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FACTORS INFLUENCING ADOPTION OF IMPROVED POTATO (BELETE) VARIETY: EVIDENCE FROM ETHIOPIAN SMALLHOLDER FARMERS

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ABSTRACT. Improving the adoption of improved crop varieties is very important to increase income, reduce hunger, sustain food security, and to reduce poverty in sub-Saharan Africa like Ethiopia. Similarly, Belete potato variety is one of the improved varieties that have been utilized by Ethiopian farmers, but this variety was not conjointly adopted in all parts of the country. Thus, this research was intended to analyze factors influencing rural farmers' decision for the adoption of improved potato varieties in Southern Ethiopia. Both qualitative and quantitative data were collected from primary and secondary sources. To select the sample respondents, two-stage sampling techniques were employed and finally, 146 households' heads were selected. To get the data survey questionnaires, interview schedules, Focused Group Discussions, observations and key informant interviews were employed. To analyze the data, both descriptive statistics and econometric model were employed. Accordingly, the econometric model indicated that family labour, access to fertilizer, access to credit service, frequency of extension contacts, participation in training and field day, and educational level were positively and significantly influenced the adoption of Belete potato adoption, however, the market distance was influenced negatively. Therefore, this result implies that researchers, policymakers, extension service providers and other concerned bodies should be given attention to increasing the adoption of improved Belete potato variety.

Introduction

Agriculture in the Ethiopian economy prominently is the largest contributor to the national economic development and the main income-generating sector for the majority of the rural population. Among the agricultural sectors, potato production is one that plays a crucial role in the livelihoods of the people. Ethiopia is known in potato production and it is the fourth-best very important crop next to others and cultivated on about 18.1 million hectors of land (FAOSTAT, 2010). In Ethiopia, potato is mainly produced not only for consumption, but it is also important to improve the livelihoods of the people by using it as exchanges with other commodities, for market purposes to increase the income of households and foods of crops where there is land grazing problem. Potato is used to overcome the problem of seasonal food shortage when other food crops are decreased from storages (Singh, Rana, 2013) and it also encourages farmers as the monetary rewards for those farmers who are participating in potato production (Elraiah *et al*., 2014). Thus, the demand for potato production in Ethiopia is very high and the producers cover huge amount of land farming for potato production. Potato holds great potential for improving the livelihoods of Ethiopian people in multi-dimensions: high yield, early maturity, excellent food value, increasing household revenues and reduction of food deficiency (Leprince *et al*., 2014).

Potato production is seasonal based and farmers tolerate to find out an appropriate season for its farming base on climate variability (CSA, 2014). These potatoes are produced from both traditional and scientific methods in the Ethiopian context. The scientific one is mostly produced in the process of adoption mechanism with selection of improved varieties coming from either

domestic or abroad. Adoption of improved varieties has its own pattern and its impact the likelihood of the farmers is different too. Adoption inculcates improved potato varieties, better storage facilities, value-added products and enlightening right of entry to marketing (Ayalew, 2014). In Ethiopia, adoption of potato is steered by low level of technologies (Abebe *et al*., 2013; Ortiz *et al*., 2013). Though there is adoption of improved potato varieties, farmers are not utilizing, as it is required because of factors of high price of seed, inadequate supply of seeds, low level of technologies, inadequate supply of fertilizers and pesticide, not sufficient credit services especially to buy the required inputs. Most of the time farmers are getting limited varieties through informal ways, in a sense, farmers-to-farmers or brokers to farmers. This is because of the low capacity of formal sectors to supply the nation's demand and thus, those farmers who did not get the improved one they come back to producing the traditional one, which has low quality in the existing context (Abera, 2013).

To come up with the solution, Ethiopian Institute of Agricultural Research released different improved potato varieties and fore example, Belete potato was one of the improved potato varieties released by Holetta Agricultural Research Center (MOA, 2013). Doyogena district is where this study was carried out and this district has the potential for the potato production but farmers are still old varieties, which were released before two decades. These old varieties are very susceptible to diseases and their yield is also quite low. Evidence shows rural people are facing the problem of food insecurity when there is inadequate other crop productivity because of factors like shortage of rainfall, climate change, lack of improved seeds and lack of technologies. Therefore, why farmers do not want to shift from the old varieties to more the improved one is the basic investigation waiting for research and knowing the reason why adoption of this variety lagging behind is also quite relevant to solve the problem of the community. It is pertinent to undertake area-specific studies to assess the status of potato adoption and identifying factors that hamper further adoption of this improved variety, hence, factors affecting the adoption of Belete potato variety was not systematically and empirically studied that leads to an information gap. Therefore, to fill up the gap critical research investigation was carried out to identify the factors that limit smallholder farmers not to adopt Belete potato variety in the study context. Based on the stated problems the scientific research questions were withdrawn including: Is potato variety the improved or the old variety? Which potato variety is more adopted than others are? Is there Belete potato variety? Is it fully adopted by farmers? If not, why the reason? Do the farmers know about this type of variety clearly? What factors limit the farmers not to use this variety? How is the comparison between the old potatoes with the new one?

Research Methods

The study was conducted in Doyogena District, in Kembata Tembaro Zone, Southern Ethiopia. To carry out this research cross-sectional data was employed. To analyze the data both qualitative and quantitate data were used from both primary and secondary sources to identify the explanatory variables that affect the adoption of smallholder Belete potato producers in the study area. The primary data were collected from sample smallholder farmers, local elders, model farmers, agricultural extension workers and different seed enterprise agencies and brokers by using survey questionnaires, semi-structured interview schedule, focused group discussion and key informant interviews. Secondary data were collected from district agricultural offices, journals and articles and office records. Besides, key informant interview schedule was used to understand the challenges of Belete potato producers by focusing on the factors affecting the adoption of this improved variety. In this regard, twelve smallholder farmers' potato producers were purposefully selected by carrying out depth interview to obtain the knowledge and experience about the improved potato production with the help of checklist.

The district was selected purposively on the basis of the better production potential of potatoes. From the district four kebeles were randomly selected since all kebeles in the district have the production potential of potato. Accordingly, the potato producers were stratified into two categories (adopters and non-adopters) of subgroups. Finally, taking out the list of potato producers from each kebeles, 146 sample respondents were selected by grouping them into 52 adopters and 94 non-adopters of Belete potato producers based on the probability proportional to size from the selected kebeles. Then, a total of respondents were used for personal interview by using well-trained and qualified enumerators. Moreover, the following (Table 1) shows how selection of final sample household heads was done. The study used a formula designed by Yamane (1967) and if the sample size is too small, the objective of the analysis may not be addressed precisely. To determine the required sample size at 95% confidence level and the degree of variability = 0.5 and the way sampled households captured is seen in the following formula:

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

$$n = \frac{2480}{1+2480(0.08)^2} = \frac{2480}{16.872} = 146,$$

where
n – the sample size,
N – the population size (total household heads size)
e – the level of precision.

Table 1. Sample size distribution with respective kebeles

Name selected	Adopte	Non-	Total	Adopte	Non-	Sample
Serera	235	530	765	14	31	45
Lemi Suticho	225	490	715	16	27	43
Bekafa	175	335	510	12	18	30
Murasa Weramo	160	330	490	10	18	28
Total	795	1685	2480	52	94	146

Source: Authors Competition (2018)

To achieve the objective of the research different approaches of analysis were adopted. In view of that, both descriptive statistics and econometrics model have used to analyze the data. Descriptive statistics such as average mean, frequency and percentages were used. Chi-square and t-tests were used to see the presence of the significant association between the dependent and explanatory variables between the adopters and non-adopters of Belete potato producers. Statistical packages including SPSS and STATA were used to run data entry and analysis purposes. To identify factors affecting the smallholder farmers' adoption of Belete potato varieties logistic regression model was used. This model is selected for this study and it was also used when the response of the respondents is binary (yes or no). Here, the dependent variable is adoption categories for adoption of Belete potato variety: 1 if the farmers adopt this improved variety and 0 otherwise. The functional formula of the logistic regression model used in this study is presented as follows:

$$p_i = \frac{1}{1+e^{-z_i}}, \quad (2)$$

where

Pi – the probability of being willing to adopt Belete potato for the i^{th} farmers

Zi – the function of n explanatory variables (xi) and expressed as:

$$z_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n X_n, \quad (3)$$

where

Bo – the intercept and

Bi – the slope parameters in the model.

The slope tells how the log-odds in favour of being willing to adopt Belete potato variety cultivation change as independent variables change. Since the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean Pi, interpretation of the coefficient was understandable if the binary logistic model can be rewritten in terms of the odds and log of the odds, (Gujarati, 1995). The odds were defined as the ratio of the probability that a farmer will adopt Belete potato variety (Pi) to the probability of non-adopter of Belete potato variety (1-Pi). But

$$(1 - p_i) = \frac{1}{1+e^{z(i)}}, \quad (4)$$

therefore

$$\left(\frac{p_i}{1-p_i}\right) = \frac{1+e^{z(i)}}{1+e^{-z(i)}} = e^{z(i)} \quad (5)$$

and

$$\frac{p_i}{1-p_1} = \frac{1+e^{z(i)}}{1+e^{-z(i)}} = e^{\beta_0} + \sum_{i-1}^{m} \beta_i Y_i \quad (6)$$

Taking the natural logarithms of the odds ratio of equation (5) will result indicated as the following formula:

$$ln\left(\frac{p_{(i)}}{1-p_{(i)}}\right) = \ln\left[e^{\beta_\circ} + \sum_{i-1}^{m} \beta_i x_i\right] = z_{(i)} \quad (7)$$

If the disturbance term Ui is taken into account, the Logit model becomes:

$$z_i = \beta_\circ + \sum \beta_i x_i + u_i \quad (8)$$

Therefore, the above binary logit model was employed to estimate the effect of the hypothesized explanatory variables on the adoption decision of farmers to use Belete potato variety. Before taking the selected variable into the model, it was authoritative to check for the existence of multicollinearity among the continuous variables so that Variance Inflation Factor (VIF) was used. This technique tells us large VIF are indicators of multicollinearity and those explanatory variables with VIF>10 were excluded from the regression analysis. Its formula is indicated as:

$$VIF\ (Xi) = (1\text{-}Ri^2)^{-1}, \quad (9)$$

where

Ri^2 is multiple correlation coefficients between Xi and other explanatory variables. Similarly, when there is an interaction between two qualitative variables, it leads to the problem of high association. To detect the problem, the contingency coefficients were computed and when contingency coefficient is greater than 0.75, it is an indication of existence of multicollinearity among qualitative variables. Here the following formula:

$$C = \sqrt[2]{\frac{\chi^2}{\chi^2+n}}, \quad (10)$$

where

C refers to contingency coefficient, x^2 is chi-square and n is the total sample size. Many factors are influencing decision of farmers to adopt or reject Belete potato in the study context. Table 2 shows the definitions, descriptions and hypothesized variables.

Table 2. Definition of explanatory variables for analyses

Variables	Measure-ment	Description	Expected sign
AGEHH	Continuous	Age of household head (in years)	-ve
FAMILAB	Continuous	Family labour available for	+ve
DISTNMkt	Continuous	The distance of home from	-ve
TLU	Continuous	Livestock owned Measured	+ve
OFFAIM	Dummy	Involvement in off farm	-ve
PARTFIDA	Dummy	Participation on field	+ve
CONTEXA	Continuous	Contact with extension	+ve
LANDHLG	Continuous	Total land holding	+ve
EDULEVEL	Continuous	Education of the household	+ve
ACSCRDT	Dummy	Access to credit (0=no, 1=yes)	+ve
ACSTRAIN	Dummy	Access to training (0=no, 1=yes)	+ve
RADIOWN	Dummy	Radio owner ship (0=no, 1=yes)	-ve
AVALFER	Dummy	Availability of fertilizer (0=no, 1=yes)	+ve
SEX	Dummy	1 if the household head is	+ve

Source: Authors Computation (2018)

Results

Results of descriptive statistics

The following Table 3 and Table 4 clearly revealed the summary of social, economic and institution of descriptive and econometric results. Accordingly, the results in Table 3 show the relationship between the continuous variables with the adoption categories of the respondents at different probability level. For example, age of household head has a vital role in agricultural production with special reference to adoption of Belete potato variety production. The maximum and minimum age of the sample households is 60 and 27 years, respectively. On the other hand, the average age of sample adopter and non-adopter was 38.84 and 41.12 years, respectively. The t-test result revealed that the statistical mean difference between adopter and non-adopter categories of the respondents was statically significant at 5% probability level. The educational level of farmers influences the adoption of Belete potato and the comparison was done between adopter and non-adopter in relation to their mean educational level. Accordingly, the result of t-test shows that the statistical mean difference between adopter and non-adopter of Belete potato was significant at 1% probability level. This shows that the education level of adopters of Belete potato is higher than non-adopters of the technology, implying the influence of the variable in making adoption decisions. Landholding and ownership is the critical factor for agricultural production and adoption of agricultural innovation for the farm community. In this study, the average landholding of sample respondents was found to be 1.025 hectares with standard deviation of 0.271 hectares. The maximum land size owned by the sample households was 2 hectare while the minimum is 0.50 hectare. The average landholding for adopter group was 1.08 hectare while that of non-adopter group is 0.992. The t-test result shows that there is a significant mean difference between adopters and non-adopters at 5% probability level.

Table (3) also indicates that access to having human labour may increase the probability of households to adopt Belete potato variety. In view of that, in this study, the maximum and minimum family size was 9 and 3 persons per family. The average person equivalent of sample adopter and non-adopter households is 6.192 and 5.329, respectively. Hence, the family labour in man equivalent shows that there is significant mean difference between both adopter and non-adopter groups at 1% probability level. Regarding livestock holding, the average cattle ownership of sample households for the adopters was 4.35 TLU, while for the non-adopters was 3.96 TLU. The result of t-test shows that the livestock holding owned mean difference between the two groups was statistically significant at 1% probability level. The minimum and the maximum distance that a farmer had to travel to access nearest market centre were 0.30 hr and 3 hr, respectively and it takes on average 1.56 hr with standard deviation of 0.747. Mean distance travelled to the nearest market centres by adopters, and non-adopters were 1.427 hr and 1.640 hr, respectively. The t-test result shows that there is statistically insignificant mean difference between both adoption categories in terms of distance to the market centre. The average score of frequencies of farmers contact with agricultural development agent accounts for adopters and non-adopter farmers were 9.67, and 3.32, respectively shown in Table 3. Therefore, the t-test analysis result shows that there was significant mean difference between both adoption categories in terms frequency of contact with the extension agent at 1% significance level.

Table 3. Summary of continuous variables

Variable	All sample		Adopter		Non-adopter		t-value	p-value
	Min	Max	Mean	SD	Mean	SD		
Age of HHH	27	60	38.84	6.15	41.12	6.13	–2.149	0.033**
Family labor	3	9	6.192	1.32	5.329	1.19	4.012	0.000***
Market distance	0.30	3	1.427	0.759	1.640	0.733	–1.655	0.1000^{NS}
Education level	0	12	7	2.457	4.372	2.305	6.443	0.000***
Livestock owned	2.06	6.9	4.35	0.763	3.96	0.794	2.940	0.004***
Extension contact	2	12	9.67	1.854	3.32	1.447	22.891	0.000***
Land holding	0.50	2	1.08	0.270	0.992	0.268	2.033	0.044**

Sources: Authors computation (2018); ** and *** at 5% and 1% probability level, respectively; NS = non-significant

Table 4 shows the association between the dependent variables (adoption groups) and the dummy explanatory variables at different probability level. Accordingly, sex of household head affects the adoption of Belete potato variety in such ways that, because of the existing socio-cultural contexts males have freedom of mobility, participating in different meetings and training. From the total respondents, 94.2% and 5.8% of the adopter sample farmers were male and female-headed households, respectively. Therefore, sex of household head is statistically significant and positive relationship with the adoption decision at 5% probability level. This implies that male-headed households had capability to participate freely in different social organization to have better exposure to the production of the selected variety than their counterparts did. Coming to the off-farm activities out of the total households interviewed 36 (69.2%) had participated in off-farm activities, while 52 (55.3%) had not participated. Unlike prior expectation, participation in off-farm activities had insignificant relationship with adoption of Belete potato variety at 5% probability level.

Access to credit service is another factor that influences the adoption decision of farmers and most of the Belete potato adopter farmers got the loan in kind especially the improved seeds and fertilizers; because those are only obtained from input supply office in collaboration with Omo Microfinance and Kebele multi-purpose saving and credit cooperatives. Out of the total sample respondents, 41.1% got credit service from the district credit service were delivering institutions to run their agricultural production. On the other hand, 58.9% of the total sample households were non-credit recipients. Additionally, 55.8% and 34.0% of the adopter and non-adopter sample households accessed credit services. The chi-square result showed that access to credit service had an association with the adoption of Belete potato variety among farmers at 1% probability level. Regarding access to training service, the sample households had taken training on fertilizer application, planting methods and other management methods like chemical application for the variety. Training is also important for easily applying the innovation at farmers' level to get more yields by the farm community in the district. 67.3% and 30.9% of the adopter and non-adopter sample respondents have participated in training related to Belete potato variety, respectively. The chi-square result revealed that training has statistically significant relationship with the adoption of Belete potato variety at 1% probability level.

On the field day participation, farmers exchange information on agricultural practices, which have an important role in the adoption of improved agricultural technologies, which is evidence-based extension system where information is shared easily on the comparative advantage, agro-ecological suitability of the technology to be adopted by showing tangible results in the real-life situation. The sample adopter and non-adopter sample households selected for the study participated on field day were 76.9% and 40.4%, respectively. The chi-square result indicates that the association between participation in field day and the two adoption categories of Belete potato variety is statistically significant at 1% probability level. Fertilizer availability on time determines adoption decision of Belete potato varieties and which helps to increase production and productivity. Accordingly, out of the total sampled respondents, 47.9% got access to fertilizer from the district service delivering institutions to run their agricultural production. 71.2% and 35.1% of the adopter and non-adopter sample households accessed fertilizer on time. The chi-square result showed that the relationship between fertilizer availability and the adopter of Belete potato variety is statistically significant at 1% probability level. In this study, respondents' radio ownership was measured on having radio to get up-to-date information which contributes to the adoption of agricultural innovation and farmers who have radio ownership on Belete potato production had the opportunity to decide to use the variety. When we compared the adopters and non-adopters radio ownership, 48.1% of the adopters had radio ownership whereas 37.2% of the non-adopters got access to utilize radio, which had statistically insignificant with adoption of Belete potato production in Table 4.

Table 4. Summary of discrete/dummy variables

Variable	Response	Adopter		Non-adopter		Total		X^2	P-value
		N	%	N	%	N	%		
Sex of house hold head	M	49	94.2	76	80.9	125	85.6		
	F	3	5.8	18	19.1	21	14.4	4.867	0.027**
Access of training	Yes	35	67.3	29	30.9	64	43.8		
	No	17	32.7	65	69.1	82	56.2	18.074	0.000***
Off-farm participation	Yes	36	69.2	52	55.3	88	60.3		
	No	16	30.8	42	44.7	58	39.7	2.706	0.100^{NS}
Field participation	Yes	40	76.9	38	40.4	78	53.4		
	No	12	23.1	56	59.6	68	72.3	17.923	0.000***
Access to fertilizer	Yes	37	71.2	33	35.1	70	47.9		
	No	15	28.8	61	64.9	76	52.1	17.431	0.000***
Access to credit service	Yes	29	55.8	31	34.0	60	41.1		
	No	23	44.2	63	67.0	86	58.9	7.184	0.007***
Radio ownership	Yes	25	48.1	35	37.2	60	41.1		
	No	27	51.9	59	62.8	86	55.5	1.626	0.202^{NS}

Sources: Authors computation (2018); ** and *** at 5% and 1% probability level, respectively; NS = non-significant

Results of the econometric model

The results in Table 5 indicate how a logistic regression model explains explanatory variables such as economic, institutional, demographic and as indicated, 85.6% of the total variation for the Belete potato variety. The chi-square result also shows that the parameters are significantly different from zero at P<0.01 for the adoption of Belete potato variety. The model correctly predicted sample size of 75% and 91.5% for adopters and non-adopters, respectively. From fourteen explanatory variables hypothesized to influence the adoption decision, eight of them; namely, family labour, availability of fertilizer, access to credit service, frequency of contacts with extension agents, participation in training, education status and field day participation were found to be significantly influencing the probability of adoption of Belete potato variety at 1% and 5% level of significance. Whereas market distance influenced the adoption of Belete potato variety negatively at 10% level of significance. On the contrary, the remaining six non-significant explanatory variables; sex of household head, age of household head, participation of farm activity, livestock owned, radio ownership and cultivated land size are influencing the adoption of Belete potato variety but not statistically significant.

Table 5. Binary logistic regression for factors influencing the adoption of Belete potato variety

Variables	B	S.E.	Wald	Sig.	Odd ratio
Sex of house hold head	0.825	1.019	0.655	0.418	2.281
Age of household head	–0.070	0.045	2.361	0.124	0.933
Educational status	0.635	0.322	3.891	0.049**	1.888
Access to training	1.707	0.629	7.363	0.007***	5.513
Off-farm participation	0.123	0.626	0.039	0.844	1.131
Livestock ownership (in TLU)	0.200	0.362	0.307	0.580	1.222
Family labor	0.500	0.239	4.371	0.037**	1.649
Access to credit service	1.447	0.613	5.563	0.018**	4.249
Availability of fertilizer	1.346	0.647	4.335	0.037**	3.844
Frequency of extension contact	1.073	0.352	9.278	0.000***	2.923
Radio ownership	0.389	0.598	0.423	0.516	1.475
Market distance	–0.607	0.356	2.916	0.088*	0.545
Cultivated land size	1.107	0.981	1.273	0.259	3.024
Field participation	1.596	0.668	5.713	0.017**	4.932
Constant	–11.239	3.298	11.612	0.001	0.000
- 2log likelihood	87.401				
Significance	0.000				
Chi-square(X^2)	102.74***				
Correct Prediction of adopter	75				
Correct prediction of non-adopter	91.5				
Overall percentage	85.6				

Source: Authors computation (2018); Note: ***, ** and * are significant at less than 1%, 5% and 10% level of significance

Discussion

From the above result in (Table 5) from the total fourteen variables, eight of them had positively influence adoption of Belete potato variety. Additionally, the detail relationships of those statistically significant explanatory variables with the adoption of Belete potato variety are described as: Educational status had positively and significantly influenced the probability of adoption of Belete potato variety at less 5% level. The odds in favour of adopting Belete potato variety increased by a factor of 1.88 for potato producers who are more educated, keeping all other factors constant. This shows that education raises the awareness of Belete potato producers they get more access to information and this recommends that farmers with higher educational background would have better chance to access information can simply realize the use of Belete potato. This result is consistent with earlier studies of (Bekele *et al*., 2013). Access to training was positively and significantly influenced the adoption of Belete potato variety at 1% probability level. The odds ratio in favour of adopting Belete potato variety increases by a factor of 5.513 when the farmer is trained, keeping the influence of other factors constant. When farmers get knowledge, skills and attitudes training their probability to accept and adopt the improved new varieties as Belete potato increased too. This finding is similar to the results of (Ahmed *et al*., 2016).

Family labour was positively and significantly influenced the adoption of Belete potato variety at 5% probability level. The outcome of the odds ratio indicates that if the household head has raised in the number of family labour in mam equivalent in one unit, the logs of odds ratio is in favour of the households' adoption of Belete potato variety will raise by 1.649 as labour works raise by one unit. This result is the fact that when farmers are not facing shortage of labour works at farming activities they can easily manage the adoption activities of Belete potato. The finding of this study endorses the findings of (Adesope, 2006; Garba, 2016). Access to credit service was positively and significantly influenced the adoption of Belete potato variety at 5% probability level. The result of the model shows that the odds ratio in favour of farmers' adoption Belete potato increases by the factor of 4.249 when there is access to credit services. This reveals that access to credit increases farmer's opportunity to adopt Belete potato variety and the findings of (Garba, 2016; Kafle, 2011) confirms this also.

Availability of fertilizer had positive and significant influence to the adoption of Belete potato at 5% probability level. The odds ratio in favour of adopting Belete potato technology increases by a factor of 3.844 as availability of fertilizer raises by one unit as the fertilizer available on time, keeping all other factors constant. This means that those farmers who get chemical fertilizer on time are more likely to adopt Belete potato variety than those who do not have access to fertilizer on time. Chilot et al. (1996) reported a similar result. Frequency of extension contact was found to be positively and significantly affecting the adoption of Belete potato production at 1% probability level. The odds ratio in favour of adopting Belete potato variety increases by a factor of 2.923 as a farmer-extension contact raises by one unit, keeping all other factors constant. This could be because increased farmers' contact with extension agents significantly raises farmers' awareness of available technologies. This study was similar to the findings of (Adella, 2014; Namwata *et al*., 2010).

The market distance was negatively and significantly associated with the adoption of Belete potato production at 10% probability level. Moreover, as the market distance increases, the logs of odds ratio in favour of farmers' adoption of Belete potato will decrease by 0.545 as market distance raises by one unit, keeping all other factors constant. This further shows that as market distance decreases, adoption of the variety by the household raises. The result is consistent with the finding of (Legesse *et al.,* 2001; Yishak, 2005). Field participation has positive and significant relationship to adoption of Belete potato variety at less than 5% probability level. Keeping all other factors constant, the odds ratio in favour of adopting Belete potato varieties raises by a factor of 4.932 as a farmer meeting in field days raises by one unit. The result shows having formal information through field day Participation raises the likelihood of adoption of Belete potato variety. This result is in line with (Tesfaye *et al.,* 2001).

Conclusion and Policy implications

The aim of this study was to assess Belete potato varieties the adoption determinates in Doyogena district in Southern Ethiopia. The variations in adoption perform among the households were assessed from the point view of various factors which influence farmers' adoption behaviour. These influencing factors are categorized as demographics, institutional, economic and resource ownership factors. The outcome result indicates that the relative influence of different variables on probability of adoption of Belete potato variety. Thus, seven variables namely family labour, availability of fertilizer, access to credit service, frequency of extension contact, access to training, education status and field day participation were positively and significantly influenced the adoption of Belete potato variety. However, market distance was influenced negatively. Thus, to promote the adoption of Belete potato variety by smallholder farmers in the study context the following suggestions are forwarded for the concerned bodies for further interventions:

- Extension and other organizations to target them during on-farm research and improved technology promotion, as they can easily understand about the technology.
- Farmer training centres may be well equipped with training facility will help to deliver qualified knowledge and skill-based training to farmers to improve the adoption decision.
- Well-equipping work force with the necessary skill and knowledge through training is important to increase the production performance of the variety.
- Establishing rural micro-institutions to expand access to credit in all-inclusive manners so that farmers can easily access it.
- Providing technical support on access to get fertilizer should be encouraged.
- Providing rural FTC systems with well-equipped work force who can deliver training.
- Establishing rural markets at village levels with accessible roads
- Finally, the government and other stakeholders should support Belete potato producing farmers so as to increase the adoption degree of improved varieties.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author contributions

AF – contributed to the design and implementation of the research, the analysis of the results and to the writing of the manuscript.
GR – supervised and advised starting from title selection to the publication of the manuscript. GR also contributed to taking the initiation of manuscript publication on the appropriate and reputable journal.
MM – has a role of advising only.

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