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Determinants of Adoption of Haricot Bean (Nasir Variety) and its Effects on Household Income: The Case of Kucha Woreda, Southern Ethiopia

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Abstract: *The objectives of this study were to identify the determinants of the adoption of Nasir variety and to examine the effect of its adoption on gross annual household income. A cross sectional study was carried out on Kucha Woreda in three sample kebeles with total sample size of 164 respondents selected via systematic random sampling principle. Both primary and secondary data were collected. Descriptive and inferential analyses were employed. The binary logit result revealed that, household labor availability, farming experience, total farm size of households, use of credit and contact with development agents per month had positively and significantly affect the adoption of Nasir variety at 1% significance level. Attended on training last year had positively and significantly affect adoption of Nasir variety at 5% level. The ordinary least square model result revealed that, adoption of Nasir variety has a positive and significant effect on household annual gross income at1% level (p<1%). As household adopt Nasir variety, the gross household income increased by Birr 4,139.7 by keeping other things constant. A year increase in age of the household head decrease the annual gross income of the households by Birr 96.1 at 1% significance level by keeping other things kept constant. A one grade increase of schooling, being credit user, and attend training increases the household annual gross income of sample respondents by a factor of birr 1536.492, 1828.203, and 1749.294 at 1% significance level respectively. A unit increase of labor force in man equivalent and livestock number in TLU increases gross annual household income of sample respondents by birr 382.905 and 563.139 at 5% significance level respectively. The findings suggest that the government and stakeholders should need to focus on wide distribution of Nasir variety.*

Keywords: *Agronomic practice, Haricot bean (Nasir variety) adoption, household annual gross income.*

1. INTRODUCTION

In Ethiopia about 57 improved common bean varieties has been released yielding up to 2.5-3.5t ha-1 at research fields (MoANR, 2016), and there is still a gap with national average yield (1.6 t ha-1) and remain below the potential productivity. In Ethiopia, haricot bean is grown predominantly under smallholder producers as an important food crop and source of cash. The major haricot bean producing regions include Oromia (the main production areas include the East Hararghe, West Wellega, East shewa, West Arsi), Amhara (Wollo and East Gojam), and Southern Nations, Nationalities and Peoples Region, SNNPR(Sidama, Gamogofa, Wolayita) (CSA, 2014).

As it indicated in CSA (2014) official report, their share to the national haricot bean production is 51% for Oromia, 24% for Amhara and 21% for SNNPR. Haricot bean is grown either as a sole crop and/or intercropped with either cereal or perennial crops. Nasir variety Haricot bean was released from Ethiopia Institute of Agricultural Research center in 2003 G.c. (EIAR, 2003). Though it is produced in most parts of the southern region, the leading zones of production are Sidama, Wolayita, and Gamo Gofa.

Adoption of improved Haricot bean varieties is one of the most promising ways to reduce food insecurity in Ethiopia (Walelign, 2015). However, the adoption of Haricot bean is influenced by many factors, like socio-economic, socio-demographic; physical and institutional factors.

Studies so far mainly focus on adoption of new technologies and its determinants (Mekuria Awoke, 2013, Solomon et al., 2014). However, there remains a lot when it comes to studies on the effect of adoption of improved seed on income and poverty. Therefore, this study also fills this gap, and examines and compares the contribution of Nasir variety adoption on household income among adopter and Non- adopter households in the study area.

2. OBJECTIVE OF THE STUDY

1. To assess the existing agronomic practices of haricot bean (Nasir variety) production in the study area.
2. To identify factors affectingHaricot bean (Nasir variety) adoption in the study area.
3. To examine effects of Haricot bean (Nasir variety) adoption on household annual gross income in study the area.

3. RESEARCH METHODOLOGY

Households in the study areas were used as a sampling unit, and all necessary data were drawn from the household heads. We consulted the woreda Agriculture administrative office to provide us detail profile of each kebele in the woreda in terms of population size, distance and logistics-related issues. In this study, a multi-stage (three stage) sampling procedure was employed for the selection of Woreda, sample Kebeles and respondent households. In the first stage Kucha woreda was selected purposively from 14Gamo zone Woredas due to Haricot bean production potentiality of the area and accessibility and availability of enough information about the practice.

In the second stage, three rural kebeles Gale, kullo and Basso were purposively selected, based on production potential and relative performance of haricot bean production from other kebeles of the woreda (relatively better presence of adopter households when compared to other kebeles of the woreda).

In the third stage, the total Haricot bean growing households residing in the three *Kebeles* (2,715) were stratified into two strata: adopter (1,253) and non-adopter (1,462) households to maintain inclusion of respondents during selection process. Adopter and non-adopter households were selected at kebele level prior to survey in each three respective kebeles, collaboration with DAs, kebele leaders, Data collector teams and the supervisor (researcher of the study). In this process the list of adopters (1,253) and non-adopters (1,462) were identified with detail discussion and screening by using documented secondary reports of each kebele agriculture administration office and probing kebele leaders for further confirmation. According to 2018 (KWANRD) official report, the total number of haricot bean producer households accounts 22,645 and out of these 1,440 are female headed households. In three sample kebeles 2,715 household heads produce haricot bean and among them 86 producers were female headed households and considered to be total population for this survey. According to Kothari, (2004) the most widely used confidence levels are 90%, 95%, and 99% and their respective Z-values from normal distribution table are 1.645, 1.960 and 2.576 respectively.

For this study 95% confidence level was assumed to become more confident, and increase accuracy. The other determining factor for sample size determination is margin of error and it is defined as the small amount allowable error value in case of miscalculation or change of circumstances. For this study 5% (0.05) margin of error is considered to be allowable. To compute estimation of population proportion in case of finite population the following formula was suggested by (Kothari, 2004).

$$n = \frac{Z^2 pqN}{e^2(N-1) + Z^2 pq}$$

This study was also used this formula to determine sample size of survey respondents.

Where: “n" stands for estimated sample size taken from total haricot bean producers in sample kebeles, Z -stands for Z score (as per table of area under normal curve for the given confidence level of 95%), P is proportion of sample population to be included as sample respondent 0.13, and “q" is estimate of the proportion of the population to be sampled (1-p = 87%).

"N" stands for total number of haricot bean producing farmers under the study (in three kebeles) of study area, e = acceptable error (allowable error) - in this case it will assumed to be 5% (0.05)

Substituting this numbers and computing the process by using the above formula it gives:

$$n = \frac{1.96^2 \times 0.13 \times 0.87 \times 2715}{0.05^2(2715-1) + (1.96^2) \times 0.13 \times 0.87} = 164$$

Before selecting Household heads to be included in the sample, adopter and Non-adopter household heads of each rural kebele were identified in collaboration with kebele leaders, key informants and development agents of the respective rural kebele. Out of the total Haricot bean growing households, 75 adopter and 89 non-adopter households selected from three sample Kebeles via probability proportionate to sizeprocedure. This sample size was redistributed to each kebele via probability proportion to size through the following formula:

$n_i = N_i * n/N$: Where, n_i is number of sample HH from each Kebele, Ni is the number of adopter households in each kebele in case of selecting adopter household's and the number of non-adopter households in each kebele in case of selecting non-adopter household's, n is total sample size for adopters (n=75) and for non-adopters (n= 89), and N is the universe or total population in case of adopters it was 1,253 and for non-adopters it was 1,462. The 75 adopter and 89 non adapter survey respondents selected through principle of systematic random sampling method.

The main data collection tools used in this study was semi structured interview schedule, and focus group discussion. The quantitative data were collected through semi-structured interview schedule. Depending on the objectives of the study, descriptive and inferential analysis was employed through SPSS software version 20.0. The descriptive statistics such asfrequencies, percent, means, standard deviation minimum, and maximum were used to analyze agronomic practices of the haricotbean (Nasir variety). Those descriptive statistics were also used to analyze the socio-economic characteristics, Household's demographic variables and institutional factors of the households.The statistical relationships of the categorical variable with dependent variable were tested through Chi-square and the mean variation of continuous variables between adopter and non-adopter were tested through t-test.

In this study both Binary logit and Ordinary Least Square (OLS) models were used to analyze the collected data. Binary logit model was employed to analyze factors affecting adoption of Haricot bean (Nasir variety) whereas Ordinary Least Square (OLS) model was used to examine the effects of Haricot bean (Nasir variety) adoption on annual gross income of survey respondents.

4. RESULT AND DISCUSSIONS

4.1. The Existing Agronomic Practices of Haricot Bean (Nasir Variety) Production in the Study Area

The results obtained from respondent interview and focus group discussion revealed that in the study area adopters practice different agronomic practices mainly, land Preparation, seed rate application, Practice of sowing methods, Practice of inorganic fertilizer application, weed, Pest and disease control practice methods.

4.1.1. Land Preparation Practice

The average practice of land preparation among adopter respondents is 2.3 with minimum and maximum practice of 1 to 4 times before plantation respectively (Table 3). This indicates that adopter households land preparation practice was less than research recommendation that suggests averagely 3 to 4 times before plantation of Haricot bean (Walelign, 2015).

4.1.2. Seed Application Rate

Use of proper seeding rate is one of the most important practices in Nasir variety haricot bean production. Excessive or underutilization of seed will result in poor production performance. According to the SNNPRS, BOANRD(2010), extension department report, the recommended seed rate for row planting is 70- 80 kg and for broadcasting is 90-120 kg seed per hectare. Averagely adopters used 60.34 kg seed per/ha with minimum and maximum of 50 kg, and 70kg respectively

(Table 1). This average seed application by adopters were far less than from research recommendation suggested that 90-120 kg per ha for broadcasting (BOANRD, 2010) and this underutilization of seed was result in poor plant population and may leading to low production (lower grain yields).

4.1.3. Fertilizer Application

According to Extension manual of the 2009, the recommended rate of DAP and Urea fertilizers per hectar was 100kg and 50kg respectively (MoARD, 2016). As secondary data obtained from annual report of KWANRD (2018), commonly two types of inorganic fertilizers such as DAP and urea were distributed to the farming community in the study area. The average rate of DAP and urea fertilizer applied for haricot bean production by adopter households during the 2018 production year was 69.kg/h and 4.67kg respectively (Table 2). The minimum and maximum amount of DAP fertilizer practiced per hectar by adopters were 0 and 100kg respectively. This application was better than the findings of the previous study done by Rhamato, N, (2007) for Alaba special woreda, implies that average rate of fertilizer applied for haricot bean adopter households during the 2005/06 production year was 32 kg/ha.

Table1. *Land preparation, seed rate and fertilizer application practice of adopter respondents*

Agronomic practices	**N (75)**			
	Min.	**Max.**	**Mean**	**Std. Deviation**
Frequency of land Preparation	1.00	4.00	2.32	.62
Amount of DAP applied per ha.	.00	100.00	69.	40.25
Amount of urea applied per ha.	.00	50.00	4.67	14.64
Amount of seed rate applied	50	70	60.34	6.98

Source: computed from own field survey, 2019.

4.1.4. Sowing Method and Time

All adopter respondents (100%) practiced broadcasting method of sowing and no one did practiced row planting in the study area. Regarding to plantation time practice, 73.3% adopters practiced early planting and 26.7% adopter households did not practiced early planting practice in the study area. This finding was deviates from research recommendation of (Walelign, 2015), suggested that row planting is the best way to get uniform stands and easier control of weeding and insect problems in haricot bean production and late sowing lowers the crop yield and increased the occurrence of the pest and disease attack.

4.1.5. Weed Control

Weed control in Haricot bean is important to reduce competition for water, soil nutrients, and light. About 46.67% adopters practiced only one time weeding across crop season whereas 28% of the adopters practiced weeding two times after plantation. Even some adopter households did not practiced weeding at all after plantation (1.33%). This result is consistent with previous study conducted at Jimma (Amanuel, 2018); suggested that late and poor weeding can result in yield reductions over 36% in haricot bean production.

Table2. *Sowing, plantation time, land preparation, fertilizer application, and weed control practices of adopter households*

Agronomic practices	Categories	% of Adopters (75)	
		N	%
Sowing methods	Broadcast	75	100
	Row planting	0	0
Plantation time	Early planting	55	73.3
	Not	20	26.7
Weed control	Not	1	1.33
	Once	53	46.67
	Twice	21	28
	Three times	0	0

Source: Computed from own field survey, (2019).

4.1.6. Practice of Pest Control

Cut worm, bean stem maggot, bollworm, aphids, and bean weevil are one of the nation's most serious pests that significantly constraint Haricot bean production in Ethiopia (Walelign, 2015). These pests are prevalent during dry spells or in areas with hot weather and marginal rainfall. Cultural and chemical control measures of the pest have been recommended (BOANRD,2010; Walelign, 2015; Amanuel, 2018). As the result indicated, the prevalence of pest attack was low in the area; only 5.3% adopters reported its occurrence and others did not.Even though its prevalence was low, those individuals reported its occurrence did notpractice any method to control its infestation.

Male focus group discussants were clearly justified the benefit of pest control for Haricot bean production, as, "it affects Nasir during seedling and in the storage place" by cutting the plants at ground level, entering and feeding on the immature pods and damaging seeds in storage". Female group discussant's were also lists a lot information about the benefits of pest control, however, when come to their current controlling practice, most of them become silent and not interested to share their experience on its current practice. This may implies pest occurrence is not prevalent in the area or they did not know its controlling measures.

4.1.7. Disease Control

Haricot bean rust, anthracnose and bacterial blight are the most important ones among the various diseases that affect the crop (Walelign, 2015). These pathogens mainly damage the leaves and to some extent pods to a varying degree. The finding indicates, 29.33% of the adopter households currently reported the occurrence of disease and among them only 13.34 % respondents practiced cultural method of disease controlling and the rest 16 % respondents did not practiced any method of disease controlling (table 3). This implies that, the problem needs additional investigation on the area of extension skill training, contents of extension provision or the way how the stockholders approach to address disease infestation problem among farmers in the area.

Table3. *Pest and disease controlling and harvesting practice application of adopters*

Agronomic practices applied	Categories	Percentage of Adopters(75)	
		N	%
Pest occurrence reported	Yes	4	5.3
	No	71	94.7
Pest control methods applied	Not occurred	71	94.7
	Not practiced	4	5.3
Disease occurrence reported	Yes	22	29.34
	No	53	70.66
Disease control methods applied	No disease occurrence	53	70.66
	Practice cultural methods	10	13.34
	Not practiced any method	12	16

Source: computed from own field survey, 2019.

4.2. Determinants of Adoption of Haricot Bean (Nasir Variety)

As it is showed in Table 4, thirteen explanatory variables were included into the Binary logit regression model and out of which seven variables were found to significantly influence the adoption of Nasir variety in the study area. The detail of each variable is presented below:

Labor availability: household size converted to adult equivalent is considered as the total active household labor force. Large family size is assumed as an indicator of labor availability in the household. The coefficient of Labor availability is positive and significant. It shows that, households with large labor availability in terms of man equivalent were voluntary to adopt the Nair variety in the study area which is consistent with hypothesized sign. The result of the survey revealed that, labor availability had significant positive effect on adoption of Nasir variety at ($p = 0.003$). The model result confirms that household with high labor availability in ME are more likely to adopt adoption of Nasir variety than households with low labor availability in adult equivalent. The odd ratio of 2.458 implies that being other things kept constant, the likelihood to adopt Nasir variety increased by a factor of 2.458 as labor availability increased by one man equivalent (ME) unit.

Farming experience: Haricot bean farming experienced farmers are expected to have greater chance to adopt it and expected to be faster in adopting Haricot bean (Nasir variety) than inexperienced farmers. In this study year of Nasir variety farming experience of household head significantly and positively influenced the adoption of Nasir variety at (p = 0.000). The odds ratio in the model output implies that every additional increase in year of farming experience of the household head increases the likelihood of adoption of Nasir variety by a factor of 2.635 as keeping other things kept constant.

Total farm size: had significant positive effect on the adoption of Nasir variety at (p = 0.006). The odds ratio reveals that as land size increases by one hectare the likelihood of adopting Nasir variety will increases by a factor of 16.442. This study confirmed that the prior hypothesis of possession of land was positively and significantly related to the dependent variable (adoption of Nasir variety). Therefore, better land holderhouseholdshave more chance to adopt Nasir variety Haricot bean when compared to their counterparts. This finding is consistent with Ahmed (2010) that farm size exerts positive influence on adoption of improved teff and wheat production technology in northern and western shewa zones of Ethiopia.

Use of credit: Organizing of farmers to be a member of cooperative society would facilitate access to credit, access to extension information and access to market. The credit use of the household head had a positive coefficient which was significant at (p = 0.005), on the decision to adopt Nasir variety in the study area as hypothesized (Table 15).The positive sign and significance of the estimated coefficient of credit use suggests that respondents who used credit are more likely to adopt than farmers who did not used credit. The odds Ratio implies that as farmers being user of credit, the likelihood of adopting Nasir variety increases by a factor of 14.506 while other predictors (variables) in the model are held constant.

Frequency of contact with development agents: The survey result showed that frequency of extension contacts by extension workers varies among the sample households. The coefficient of frequency of extension contact (visit) is positive and statistically significant which is consistent with hypothesized sign. The frequency of contact with development agents per month had significant positive effect on the adoption of Nasir variety at (P =.002). The odds ratio for Frequency of contact with development agents is 10.651. Therefore, respondents who regularly contact with DAs per month have more chance to participate in adoption of Nasir variety in the area. This result is consistent with earlier studies on adoption of dairy technology on small holder dairy farmers (Dehinenet *et al*., 2014).

Attend training: Nasir variety production related training creates its awareness and is expected to affect its adoption positively. Attendance in extension training is the other means through which farmers get information about improved technologies. Extension workers, cooperatives were provide trainings related with Haricot bean production (time of planting, weeding, application of chemicals, harvesting, threshing and storage), for farmers in the study area. The survey result indicated that, attending in training related with Haricot bean production had significant and positive influence with the adoption of Nasir variety at (P <.040). The odds ratio of attending in training, 6.558 favors the likelihood of adopting Nasir variety by a factor of 6.558 as other things being kept constant.

Table4. *Maximum likelihood estimates of the binary logit model*

Variables	B	S.E.	P-value	Odds Ratio
Sex of respondents(1)	2.355	1.542	.127	.095
Age of respondents	-.021	.043	.627	.979
Education level	.348	.422	.409	1.416
Labor availability	.899***	.301	.003	2.458
Farming experience of HHs	.969***	.273	.000	2.635
Total farm size of HHs	2.800***	1.012	.006	16.442
Livestock holding in TLU	.483	.342	.158	1.621
Market distance ce	.064	.123	.605	1.066
Membership in coop.(1)	.447	.809	.581	1.563
Use of credit(1)	2.675***	.955	.005	14.506
Contact with DAs.	2.366***	.748	.002	10.651
Attend in training (1)	1.881**	.917	.040	6.558
Frequency of training received	1.084*	.628	.084	2.958

Constant	-16.118	4.153	.000	.000
➢ Correctly predicted adopter = 88.0%, ➢ Correctly predicted non-adopter = 93.3% ➢ Overall prediction= 90.9%, ➢ -(-2loglikelihood=76.332)				

, **and *, significance at 10%, 5% and 1% level respectively.*

Source: computed econometric model result from own field survey, 2019.

4.3. The OLS Estimates on Household Annual Gross Income

Haricot Bean (Nasir Variety) adoption: Haricot bean (Nasir variety) adoption is the variable of interest, which is the research question of this study. It answers the question whether or not adoption of Nasir variety affects household income of the households. The result showed that Nasir variety adoption had a positive and significant effect on household annual gross income at 1% significance level in the study area (p= 0.000). This evidenced as, keeping other things being constant, when households adopt Nasir variety, the household annual gross income increased by a factor of birr 4,139.735(Table 5). This implies its adoption increases the income of adopters by a factor of 4,139.735 birr.

The mean difference analysis result also showed that Nasir variety adoption had positive and significant effect on household gross incomeof adopters and non-adopters. The average (mean) annual gross income of the adopters was 14,561.5 birr while that of non-adopters was 6,228.1 birr with significant mean difference of 8,333.38 birr (t =11.932, p=0.000)**.** This implied that the adopters of Nasir variety had a significantly higher annual income than that of non-adopters. Most of this difference in gross income is the result of Nasir variety adoption which is identified in the econometric analysis part in table 5 using linear regression(OLS) method. Hence, adoption of Nasir variety had a positive and significant effect on household annual gross income of the adopters. However the mean annual gross income of the overall sample households is 10,039 birr with standard deviation of 6088.6.

Age of household head: Theresult indicates that age of the household had significant negative effect on household annual gross income at 1% significance level (p = 0.001) in the study area as expected. The coefficient for age of the household is negative (-96.220) and showing that increases in age of respondent would lead to decrease in household annual gross incomeof households by a factor of birr 96.220 at 1 % level (Table 5) as being other things keep constant (ceteris paribus). Hence, ageing reduces the probability of income acquisition for old aged household heads and younger household heads were more able to adopt new technologies quickly relative to the older counterparts and their income is also higher. Therefore, a farmer who was older age group has less chance to increase household gross income when compared to active age group farmers.

Education level of household head: In line with the hypothesis, level academic qualification of farmers has a significant influence in favor of the household gross income at 1% significant level. The coefficient of the variable is statistically significant and positive. Education level of household head is found to be very significant determinant factor for income acquisition of households at 1% significant level in the study area as expected (p= 0.000) and, its coefficient had a positive sign. This indicated that the higher the level of education of the household head, the higher the household gross income (the more the household heads are educated the more they acquire household income).

This is evidenced that keeping other variables(predictors) being constant, the coefficient indicates households that invest a one additional year on schooling, increases their annual gross income by a factor of birr 1,536.492. That is educating farmers is very important to achieve agricultural lead strategy of economic growth and to speed up the efforts of food security of the farmers and other citizens of the country.

Labor availability: It has positive and statistically significant association with household gross income at 5% significant level (p = 0.040). The coefficient of 382.905 indicates that a unit increase in labor availability increases the annual gross income of households by a factor of birr 382.905 by keeping all other variables being constant. Increase in the labor size means that there will be more labor to work on farms or rear animals and this is likely to increase household production as well as

income. Another reason may be that rural farming activities require more labor inputs to undertake the various farm activities. Therefore households with large members are more likely to cultivate large farm size which could result in more output and more income. Therefore a large household size has comparatively more labor which enhances more farm land cultivation, increase output and income levels.

Number of livestock in TLU: As expected, the coefficient of the tropical livestock unit (TLU) (563.139) is positive and statistically significant at the 5% level (p = 0.010). By taking other predictors keep constant, a unit increase of livestock number in terms of TLU increases households annual gross income by a factor of birr 563.139 (Table 16). By implication, increase in livestock production enables farm households to produce and sell more animals as well as animal-source products hence it increases households annual gross income, as keeping other things being constant (ceteris paribus).

Use of credit from institutions: The study showed that the use of credit had a positive and significant influence on the dependent variable (household gross income) at 1% level (p= 0.002).The beta coefficient revealed that using credit improves (increases) household annual gross income by a factor of birr 1,849.103 by considering other things being kept constant (Table 5). It implies a person who uses credit from different credit sources was in the advantageous position than a person who did not receive any credit. Therefore households with credit are better off compared to those without.

Attended in training: This study showed that attendance in training had positive and significant effect on household annual gross income at 1% significance level (p = 0.003) (Table 16).It indicates that household income would increase if the households attend on training and reduces if not. As expected, the coefficient of the attending on trainingin the regression analysis was found significant and the magnitude of impact on household gross income was high (1,732.499 birr). This implies when all other inputs are held constant, the household annual gross income of the households who attend training has increased by a factor of birr 1,732.499.

Table5. *OLS result of the income Model*

Model(variables)	**Coefficients**		**t-value**	**P-value**
	B	Std. Err		
(Constant)	6632.59	2005.28	3.308	.001
Adoption of Nasir variety	4139.735***	712.73	5.698	.000
Sex of household head	403.729	791.46	510	.611
Age of household head	-96.220***	28.337	3.396	.001
Education level of HHH	1536.492***	272.83	5.631	.000
Labor availability	382.905**	184.69	2.073	.040
Farming experience of HHs	23.039	151.04	.153	.879
Total farm size of households	602.721	624.48	.965	.336
Number of livestock in TLU	563.139**	216.76	2.598	.010
Market Distance in km	-127.968	87.07	1.470	.144
Membership in cooperative institutions	-514.662	554.90	-.927	.355
Use of credit	1849.103***	575.82	3.211	.002
Frequency of contact with DAs per month.	507.623	356.72	1.423	.157
Attended in training in last one year	1732.494***	575.53	3.010	.003
Frequency of training received	332.201	315.98	1.051	.295
➢ Dependent Variable=Total household income, ➢ R^2 = 0.813, Adjusted R^2 = 0.795 ➢ F-statistic = 46.224, P-value (overall) = 0.000 ➢ Total sample mean =10,039.1birr				

***and ***, significance at 5% and 1% level respectively.*

Source: computed from field survey, 2019.

5. Conclusion and Recommendations

Relaying on the finding of this empirical study, the following recommendations are suggested:

- Due emphasis has to be given to strengthening farmer's practice of recommended agronomic applications by arranging demonstration, farmers' training, strengthening extension service provision and advice, because the assessed existing agronomic practices applied in the study area was not in line with research recommendation.
- Resource ownership factors such as labor availability, farm size (land), and institutional factors such as credit use, frequency of extension contact (visit) with development agent and training was seen as positive and significant association to the adoption of Nasir variety in the study area. Therefore, giving great consideration and priority for these factors was highly recommended during Haricot bean (Nasir variety) production process from lined stakeholders involved in its production process in planning, budgeting and evaluating to scaling up adopters good practice for others at large. It is important to pay special attention to households who do not have enough family labor to work on the farm, through strengthening one-to-five development army functionality.
- Frequency of extension contact has been found to be an important variable in explaining the adoption of Nasir variety in the study area. Hence, increasing the number of the DAs in the kebele level and daily contact of farmers with extension workers is better to maintain information and knowledge sharing process to improve Nasir variety adoption. The KWANRD and other stakeholders working in the area should encourage extension agents to strengthen frequency of extension contact (visits).
- Attendance on training related to Nasir variety production and its frequency was found to be positively and significantly influenced adoption of Nasir variety in the study area. Hence, Agricultural extension wing, research institutes, and universities involved in the area should provide adequate and effective training on Nasir variety production to the rural farming households in general and to the study area in particular.
- Nasir variety adoption has positive and significant effect on household annual gross income in the study area.So, due attention has been given by stakeholders in the provision and widespread distribution of Nasir variety for farmers particularly in the study area.
- The study also recommend that those income influencing factors identified in this study should be carefully integrated in rural development plans and strategies implemented in the area in order to improve households annual gross income.

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