Analysis of Factors Influencing Adoption of Quncho Tef: The Case of Wayu Tuqa District

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Abstract
The purpose of this paper is to analyze factors influencing adoption of Quncho tef in the case of Wayu Tuqa District. The primary sources of data were obtained from sample farmers and the secondary data from different sources were used. Both Probability and non probability sampling technique were employed to conduct the study, stratified random sampling procedure was employed for the selection of sample Peasant Association and random sampling was used to select 355 sample households from which 125 were adopters. For data analysis, descriptive statistics and econometric model, which is logit model, were used to state the influence of variables. Descriptive statistics revealed that aged farmers were less adopter than younger. Farmers with better education level show willingness to take new ideas than less educated and farmers having higher livestock were better adopter than the lower livestock holders and also farmers nearest to market and high frequency of extension service were better adopter than the farmers who were not. Econometric result shows that distance from household residence to market center and age of the household were found to influence adoption negatively, family labor in-terms of man equivalent and participation of farmers in agricultural trainings were found to affect adoption positively, while farmers owning the oxen were found to influence negatively. Also education level of the respondents, livestock holding in-terms of tropical livestock unit, farmer's ability of meeting the family food consumption, frequency of extension contact was found to affect adoption of Quncho tef positively.
Keywords: Adoption, Quncho tef, Wayu Tuqa District

1. Introduction

The adoption of improved technologies for staple crop production is an important means to increase the productivity of smallholder agriculture so as to foster economic growth and improved well-being for millions of poor households (Devereux & Guenther, 2007). Without basic descriptive information, about who is adopting technologies and who is not, it is difficult to formulate policies for increasing agricultural productivity (Doss, Mwangi, Verkuijl, & Groote, 2003) .

Technology adoption is often used broadly to encompass physical/biological structures or objects as well as management practices. Most often, researchers are interested in the adoption of specific technology components (e.g. fertilizer) or integrated technological packages (e.g. high yielding crop variety with fertilizer). However, it may be more important to study the character or functions and impacts of these technologies (Frank & Brent, 2000). Since the role of the agricultural sector of its contribution to the Ethiopian economy is very immense, the success and failure of the Ethiopian economy is highly correlated to the performance of this sector (Admassu, Workneh, & Sisay, 2015).

Among cereals, Tef (Eragrostis tef) is indigenous to Ethiopia in its origin. It is a grain crop solely produced in this country for human consumption purpose. It grows in most of the agro ecological zones of Ethiopia. The grain is an important crop used to make the Ethiopian staple food, Injera, which is consumed at least once a day in better off households and its straw serves as a feed for livestock and it is important raw material for the purpose of house construction (Mesfin, Tesfaye, Lemlem, & Eyob, 2004). Quncho tef is one of the new tef crop varieties which are rapidly expanding to the most tef growing potential areas of the country with high genetic capacity (ATA., 2012).

Statement of the Problem

To increase the production and productivity of agricultural output, the use of improved agricultural inputs are very important out of which high yielding variety crop with fertilizer is the most important (Setotaw, 2013). Thus, Quncho tef is one of the new crop variety which is rapidly expanding to the most tef growing areas of the country with the genetic capacity of the crop's production more than 30qt per ha, which is three times more than the local tef but faces the adoption bottle neck. The most prevalent challenge to adoption of Quncho variety of tef is the sowing method (row planting, transplanting) and its management. For instance, to give more yields, the recommended sowing methods are drilling with three hand fingers and/or transplanting after seedling preparation on seedbed (ATA., 2012).

Despite, increasing the demand for tef, there is no survey carried out that characterizes the farming system of the area. Also, factors that hinder adoption of quncho tef are unknown and not systematically and empirically studied and documented in the study area. Thus, the Author is inspired and initiated to conduct

research focusing on analyzing factors that affect the adoption decision of quncho tef. So, the objective of the study is to analyze factors that influence adoption of Quncho Tef in Wayu Tuqa District.

2. Literature Review

2.1 Definition

Adoption is the degree of use of a new innovation in long-run equilibrium when a farmer has full information about the new technology and its potential; while the rate of adoption is defined as the percentage of farmers who have adopted a new technology or the area under a new technology. The intensity of adoption is defined as the level of adoption of a given technology (Nkonya, et al., 1998).

Tef is the most widely adapted grain crop compared to any other cereal or pulse crop in the country and can be grown under wider agro-ecologies. It can be stored for long period of time without quality deterioration and quantity decline (Gezahegn, Mekonnen, & Samia, 2006).

Quncho tef is the variety of tef, which is a grain crop of Ethiopian obtained in Debre Zeit Agricultural Research center. From tef varieties, quncho tef (Dz-Cr-387) is high yielding and can be done in almost all of agro-ecologies (MoA, 2005). Quncho tef was developed from an intra-specific hybridization between two improve pure line selection varieties (DZ-01-974 Dukem and DZ-01-196 Magna). The variety DZ-01-974(Dukem) is high yielding, but because of the seed color (pale white) its preference by farmers was limited. On the other hand the variety DZ-01-196 (Magna) has been popular for its very white seed color, but its productivity has been relatively low. So, Quncho tef was developed by crossing the high yielder and color full varieties (Kebebew, Sherif, Getachew, Gizaw, & Hailu, 2011).

2.2. Empirical Study

Bedassa (2000) finds that as age increases by 1 year the likelihood of adoption of the HYV maize package decreases by about 0.02 percent and as education level increases by 1 school grade, the likelihood adoption of the HYV maize increases by 1 percent. Similarly, as number of livestock in terms of TLU and labour force in terms of Man equivalent increases by 1 unit, the likelihood adoption increases by 2 and 3 percents respectively.
Tesfaye & Alemu (2001)conducted the study on adoption of high yielding maize technology in major maize growing region of Ethiopia and the results revealed that distance to the nearest market center, family size, livestock holding interims of tropical livestock unit, access to credit, significantly and positively influences the adoption decision of improved maize.

Legesse Dadi, Burton, & Ozanne (2001) showed that farm size and farmers' perception of input prices were found to be significant with positive and negative effects respectively; age had a negative impact on the decision to adopt fertilizer on tef, but a positive impact on the adoption of herbicide on wheat.

According to Endrias (2003), the results computed indicate that one percent increase in farm size decreases the probability of adoption and intensity of use of improved sweet potato varieties by about 0.21 and 0.30 percents respectively. A marginal change in extension contact increases the probability of adoption and intensity of use of improved sweet potato varieties by about 0.10 and 0.14 percents respectively.

Mesfin (2005) revealed that famers' perception of yield superiority of triticale which was found to be significant at 1%, off / non-farm income and distance from household residence to market center, which were found to be significant at 5% probability level. distance from household residence to all weather road, livestock holding, and Investment cost are found to be significant at 10% probability level. The result revealed that the probability of adopting triticale or the odd-ratio in favor of adopting triticale decreases by a factor of 0.826, as the market distance increases by one kilometer and the odds ratio was by a factor of 0.800 for road distance, implies that the probability of adopting triticale decreases by 0.800 as the distance from all weather road increases by one kilometer, other things kept constant. Similarly, the probability of adopting triticale increases by a factor of 1.0 as the farmers' income from off/non/farm source increase by one unit and the probability of adopting triticale increases by the factor of 1.685 for each increase in TLU.

According to Ashenafi (2006), the marginal effect shows that, an additional one kilometer distance of the input delivery institutions decreases the probability of being an adopter by 1.3 percent. In similar way, the impact of the distance of the input delivery institutions from the household is negative and statistically significant (at 10 percent) and a kilo meter increase in the input distance will decrease the probability of being adopter by 3.2 percent. While having an extension contact increases the probability of being adopter by 27 percent which is statistically significant (at 10 percent) as compared to those who did not have the contact. In addition, the ownership of radio is found to have insignificant effect on the adoption decision of the farmers.

Hattam (2006) showed that, age often exerts a negative influence on adoption decisions, and education has positive effect. The econometric result shows that as age increases by one year, the probability of adoption decreases by probability of 1 percent and as education increases by one category, the adoption increases by probability of 18 percent.

As shown by Bart & Christopher (2006), agricultural productivity is, as one would expect, strongly and

positively associated with the adoption of improved agricultural technologies, access to agricultural extension, the availability of irrigation and market access.

According to Bwire (2008), education, distance to market, access to credit, farming experience, membership to farmer organization and land size owned had a significant relationship on the intensity of adoption. The study revealed that an increase in education level by ten years will increase the probability of adoption by 46 percent, as distance increases by 10 km the adoption decreases by about 17.2 percent and an increase of land area by one hundred percent will increase adoption by 0.6 percent. Whereas land size, level of education, extension services, and labor availability had a significant relationship on the probability of adoption.

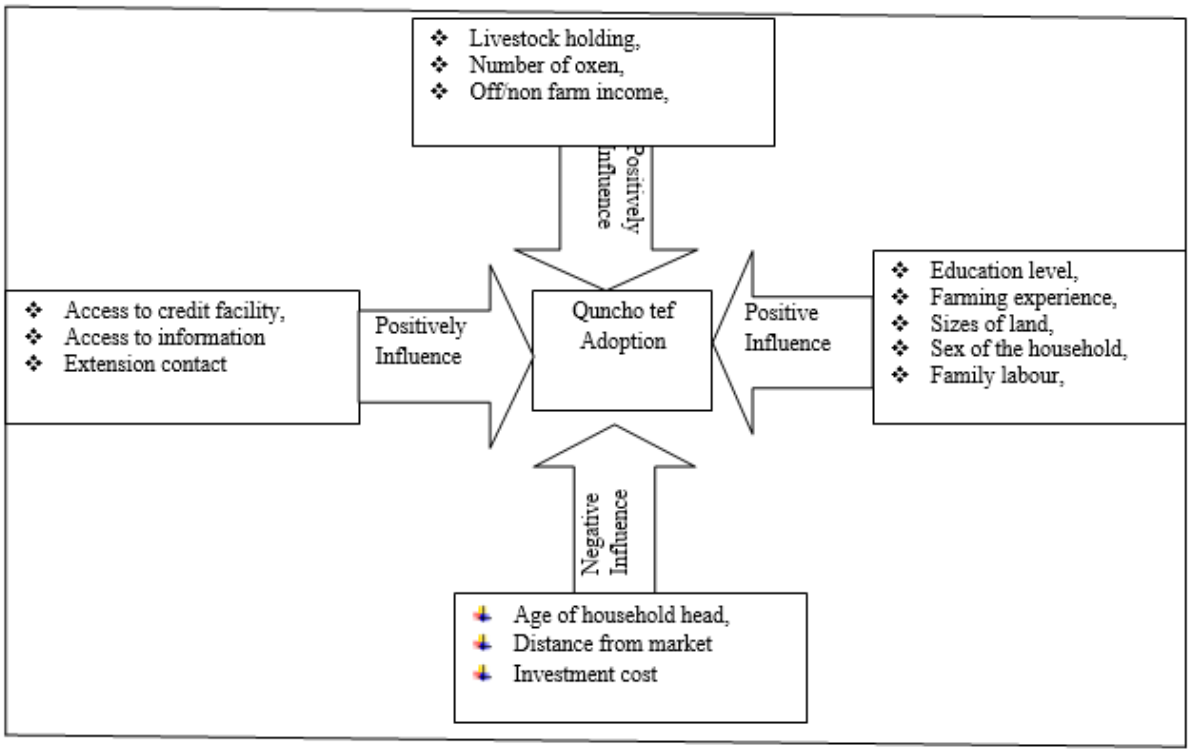
Alemitu (2011) conducted research revealed that, participation in training was positively and significantly affected by acquiring training at 5 percent significant level and an increase in improved haricot bean production training increases the probability of adoption and intensity of use of improved haricot bean production package by 3.1 percent and 7.3 percent and also increasing conducting demonstration was increases the probability of adoption and intensity of use of improved haricot bean production by 5.2 percent and 9.3 percent respectively. The marginal effect result shows that, being male headed house hold in the area increases probability of adoption and intensity of use of improved haricot bean production package by 47 percent and 56 percent respectively. The study result indicates that most farmer who had contact with the extension agent were adopters than who were not.

Generally, many scholars stated that, education level of the household heads, age, sex, farming experience, family labour, number of livestock influences adoption of technologies with different directions.

2.3 Conceptual Framework of the Study

The conceptual framework of the study is developed on the existing literature. that is the education level, farming experience, sizes of land holding, off/non farm income, sex of the household, access to credit facility, family labour, livestock holding, number of oxen, access to information and net income of the households influences adoption of quncho tef positively, while age of household heads, extension contact, distance from market and investment cost influence negatively (See Fig.1).

Figure 1 Conceptual framework of the study



Source: Own completion based on literature

3. Methodology

This topic includes some sub-topics such as Description of the Study Area, sampling procedure and sample size determination of households, method of data collection and its model specification.

3.1. Description of the Study Area

The study was conducted in Wayu Tuqa District which is found in East Wollega Zone, Oromiya Regional state, Ethiopia. It is one of seventeen District of East Wollega zone, Oromiya, Ethiopia. It is located 320 km from the capital city Addis Ababa toward the west of the country and 10 km away from Nekemte, which is the East Wollega zonal town. The District is bounded by Guto Gida and Sibu Sire Districts in the north, by Guto Gida and Leqa Dulacha Districts in the west and East by Sibu Sire District, and Wama Hagalo in the south and Nunu Qumba District in the east. It has three agro Climatic zones: Dega covers about 37.66 percent, Woina Dega 49.23 percent and Kolla 13.11 percent, with min 12 ^{0}C and max 32 ^{0}C temperatures. The altitude range of the District is 750 masl to 3180 masl, and the Rainfall of the area is min 1400mm & max 2400mm respectively. The total land of Wayu Tuqa District is 40,357 hectare in 10 peasants association (WAO, 2014).

3.2. Sampling

Both Probability and non probability sampling technique were employed to conduct the study. The study District was selected purposively. Based on the traditional agro-climatic zones, stratified random sampling procedure was employed for the selection of sample Peasant Association (PA's) from the District. After stratifying the District in to three, the sample Peasant Associations was selected by using random sampling procedure. Accordingly, after stratifying the Peasant Association s in to three agro ecological zones, 5 Peasant Association s were selected randomly using proportional allocation for the study. The farmers in each Peasant Associations were stratified into adopter and non-adopter categories giving the relative homogeneity of the sample respondents of their adoption status of quncho tef and their experience of growing the tef. Hence, in this study, considering those farmers cultivated quncho tef for one and more years as adopters and those not cultivating quncho tef currently as non-adopters. Since the numbers of farmers in each sample peasant association are different, specific numbers of respondents were selected with probability proportionate to size (PPS) random sampling technique to ensure representativeness of the population.

Following Watson (2001), the sample size of the population that was interviewed was selected using the following formula

$$n=\left(\frac{p[1-p]}{\frac{A2}{Z2}+\frac{p[1-p]}{\frac{N}{R}}}\right)$$

Where, n = sample size required, N = size of total population,
P = estimated variance in population, A = is the desired level of precision,
Z= confidence level for the test and, R = estimated Response rate,
Based on the Watson (2001) formula the required sample size would be

$$n=\left(\frac{0.5[1-0.5]}{\frac{(0.05)2}{(1.96)2}+\frac{0.5[1-0.5]}{\frac{6274}{0.95}}}\right) = 362 \text{ farmers}$$

Where, N = 6274, P=0.5, A =0.05, Z= 1.96, R= 95 percent.

3.3 Data Collection

Both primary and secondary data were used in this analysis. Primary data was collected from sample respondents through a structured closed and open ended questionnaire, which was designed to generate data on some social, institutional and economic variables that were supposed to be important for the study. Also, secondary data was used from CSA, and District level offices to obtain the required important data.

3.4 Model Specification

Both descriptive and econometric method of data analysis was employed. Descriptive data analysis was used to analyze the dispersion, central tendency of the socio-economic variables of the sampled population.
The econometric model was used to analyze the factor influencing adoption of farmers and to examine the relationships between adoption and factors influencing adoption involves a mixed set of qualitative and quantitative data. The dependent variable was dichotomous taking two values, 1 if the event occurs and 0 if it doesn't. Estimation of this type of relationship requires the use of qualitative response models (Maddala, 1992).

The choice between logit and probit models is largely a matter of convenience. Probit or logit model allows estimation of probabilities, the marginal effect marginal effects to make the interpretation of the results exciting (Greene, 2003). Logit model or probit model can be used in the adoption field. But, Logit model is better in estimating the explanatory variables because this model guarantees that the estimated probabilities indeed lay between the logical limits 0 and 1(Ali & Amin, 2012). Thus, the logit model based on cumulative logistic probability function was used in this study.

$P_i = E(Y=1/X_i) = \beta_0 + \beta_1 X_i$ …… (1)

Where X is covariates and $Y = 1$ means the adoption of quncho tef.
But now consider the following representation of quncho tef adoption:

$P_i = E(Y=1/X_i) = \frac{1}{1+e^{-(\beta 0+ \beta 1 Xi)}}$ ……. (2)

For ease of exposition, we write (2) as

$Pi = \frac{1}{1+e^{-Zi}} = \frac{e^{z}}{1+e^{Z}}$ ……. (3)

Where, e^{zi} - stands for the irrational numbers *e* to the power of z_i

z_i – stands for a function of m- explanatory variables (Xi) which was also expressed as

$Z_i = \beta_0 + \sum_{1=i}^{m} \beta i x i + \varepsilon t$

Z -stands an underlying and unobserved stimulus index for the i[th] farmer

i = 1, 2… m, were observations on variables for the adoption model, m being the number of explanatory variables in this study represents 13 independent variables.

β_0 the constant term and

β_i - the unknown parameters to be estimated, and

ε_t - the disturbance term

Equation (3) represents the logistic (cumulative) distribution function**.** It is easy to verify that as *Zi* ranges from −∞ to +∞, *Pi* ranges between 0 and 1.

If p_i is the probability of adopting quncho tef then 1-P*i* represents the probability of not adopting it.

$1\text{-}p = 1 - \frac{e^{Zi}}{1+e^{Zi}} = \frac{e^{-Zi}}{1+e^{-Zi}} = \frac{1}{1+e^{Zi}}$ ……. (4)

Therefore, the odds ratio can be written as

$\frac{p}{1-p} = \frac{1+e^{Zi}}{1+e^{-Zi}} = e^{Zi}$ ……. (5)

So, $\frac{p}{1-p}$ is simply the odd ratio in favor of adopting quncho tef. It is the ratio of the probability that the farmer would adopt a quncho tef to the probability that the farmer would not adopt. In practice many researchers choose the logit model because of its comparative mathematical simplicity (Gujarati, 2004).

Binary logit model was used in this study with using STATA version 12 for the data entry and analysis. Before taking the selected variables into the logit model, existence of multicollinearity among the continuous variables would be seen and association among the dummy variables would be verified with variance inflation factor (VIF) and contingency coefficient (CC) (Gujarat, 1995).

4. Results and Discussion

This topic describes the findings of descriptive and econometric analysis in line with the Quncho tef adoption decision.

4.1 Descriptive Data Analysis

The required data was collected from five Peasant Associations (Dalo Komto, Wara Babo Migna, Migna Kura, Gute and Boneya Molo) of Wayu Tuqa from 355 households (Table.3) and seven sample populations were not responding, meaning there were 7 missed values. The descriptive statistics was run to observe the distribution of the independent variables. The socio-economic and institutional characteristics of the respondents such as family size, age, sex, level of education, land holding, farming experience, livestock holding, oxen holding, etc of adopters and non adopters of quncho tef were analyzed. From the total sample respondents interviewed 125 and 230 were adopters and non-adopters respectively. These were 35.21 and 64.79 percents of the total sample of adopters and non-adopters, respectively. The mean and standard deviation of adopters was 0.91 and 0.28 respectively, while it was 0.84 and 0.36 for non-adopters respectively.

Table 1 Collected sample size

Agro-climatic zone	Sample Peasant Associations	Number of total Households	sample size of adopters	sample size of non adopters	Total sample size
Dega	Dalo Komto	1521	28	43	71
Woina	Wara Babo Migna	1092	20	50	70
	Megna Kura	900	21	24	45
Dega	Gute	1106	17	52	69
Kolla	Bonaya Molo	1655	39	61	100
Total		6274	125 (35.21)	230 (64.79%)	355

Source: own computation

In general the descriptive statistics of variables such as age of households, family size, family labour, non/off-farm activity, education level, farm land size, number of livestock in-terms of TLU, oxen holding, market access, sex, extension contact, crops net income and investment cost of households were summarized as the table 2 below.

Table 2 Summery of descriptive statistics

Variables	Mean Values			t-test	
	Adopters	Non-adopters	Total	t	p>|t|
Age of households	38.26	38.29	38.28	-2.59	0.010*
Family size	6.29	6.08	6.15	-3.22	0.001**
Family labor	3.70	2.09	2.66	1.84	0.066*
Non/off- farm activity	514.56	1235.46	981.62	-0.93	0.354
Education	7.92	3.35	4.96	2.54	0.011*
Farm Land size	2.10	1.79	1.89	0.77	0.441
Livestock (TLU)	4.83	3.66	3.55	2.99	0.003**
Oxen holding	1.94	1.5	1.64	-4.63	0.008**
Market Access (Km)	4.58	14.04	10.70	-2.63	0.009**
Sex of households	0.912	0.847	0.87	1.51	0.130
Extension contact	3.3	1.33	2.02	2.5	0.012*
Crops Net Income	48590.1	24780.6	33164.2	3.10	0.002**
Investment cost	4483.89	3251.05	3685.17	-0.34	0.731

*, ** shows the significance level at 5% and 10% respectively
Source: own computation

The mean and standard deviation of the family size of adopters was 6.29 and 1.59 respectively, while it was 6.08 and 1.69 for non-adopters respectively. The mean and standard deviation of the labor of adopters was 3.70 and 0.93 respectively, while it was 2.09 and 0.40 for non-adopters respectively. The size of labour force in the household is a priori to contribute for variation on adoption decision of Quncho tef as expected. Also, the mean and standard deviation of the education level of adopters was 7.92 and 2.28 respectively, while it was 3.35 and 3.22 for non-adopters respectively which could explain the variation with regard to adoption decision of Quncho tef. The study indicated that farmers who had higher education level show willingness to take new ideas and to try the technology by allocating some of the scarce resources.

The land size of sample households vary from 0.5 to 4.0 hectare with an average holding of 1.89 hectares with standard deviation of 0.88. The average size of land for adopters was 2.10, while that of non-adopters was 1.79. The result showed that the farm size of the household was the required resource for adoption of new technology and also the mean and standard deviation of the livestock holding of adopters was 4.83 and 2.75 respectively, while it was 3.66 and 2.65 for non-adopters respectively. This study indicated that there was a significant difference in livestock holding between adopters and non-adopters at a 5 percent significance level. This shows that adopters have higher livestock holding than the non-adopters. It could also indicate that adopters have better access to financial source through sell of livestock which could be used to purchase farm inputs, such as seed and fertilizer, and livestock used for minimizing risk.

The average distance from market for adopters was 4.58 km with standard deviation of 2.86, while it was 14.04 with standard deviation of 4.40. The result also revealed that mean difference of distance to market was significant at 1 percent level of significance. This shows that farmers nearest to market were better adopter than the farmers far from market and also, the mean and standard deviation of the frequency of extension contact of adopters was 3.3 and 0.83 respectively, while it was 1.33 and 1.25 for non-adopters respectively. This study indicated that there was a significant difference in the frequency of extension contact between adopters and non-adopters at a 10 percent significance level. This shows that adopters have higher frequency of extension contact than non-adopters.

It is obvious that net income is an important as in any economy. The mean crop net income of respondents was 33164.23 with a standard deviation of 13908.42. Also, the mean and standard deviation of the crops net income of adopters was 48590.1 and 12170.97 respectively, while it was 24780.6 and 4282.88 for non-adopters respectively. This study indicated that there was a significant difference in crops net income between adopters and non-adopters at a 5 percent significance level. This shows that adopters have higher crops net income in birr than the non-adopters.

4.2 Econometric Analysis

Before conducting the analysis, the problem of multicollinearity, heteroskedasticity and fitness and adequacy of the model were checked with variance inflation factors (VIF) and contingency coefficient, chi-square and remse test respectively.

Logit model was used to estimate the parameters of the variables that are expected to influence the adoption of Quncho tef (Table 3). In the model, 10 continuous and 3 discrete variables were entered. Out of the total of thirteen explanatory (predictors) variables only 10 variables of which 8 were continuous and 2 were dummies found to be significantly influencing adoption of Quncho tef.

Distance of the farmer's residence from the nearest market, the model results show that distance of

farmers' residence from the nearest market associated with adoption decision of Quncho tef negatively and significantly at 5 percent significance. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef decreases by a factor of 0.50, as the market distance increases by one kilometer. In the same way as distance increases by one kilometer, the probability of adoption of Quncho tef decreases by about 1 percent. Similar results were reported by (Bwire 2008, Mesfin 2005, Legesse Dadi, Burton and Ozanne 2001). This implies that distance to the nearest market in different localities had similar influence on the adoption of technology.

Number of livestock holding interims of tropical livestock unit, this variable was found to be influence adoption of Quncho tef positively and significantly at 5 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef increase by a factor of 3.60, as number of livestock of farmers increase by one number interims of TLU. The result implies that as number of livestock of the farmer increase by one in-terms of TLU, the probability of adoption of Quncho tef increase by about 11.4 percent similar with (Mesfin 2005, Solomon, et al. 2011, Alemitu 2011).

Frequency of extension service of the sample households, this variable was found to be influence adoption of Quncho tef negatively and significantly at 5 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef increases by a factor of 4.35, as the extension service provider visit increases by one frequency. The result implies that as contact frequency increases by one visit time, the probability of adoption of Quncho tef increases by about 2 percent. Similarly, according to (Bedassa 2000, Mesfin 2005) the extension service influence on the adoption of new agricultural technology

The total sample households' crops' net income, this variable was found to be influence adoption of Quncho tef positively and significantly at 5 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef increase by a factor of 1.00 unit, as crops' net income of the farmers in increases by one birr. The result showed that as crops' net income of the farmer increase by one thousand Birr, the probability of adoption of Quncho tef increase by about 3.1 percent. The more the farmers net income, the better adoption of Quncho tef.

Number of oxen the sample households own, this variable was found to be influence adoption of Quncho tef negatively and significantly at 5 percent significance level. This result was found to be in contrary previous researches, shows that the odd-ratio in favor of adopting Quncho tef decreases by a factor of 0.01, as productive oxen holding of the family increases by one ox. This implies that as oxen holding of the farmer increase by one unit, the probability of adoption of Quncho tef decrease by about 5 percent. This finding was confirmed by Todaro and Smith (2012) showed that smaller farms are more efficient producers of most agricultural commodities. The wealthier farmers often value their holdings not for their potential contributions to national agricultural output but rather for the considerable power and prestige that they bring. Since oxen holding are the sign of wealthier farmer, they use it for collateral for the sake of seasonal loans(Todaro & Smith, 2012).

The sample households' education status, this variable was found to be influence adoption of Quncho tef positively and significantly at 10 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef increase by a factor of 4.47, as education level of farmers in increases by year class. This implies that as school grade of the farmer increase by one grade, the probability of adoption of Quncho tef increase by about 2 percent. Similarly as confirmed by (Hattam, 2006; Bwire, 2008) the more the farmers educated level, the better adoption of Quncho tef.

Age of the sample households, this variable was found to be influence adoption of Quncho tef negatively and significantly at 10 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef decreases by a factor of 0.64, as the age increases by one year. This implies that as age of the farmer increase by one year, the probability of adoption of Quncho tef decreases by about 1 percent. Accordingly, (Alemitu, 2011; Hattam, 2006; Legesse Dadi, Burton, & Ozanne, 2001) findings, the younger farmers are better adopter than the older farmers.

Family labour of the sample households, this variable was found to influence adoption of Quncho tef positively and significantly at 5 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef decreases by a factor of 7.49, as productive labour of the family increases by one unit. This implies that as labour of the farmer increase by one unit, the probability of adoption of Quncho tef increase by about 2.2 percent. The result in accordance with (Solomon, Bekele, Franklin, & Hagos, 2011) shows that, the more the family labour, the better adopter of Quncho tef.

The sample households participated in different Agricultural training, this variable was found to be influence adoption of Quncho tef positively and significantly at 5 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef increase by a factor of 45.08, as participation of farmers in agricultural trainings and demonstrations increases by one unit. This implies that as participation of the farmer in agricultural trainings increase by one unit, the probability of adoption of Quncho tef increase by about 41 percent. Also according to Bedassa (2000), the more the farmers participate in agricultural trainings, the better adoption of Quncho tef.

The sample households' status of fulfilling the family food consumption requirement from own production, this variable was found to be influence adoption of Quncho tef positively and significantly at 10 percent significance level. The result of the sample data shows that the odd-ratio in favor of adopting Quncho tef increase by a factor of 35.41, as family food requirement level of farmers in increases by one unit. This implies that as food requirement level of the farmer increase by one unit, the probability of adoption of Quncho tef increase by about 4 percent.

With the above brief background, the effect of the significant explanatory variables on the adoption of Quncho tef was shown in the table below.

Table 3 Distribution of variables' results in logit, logistic and marginal effect

	Logit	Robust	t-test		Odds Ratio	Av. marginal
Variables	Coef.	Std. Err.	t	P>|t|	coef.	effect
Education	1.497	0.59	2.54	0.011*	4.468	0.020
Age	-0.449	1.174	-2.59	0.010*	0.638	-0.010
Farm land	0.972	1.263	0.77	0.441	2.644	0 .11
Sex	4.177	2.762	1.51	0.130	65.165	0.10
Market Distance	-0.703	0.267	-2.63	0.009**	0.495	-0.01
Labour	2.013	1.096	1.84	0.066*	7.488	0.022
Livestock (TLU)	1.275	0.427	2.99	0.003**	3.580	1.140
Oxen Holding	-4.355	1.653	-2.63	0.008**	0.013	-0.05
Extension contact	1.471	0.558	2.64	0.008**	4.353	0.02
Trainings	3.808	2.272	1.68	0.094*	45.083	0.41
Family Food	3.567	1.544	2.31	0.021*	35.408	0.040
Investment cost	-.00014	.00041	-0.34	0.731	1.000	-0.000002
Crops Net Income	.0003	.0001	3.10	0.002**	1.000	0.0000031
_cons	-15.43	5.11	-3.02	0.003	.0000002	
Number of obs = 355						
Prob > chi2 = 0.0000****						

,* Shows significance level at 5% and 10% respectively ** shows adequacy of the model
Source: own computation

5. Conclusion and Recommendation

5.1 Conclusion

As a conclusion, the descriptive analysis reveals that households with larger family labor and educated household heads and younger households were found to be better adopters. Further, farmers with high frequency of extension service are found to be better adopters of Quncho tef. In addition, the regression result revealed that distance of the farmer's residence from the nearest market, frequency of extension service contact and age of the households influence adoption of Quncho tef negatively and significantly. By the same scenario, family labour, education level, Agricultural trainings, livestock holding, crops net income and fulfilling requirement family food consumption from own production influence adoption of Quncho tef positively and significantly. The other thing which is contrary to other research, number of oxen own influence adoption of Quncho tef negatively and significantly.

5.2 Recommendations

The results obtained from the study can be used to show some intervention areas, specifically for the following decisive recommendations.

First, as observed in the result, there is no significant difference between adopters and non-adopters based on their land holding because the adoption of quncho tef needs few land than other due to its labor consuming. To make the land more economical, the technologies that can save labour wastage typically in quncho tef sowing activity, is ought to be employed to encourage farmers to cultivate on their potential land.

Second, it is revealed that the farmers who own larger numbers of oxen were not interested in using intensive technologies; rather they plough and cultivate all size of their lands in traditional way. Policy makers are better to focus to bring a behavioral change in respect to the attitude of farmers and upgrade them through demonstrations and practical comparison of the difference.

Finally, since it was not seen in this paper, further researchers, who has willing to conduct research on economic efficiency of adoption of Quncho tef is better to focus on the efficiency of its sowing methods (drilling, broadcasting or transplanting).

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