major problems. The objective of this study was to identify factors influencing adoption and intensity of adoption of chickpea technology package in Ada'a and Akaki districts. Results of the econometric (Tobit) model indicated that sex of household head, land holding, social participation, attitude towards chickpea technology package and innovation proneness were found to have positive and significant influence on adoption and intensity of adoption of improved chickpea production package. On the other hand, experience in chickpea cultivation had shown negative and significant relationship with adoption and intensity of adoption of improved chickpea production package. Female-headed households could not adopt chickpea technology. This might be due to lack of access to information sources. Accordingly, opportunities for equal access for women farmers should be provided through provision of empowerment intervention.

Introduction

The major chickpea production areas in Ethiopia include the central high lands of southwest, west and east Shewa zones, and south and north Wollo zones. East Shewa zone is located in Oromiya Regional State where the study area (Akaki and Ada'a districts) of this research activity is located. However, the production and productivity level is low as compared to the potential yield level for Akaki and Ada'a districts. The productivity level of chickpea in the case of the two districts (study areas) is below its potential, which is 4.7 tons/ha (ARDO, 2006\7).

[1] Lecturer, Dept of Rural Development, Bahir Dar University

[2] Professor, Dept of Rural Development & Agricultural Extension, Haramaya University

[3] Scientist, Ethiopian Institute of Agricultural Research, Ethiopia

Some of the contributing factors to the low productivity level are low yield potential of seed cultivars, low quality of seeds, susceptibility of seeds to biotic and abiotic stress, and the farmers' unwillingness to adopt the recommended package and traditional farming practices (Asnake *et al.*, 2005). Farmers in some districts of East Shewa in general and the study districts in particular are among those who are suffering from the problem of low yield.

In order to increase productivity and production, the research centers in the country have released and recommended many improved chickpea technology package components (varieties, seed rate, sowing date and chemicals). The released varieties are: DZ10-4, DZ1-11, Dubie, Mariye, Worku, Akaki, Arerti, Shasho, Habru, Chefe, Ejerie, Tigie, Mastewal, Fetenech, Kutaye, and Yelbey. Besides the technology generation, efforts were also made to promote these technologies in potential areas. Ada'a and Akaki districts are among the areas where the improved chickpea technology package was introduced to improve the food security status and income of farmers. This has been done through farmers' field day, training, on-farm demonstration, farm level seed production and seed dissemination (popularization) through the collaborative efforts of various institutions such as Debrezeit Agricultural Research Center (DZARC), Asela improved seed enterprise and district Office of Agriculture and Rural Development (OARD) in their respective areas and some Non-governmental Organizations (ARDO, 2006/7).

In spite of such interventions, information with regard to adoption of pulse crops in general and chickpea production in particular, and location specific factors that influence adoption and variation among farmers in their intensity of adoption of improved chickpea production package practices is scanty. In addition to this, information about farmers' perception of the technologies and related problems as well as psychological factors which are responsible for poor adoption and intensity of improved chickpea production package are also found to be insufficient and are not well understood. Besides, previous studies have focused mainly on factors affecting adoption of improved variety alone and socio-economic variables. However, adoption of improved chickpea variety alone is not enough to bring significant change in production and productivity at household level since the packages of the technologies influence the amount of yield obtained by farmers.

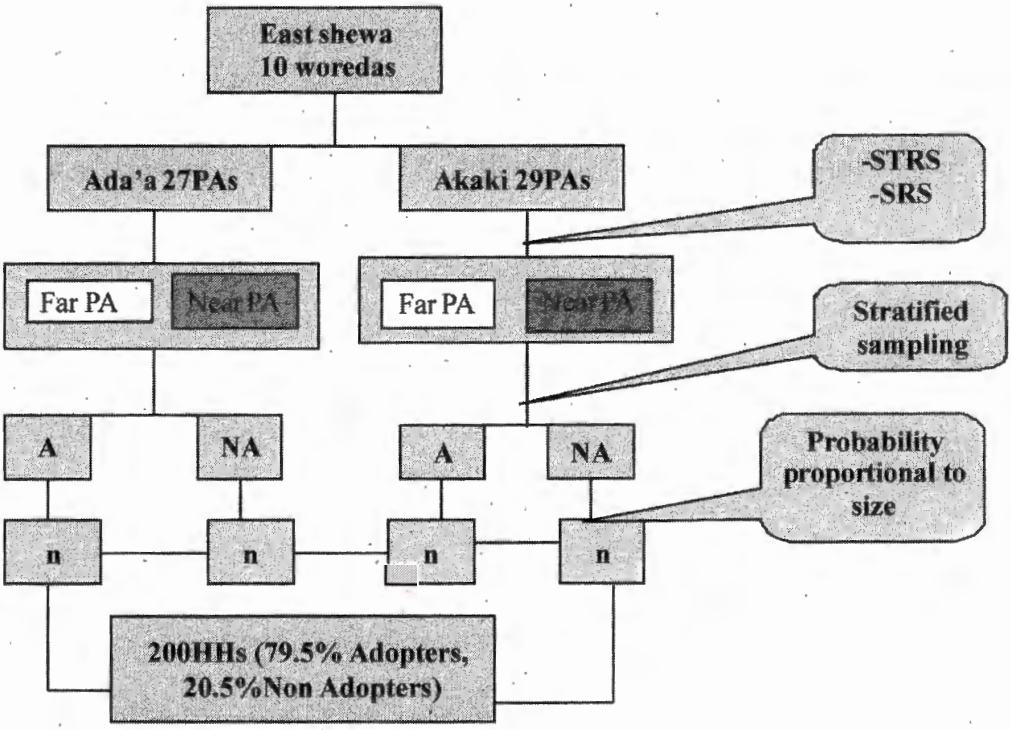
The availability of information on factors determining the adoption of chickpea technologies; extent to which chickpea technologies are adopted; farmers'

perception on chickpea technologies; and policy measures which could be designed are crucial in the process of technology generation and dissemination efforts. Therefore, this research was initiated to bridge the information gap by focusing on chickpea technology package. The specific objective of the study was to identify factors influencing adoption and intensity of adoption of chickpea technology package in Ada'a and Akaki districts in Ethiopia.

Research Methodology

The sampling procedure is depicted in the diagram below.

Sampling procedure



NB: STRS refers to stratified sampling, SRS refers to simple random sampling, PA refers to Peasant Association (far & near to towns), A refers to adopter, NA refers to non-adopter and n refers to total number of respondents

The survey was conducted among 200 households selected as per the above sampling design.

Table 1. Number of respondents in each of the selected PA, based on status of adoption

Name of districts	Name of Peasant Selected	Number of chickpea grower household heads			No of Respondents Selected		TNR	Percentage of Sample respondents (in %)
		As	NAs	Total	As	NAs		
Ada'a	*Hiddiii*	513	97	610	36	7	43	21.5
Akaki	*Denkaka*	601	201	802	43	14	57	28.5
	Iinsilalee	300	101	401	34	11	45	22.5
	Googeecha	407	76	483	46	9	55	27.5
	Total	1821	475	2296	159	41	200	100

NB: As refers to Adopters, NAs refers to Non-Adopters and TNR refers to Total Number of Respondents

Data Type, Sources, Methods of Data Collection and Analysis

The data type, sources, methods of data collection and analyses are provided here in Table 2.

Table 2. Summary of Data Type, Sources, Methods of Data Collection and Analyses

Data type	Data source	Method of Data collection	Method of Data Analysis
Qualitative	❖ Primary data sources were used (Key inform ants, Focus group discussants and sample farmers).	❖ Semi-structured and Structured interviews ❖ Discussion with focused groups, key informant interview and ❖ Personal observation	❖ Standard deviation, ❖ frequency, percentage
Quantitative	❖ Both primary and secondary data sources were used ❖ Primary source:— Sample farmers ❖ Secondary	❖ Structured interview. Discussion with focused groups and key informant interview	❖ Descriptive statistics (mean,SD, frequency, %), F- test ,chi-square, Cramer's V and Pearson

	source:- from different sources (reports, research center, CSA) was collected		correlation Econometric Model (Tobit)

Results and Discussion

In the descriptive part of this study except labor availability, frequency of contact with extension agents, scientific orientation, participation in non-farm activity and cosmopolitness, all variables had significant association with the dependent variable.

Table 3. Summary of Results of Continuous Explanatory Variables

Variable	Mean across adopter categories				F- value
	Non	Low	Medium	High	
Experience in chickpea farming	25.46	22.29	21.07	19.54	3.082**
Land holding	2.44	3.02	3.17	3.54	5.502***
Livestock possession	7.723	7.765	8.85	10.614	6.332***
Labor availability	3.43	3.71	3.59	3.92	0.795NS
On-farm income	7815.32	11016.55	11403.73	14178.98	4.336***
Social participation	16.10	16.93	19.20	24.77	11.817***
Attitude	19.75	23.32	22.27	23.80	2.698**
Achievement motivation	25.27	23.50	24.57	25.57	5.959***
Scientific orientation	18.98	18.93	18.67	19.52	0.927NS
Innovation proneness	6.39	6.11	6.46	6.98	5.513***
Level of aspiration	6.61	6.64	6.85	7.08	2.520**

Source: own survey data, 2007. ***, **, * Significant at 1, 5 and 10 per cent probability level, respectively. NS= Not significant

As may be seen in Table 3, the average land holding of sample households was 3.11 ha with standard deviation of 1.4 which is a bit larger than the national figure, 1.5 ha implying relatively better holding in the areas. The average land holding for non-adopter group was 2.44 ha while that of low, medium and high adopter group was 3.02, 3.17 and 3.55 ha, respectively. The results of one-way ANOVA (with value of F= 5.502 and P= 0.001) shows a statistically significant

mean difference among adopter categories (Table 3).Regarding the direction of relationship, result of bivariate correlation analysis revealed the presence of positive and significant association at 1% significant level (r= 0.274) between land holding and household's adoption of improved chickpea production package (Table 3).

Table 4. Summary of Results of Categorized and Dummy Explanatory Variables

Variable		Proportion across adopter categories				X^2-value
		Non	Low	Medium	High	
Sex of the Household Head	Male	70.7	60.7	82.9	83.6	8.058**
	Female	29.3	39.3	17.1	16.4	
Education of Household Head	Illiterate	14.6	14.3	5.7	0	
	Read and write	20	7.1	11.4	21.3	
	Primary Cycle	43.9	67.9	55.7	49.2	34.288***
	Secondary Cycle	4.9	7.1	17.1	24.6	
	Tertiary Cycle	0	0	4.3	4.9	
	Preparatory	9.8	3.6	5.7	0	
Participation in non-farm activities	Yes	22	21.4	28.6	34.4	2.605NS
	No	78	78.6	71.4	65.6	
Credit utilization	Yes	43.9	32.1	51.4	70.5	13.814***
	No	56.1	67.9	48.6	29.5	
Cosmopolitness	Yes	68.3	78.6	78.6	70.5	2.756NS
	No	31.7	21.4	21.4	29.5	

Source: own survey data, 2007. ***, ** and * significant at 1, 5 and 10 per cent probability level respectively. NS= Not significant

As indicated in Table 4, male respondents (77.5%) take larger proportion than female respondents (22.5%). The proportions of male respondents were high within the adopter groups (87.7%) than within non-adopter groups (70.7%). In this study, majority (79.9%) of sample improved chickpea adopter households were found to be male. This clearly shows the existing gap between male-headed and female-headed households in terms of participation in improved chickpea production. Regarding its relationship with adoption of improved chickpea production package, thus the Pearson chi-square test indicated that sex of the household head had significant relationship (c^2 = 8.058, df =3, Cramer's V

=0.201, p = 0.045) with adoption of improved chickpea production package at less than 5 per cent significance level (Table 4). The Cramer's V also shows that the relationship between the two variables is not very strong. Therefore, the result clearly shows male-headed households having high participation in improved chickpea production than female-headed households.

Determinants of Adoption and Intensity of Adoption

The determinants of adoption and intensity of adoption of chickpea technology package were analyzed using Tobit Regression Model and the results are presented in Table 5 as may be seen below. There represent the personal, socio-economic and psychological factors of the respondent farmers.

Table 5. Maximum likelihood estimates of Tobit Model

Variables	Estimated Coefficients	Standard Error	t-ratio	P-value
Constant	-0.469719	0.285292	-1.64645	0.0996705
Sex of Household Head	0.0984513	0.0477559	2.06155**	0.0392504
Education of Household Head	-0.0119472	0.020059	-0.595605	0.551439
Experience	-0.00815686	0.00224884	-3.62715***	0.000286572
Land Holding	0.0371166	0.0173378	2.14079**	0.032291
Total Livestock owned by farm household	0.0099622	0.00665275	1.49746	0.134274
Social Participation	0.00543951	0.00251421	2.16351**	0.0305018
Total on farm income	-2.61287e-006	2.5642e-006	-1.01898	0.308213
Credit Utilization	0.0111906	0.0485361	0.230563	0.817654
Attitude	0.00640844	0.00274068	2.33827**	0.0193735
Achievement motivation	-0.0119171	0.00893752	-1.33338	0.182407
Innovation proneness	0.0459635	0.0187193	2.4554**	0.0140727
Level of aspiration	0.0393913	0.0241248	1.63281	0.102508
Sigma	0.250445	0.0144695	17.3085	2.88658e-015

Log likelihood function = -37.05539

ANOVA based fit measure = 0.486641

Source: Model output ***, **, represents 1% and at 5% level of significance, respectively.

Sex of the Household Head: This variable was found to influence the adoption decision positively and significantly, at less than 5 per cent significant level towards maleness. The positive sign indicates that male-headed households were more likely to adopt chickpea production package than female-headed household heads.

The result from this test in the model shows that a male heading a household was found to have 9.8 per cent contribution to adoption and intensity of use of improved chickpea production package. The possible explanation might be that male headed households have better access to information, agricultural inputs and resource endowments.

Land Holding: The result in Table 5 revealed that land holding was positively related with adoption and intensity of use of improved chickpea production package at less than 5 per cent significance level. According to the regression model result, households land holding accounted for 3.7 per cent of the variation in adoption and intensity of adoption of improved chickpea production package. This is in line with the prior assumption that households who had large land are more likely to adopt new chickpea production packages. On the contrary, farmers who had small land size might face difficulty to adopt and increase level of use. This suggests the need to support farmers who have small land to enhance the adoption process.

Innovation Proneness: This was also another behavioral variable that was found to influence the probability of adoption and intensity of use of improved chickpea production packages positively and significantly at less than 5 per cent significant level. The model result shows that innovation proneness was found to have contribution like other explanatory variables i.e. the variable accounted for 4.6 per cent of the variation in adoption and intensity of adoption of improved chickpea production package. An individual who is interested to receive new ideas or practices of chickpea production technology package and interested to apply in his/her practical life situation might have more chance for adoption of chickpea production technology package.

Effects of Changes in Determinant Variables

Variables that were found to influence the adoption and intensity of use of chickpea production technologies might not have similar contribution in influencing the decision of farm households. Hence, using a decomposition procedure suggested by McDonald and Moffitt (1980), the results of Tobit model were used to assess the effects of changes in the explanatory variables on adoption and intensity of use and the result is presented in Table 6.

Table 6. Marginal Effects of Determinant Variables

Variables	Change in Probability of Adoption * $\frac{\partial F(z)}{\partial X_i}$	Change in the Intensity of Adoption* $\frac{\partial E(Y \mid Y^* > 0)}{\partial X_i}$	Change among the Whole $\frac{\partial E(Y_i)}{\partial X_i}$
Sex of Household Head	0.193180033	0.052979	0.075022
Experience	-0.013583783	-0.00373	-0.00528
Land Holding	0.008213328	0.002252	0.00319
Social Participation	0.010596474	0.002906	0.004115
Attitude	0.009835365	0.002697	0.00382
Innovation proneness	0.801481339	0.219803	0.311256

Source: survey data model output.

A change in sex of household heads, experience in chickpea cultivation, total land holding, social participation, attitude towards chickpea technology package and innovation proneness are among the hypothesized explanatory variables found to influence the probability and intensity of use of chickpea technologies (Table 5).

The results computed indicated that male-headed households were better in the use of improved chickpea technology as compared to female-headed households. Accordingly, with the status of the household head being male, the probability of adoption of improved chickpea production package and extent of use also increases by 19.3 per cent and 5.3 per cent, respectively.

A unit decrease in experience in chickpea cultivation increases the probability of adoption and intensity of use of improved chickpea production package by about 1.4 per cent and 0.37 per cent, respectively. A unit increase in land holding increases the probability of adoption and intensity of use of improved chickpea production package by about 0.82 per cent and 0.22 per cent, respectively. This implies the need to give emphasis to support farmers who have small landholding to enhance adoption of improved chickpea production package.

When sample respondent's participation in social organizations increases by one unit, the probability of adoption and intensity of use of improved chickpea production package increased by 1.1 per cent and 0.29 per cent, respectively.

The implication is that more emphasis should be given to strengthen institutional support in improving farmers' participation in social organizations so as to enhance adoption of improved chickpea production package.

The marginal effect result also shows that the estimated increase in the probability and intensity of use of improved chickpea production package resulting from having better attitude towards improved chickpea production package is 0.98 per cent and 0.27 per cent, respectively.

The innovation proneness of sample respondents' about improved chickpea production package brings about 80.14 per cent increase in probability of adoption and 21.98 per cent increase in intensity of use of the technology by adopters.

In general, the package of practices considered in this study were found to be used by improved chickpea growers, but there was a variation among the grower households in the level of adoption or use of these practices. On the other hand, for various reasons, farmers' practices were found to deviate from the rate recommended by the research system. As mentioned by sample respondents' the reasons for deviation range from the financial capacity of farmers to other household, technological and institutional related factors. Variation in adoption among the sample households was assessed in view of various factors theoretically known to influence farmers' adoption behavior of new technologies.

More specifically, based on the empirical findings of the study, the following recommendations were given:

Result of this study indicated that there was significant difference in adoption and level of adoption among farmers with high and low participation in social organizations. Farmers who were members of social organizations with frequency of participation were found to obtain better extension services, production inputs, credit, and other services. Hence, this calls for establishment, encouragement and strengthening of formal and informal social organizations at the grass root level to enhance adoption of improved chickpea technology package.

Attitude towards the technology package and innovation proneness were found to be important variables in influencing the adoption of chickpea technology package in the study areas. Farmers reported that risks associated with newly introduced technologies are higher than that of the existing practice and market related problems. Therefore, in order to develop a positive attitude and increase their innovativeness, it is suggested to minimize the fear of market uncertainty in

the farmers' mind by arranging a produce-procuring agency, which keeps its promise and purchases on time when farmers supply the product to the market. Moreover, concerned bodies need to verify the performance of the technology by conducting site-specific on-farm trials and demonstration methods of application as well as the results of technology outputs for farmers of the study districts.

References

ARDO (Agricultural and Rural Development Offices), (2006-07). Annual Report.Ada'a, Debrezeit and Akaki,Dukem

Asnake F., Gowda, C.L.L ., Demissie.M, Legesse D, Mcs Bantiln., Gaur, PM and Senait R, M.,(2005). Adoption of Improved Chickpea Varieties in Ethiopia. Ethiopian Agricultural Research Organization, Addis Ababa, Ethiopia.

Dereje Hamza, (2006). Assessment of farmers' evaluation criteria and adoption of improved bread wheat varieties in Akaki, central Ethiopia. M.Sc. Thesis submitted to School of Graduate Studies of Haramaya University.

McDonald, J.F. and Moffitt, R.A. (1980). "The use of Tobit analysis." Review of Economics and Statistics. 62(2): 318-321.

Mensah, S.A. and Seepersad, J. (1992). Factors Influencing the Adoption of Recommended Practices by Cocoa Farmers in Ghana. *Journal of Extension Systems*. Vol.8, no. 1:144-67.

Techane Adugna, (2002). Determinants of Fertilizer Adoption in Ethiopia: The Case of Major Cereal Producing Areas. An M.Sc Thesis Submitted to School of Graduate Studies of Haramaya University.

Yishak Gecho, (2005). Determinants of Adoption of Improved Maize Technology in Damot Woreda, wolaita Zone, Ethiopia. M.Sc. Thesis submitted to School of Graduate Studies of Haramaya University.

✡ ✡ ✡