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FACTORS AFFECTING SMALLHOLDER FARMERS' POTATO PRODUCTION IN KOFELE DISTRICT, OROMIA REGION, ETHIOPIA

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ABSTRACT

Potato is a potential food security crop in Ethiopia, in which the tuber provides high energy, quality protein, a substantial amount of vitamins and minerals. This study investigated the factors affecting smallholder farmers' potato production in Kofele district, Ethiopia with the objective of identifying and analyzing factors affecting potato production. A multi-stage sampling procedure was used to select sample households for data collection. A total of 120 potato producer households were randomly selected from the district using probability proportional to size. Semi-structured questionnaires were used to collect data from potato producer households. The descriptive statistics and linear regression model were used to analyze factors affecting smallholder farmer's potato production. The findings demonstrate that education level, the land allocated for potato production, fertilizer application and participation in the non - farm activity is positively and significantly affects potato production in the study area. The study suggested that potato productions are affected by the above mentioned factors and, thus, policies addressing these factors are required to improve smallholder farmer's potato production.

KEYWORDS: Kofele District, Potato Production, Regression Model, Smallholder Farmers

INTRODUCTION

Agriculture is the mainstay of the Ethiopian economy, providing a livelihood for over 85% of the rural population and accounting about 44% share to Gross Domestic Products (MoFED, 2013). The Ethiopian government attempts to promote the production of high value agricultural products to improve food access (MoFED, 2010). Yilma (1989) reported that about 70% of the available agricultural land in Ethiopia is located at an altitude of 1800 – 2500 m.a.s.l, which is suitable for potato production. Potato is an important root crop grown in mid altitude and high altitude areas of Ethiopia (Mulugeta and Dessalegn, 2014). Presently, potato ranks second in volume produced and consumed among root and tuber crop in Ethiopia (CSA, 2015).

Oromia is the major potato producing region in Ethiopia that constitutes 51% of the national potato production (CSA, 2015). The West Arsi zone is a highly potato producing zone in Oromia region (Bezabih and Mengistu, 2011). Kofele is the second major potato producing district in West Arsi zone (Bezabih and Mengistu, 2011).

Even though the country has suitable environmental conditions for potato production, the region (12.22 t/ha) as well as the national (13.69 t/ha) productivity of potato is very low (CSA, 2015), as compared to the world average of 17.16 t/ha (FAO, 2012). This is mainly due to shortage of improved potato varieties, lack of certified potato seed and poor agronomic practices which leads to low potato productivity. Therefore, this study was initiated to identify factors affecting potato production at smallholder farmers' level and providing location-specific and timely information.

OBJECTIVES OF THE STUDY

To describe socioeconomic and institutional factors affecting potato production; and

To identify and analyze factors affecting smallholder farmers' potato production

RESEARCH METHODOLOGY

The Study Area

This study was conducted in Kofele district, West Arsi zone of Oromia Regional State, Ethiopia. Kofele district is located at 305 km from Addis Ababa towards South direction. It shares borders with Shashemene in West, Kokosa South West and Kore in East directions (DOA, 2014).

The district covers an area of 663 square kilometers and has 38 rural and two urban Kebeles. The total population of the district is 216159 (108156 males and 108003 females) having the rural population of 194531 (96652 males and 97879 females), and urban population of 21628 (11504 males and 10124 females) (CSA, 2014).

The major Agro-ecologies of the district are the high land (90%) and midland (10%) having loam soil type for highland and sandy loam for mid land soil types (DOA, 2014). The district is found within 2400 to 2700 m.a.s.l. It receives an average rainfall of 1800 mm per annum with minimum 2300mm per annum and maximum 2700mm per annum. The district has bi-modal rainfall distribution with small rains starting from March/April to May, and the main rainy season extending from June to September/October. The average temperature is 19.5°C per year with minimum of 17^{o}C and maximum of 22^{o}C (DOA, 2014).

The land use pattern of the district shows that 40260 ha is cultivable, 21629 ha is grazing land, 3852 ha is covered by forest, bushes and shrubs, and 4486 ha is being used for other purposes such as encampments, and infrastructure facilities. The average land holding of the district is 2.6 hectares (DOA, 2014).

The district features a crop-livestock mixed farming system. The types of crops widely grown in the district are Barley, Potato, Wheat, Maize, Enset, Cabbage and Head Cabbage. The district is known for its predominance of potato production in the west Arsi zone next to Shashemene. Potato is the major cash crop produced in the district followed by head cabbage productions (DOA, 2014).

Sampling Procedure

A multi-stage sampling procedure was used to identify sample households for data collection. In the first stage, potato producer *cables* were purposefully identified in collaboration with concerned experts from the district office of agriculture and development agents based on the intensity of potato production. The second stage involved random selection of four potato producing *kebeles* from a list of the potato producer *kebeles* in the district. In the third stage, 120 potato producer households were randomly selected from the total potato producer households in the district using Yamane (1967) sample size determination.

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

Where: n = is the sample of potato producers households that are taken from potato producer households, N = is the total potato producer households in the district (N = 4010) and e = 0.09 is the level of precision defined to

determine the required sample size at 90% level of precision. The sample sizes selected from each *kebele* was determined using Probability Proportional to Size (PPS) (Table, 1).

Table 1: Sampling Frame and Sample Size Determination

Name of Selected Kebeles	Potato Producer Households (Number)	Proportion of Sampled Household (%)	Nº of Sampled Households
Koma Bitachaa	591	15	18
Afamo	1257	31	37
Garmema	647	16	19
Gurmicho	1515	38	46
Total	**4010**	**100**	**120**

Source: DOA and own computation, 2015

Data Collection and Analysis Methods

This study used household survey data that were collected from Kofele district during the end of December 2014 and January 2015. Both primary and secondary data were used in this study. Primary data were collected from sample households by using a semi-structured questionnaire through the interview.

Secondary data regarding potato production, challenges in potato production, and potato producers' *kebeles* that were relevant for this study was gathered from Kofele district office of agriculture, CSA, and from published and unpublished sources.

Data was entered into computer software for analysis. STATA version 11 was used to manage and process the data. Descriptive statistics such as mean, standard deviations, minimum and maximum values, frequencies and percentages and econometric model were used for analyzing the data.

Variable Descriptions and Hypothesis

Table 2: Description of the Variables Used in the Analysis

Variables	Description	Measurements	Sign
Prod	DV**: Quantity of potato produced	Quintals*	
Fexperience	Potato farm experience	Year	+
Sex	Respondent's sex	Dummy (1=male, 0=female)	+
Redu	Respondent's education level	Schooling year	+
Fsize	Household's Family size	Number	-
Tlu	Livestock owned	Number	+
Lapot	Land cultivated under potato	Hectare	+
Fertapp	Fertilizer application	Quintals*	+
Potseed	Potato seed	Quintals	+
Mktinfo	Access to market information	Dummy (1=yes, 0=no)	+
Credit	Access to credit services	Dummy (1=yes, 0=no)	+
Extension	Extension services	Dummy (1=yes, 0=no)	+
Nfarm	Participation in non-farm activities	Dummy (1=yes, 0=no)	±

** 1 quintal=100 kilogram, **DV: dependent Variable*

RESULTS AND DISCUSSIONS

Descriptive Analysis

Analysis of farmers' potato production showed that from the total 120 potato producer sampled households 93% were male headed households, while the remaining 7% were female headed households. The average household family

size, potato farm experience, education level and livestock owned by the respondent were 8, 22, 5 and 8, respectively. The average land allocated for potato production and quantity of potato production was 1.38 hectares and 30 quintals, respectively. On average, the respondents were used 6.6 quintal of seed for planting potatoes. From the total sample households, 58%, 10% and 61% had access to market information, credit and extension services respectively, in the study area. Crop and livestock productions are the major source of income in the study area. In addition to this, 48% of the respondents earned income by participating in non-farm activities (Table 3).

Table 3: Descriptive Statistics of Selected Variables Used in the Empirical Analyses

Variables	Mean	Std. Dev.	Min	Max
Prod	30	23.78	3	110
Fexperience	22.10	9.69	7	47
Redu	4.80	3.62	0	12
Fsize	8.52	2.16	5	13
Tlu	7.94	4.73	0	25
Land CULT	1.38	0.69	0.13	3
Fertapp	1.33	1.10	0.1	5.75
Potseed	6.60	3.12	1	14
Mktinfo	0.58	0.49	0	1
Credit	0.10	0.30	0	1
Extension	0.61	0.49	0	1
Nfarm	0.48	0.50	0	1

Regression Analysis

The presence of multicollinearity among the explanatory variables and heteroscedasticity was tested on the regression analysis. Multicollinearity was tested using the variance inflation factor (VIF), while heteroscedasticity was checked using Breusch-Pagan/Cook-Weisberg tests (Gujarati, 2004). The results of the analyses indicated that there were no serious problems of multi collinearity among the regressor (Appendix Table, 1). Outliers were checked using the box plot graph and there were no serious problems of an outlier in the data.

Factors Affecting Potato Production

The model F-test indicates that the overall goodness-of-fit of the regression model was statistically significant at 1% probability level, which in turn indicates the usefulness of the model to explain the relationship between the dependent and independent variables. Adjusted R-square values indicate that the independent variables included in the regression explain 51% of the variations in potato production. The regression model result shows that potato production was significantly influenced by the respondent's education level, the land allocated for potato production, Fertilizer application and participation in the non - farm activity (Table 4).

Table 4: Factors Affecting Potato Production

Variables	Coefficients	Std. Err.	*P>T*
Fexperience	0.006	0.007	0.406
Sex	0.035	0.218	0.872
Educ	0.418***	0.146	0.005
Fsize	-0.011	0.026	0.679
Tlu	-0.016	0.013	0.222
Lapot	1.215***	0.177	0.000
Fertapp	0.060*	0.032	0.066

Table 4: Contd.,			
Variables	**Coefficients**	**Std. Err.**	***P>T***
Potseed	0.022	0.019	0.270
Mktinfo	-0.104	0.114	0.360
Credit	-0.133	0.181	0.466
Extension	0.076	0.141	0.592
Nfarm	0.476***	0.138	0.001
_Cons	1.614	0.330	0.000

****,*: implies statistical significance at 1%, and 10% levels, F (12, 107) = 11.30, Adjusted R^2= 0.5095, Prob> chi2 = 0.0000, N = 120.*

Source: *Model result, 2015.*

Education level had a positive impact on the farmers' potato production at 1% level (Table 4). An increase of the respondents' education level would increase their potato production by about 0.4 quintal, keeping other factors constant. This implies that the level of education enhances the respondents' potato production since education improves their production skills and knowledge. This result is in line with the findings of (Sigei, et al., 2014).

In table 4 above, the land allocated for potato production has a positive and significant impact on potato production at 1% level. This implies that one hectare additional land allocated for potato production would increase potato yield by 1.2 quintals, keeping other factors constant. The reason could be access to more arable land that encourages farmers to produce more potatoes. This result is in line with the finding of (Aman, et al., 2013).

Potato production had positively and significantly affected by the amount of fertilizer applied at the 10 % level. Farmers, who applied fertilizer at the recommended rate obtained, on average, 6 kg more potatoes than farmers who didn't apply fertilizer to their fields at recommended rate. This finding is in line with the finding of (Reyes, et al., 2012).

Participation in non-farm activity had a negative influence on the potato production at 1% level. This implies that as the respondents participated more in non-farm activity the quantity of potato production would decrease by 48%, keeping other factors constant (Table 4). The reason was that, participation in non-farm activity shares more labor and time allocated for growing potato, which results in low potato production. This finding is in line with the finding of (Sebatta, et al., 2014).

CONCLUSIONS AND IMPLICATIONS

To increase the smallholder farmers' income and reduce rural poverty, subsistence agriculture needs improvement through increasing production and productivity of potatoes. Therefore, improving the smallholder farmers' potato production is required, in order to improve access to food and sustainable livelihoods. This study has identified household level determinants of potato production in Kofele district, West Arsi zone, Oromia region, Ethiopia.

Some relevant policy implications can be drawn from the findings of this study that can help to design proper intervention mechanisms to improve the smallholder farmers' potato production in the study area.

Education plays an important role in improving the household's level potato production. Therefore, any interventions that upgrade the knowledge of the households through education and trainings have better improved farmers' potato production in the study area

The size of land allocated for potato affected the smallholder potato production positively and significantly. However, increasing the size of land cannot be an option to increase potato production since land is a finite resource.

Therefore, intervention aims to increase productivity of potato per unit area of land through proper utilization of land resource in the district. Increasing the productivity of potato per unit area of land through promoting and delivering technology packages (like fertilizer) to farmers that would increase productivity will be a better alternative for potato producers.

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APPENDIX

Table 5: Multicolinearity Test

Variable	VIF	1/VIF
Nfarm	1.55	0.644503
Fexperience	1.55	0.644951
Lapot	1.49	0.669133
Tlu	1.43	0.701727
Educ	1.41	0.710086
Potseed	1.39	0.717175
Fertapp	1.31	0.764329
Mktinfo	1.20	0.836683
Fsize	1.19	0.843745
Extserv	1.18	0.847658
Credit	1.13	0.886752
Sex	1.13	0.887102
Mean VIF	**1.33**	