RESEARCH ARTICLE

Determinants of farmer's crop choice decision in irrigation agriculture in South Tigray

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Crop choice decision under irrigation agriculture is widely subjected to a serious of household, institutional, social and economic factors. This study assessed determinant factor that influence farmers to choose crops with access to irrigation in Alamata district, southern Tigray zone of Tigray region, Ethiopia. Both primary and secondary data were collected for this study. Primary data were collected from 130 sample households from both vegetable grower and non-growers. Descriptive statistics and econometric model were employed for data analysis. Multistage sampling procedure was used to select 2 Kebeles out of 8 irrigation user Kebeles in the District. The logit model reveals that gender of the household, access to market, education level, age of the household, access to credit services and total number of livestock, distance to water sources, irrigated land size and distance to farmer training center were positively and significantly related with the growing vegetable crops by farmers. Therefore, governmental and non-governmental organization should give due emphasize to the aforementioned variables in order to increase benefit of irrigation by producing more commercial crops.

Key Words: *Irrigation; Crop choice; Logit model; Agriculture*

INTRODUCTION

Agriculture remains one of the important sectors with enormous contribution to socio-economic well-being of the world's population. The current Growth and Transformation Plan (GTP) agricultural investment areas are divided into implementation directions: scaling up model farmers' practices to all farmers, improving agricultural water use and expanding irrigation development, proper utilization of agricultural land, extensive use of labour, linking specialization with diversification, efficient agricultural marketing and increasing the production of high value agricultural commodities using medium and small scale irrigation systems to enable at least double production. Thus, the commercialization aspect is to be assisted through well-organized market linkages so that what is produced can be marketed and this needs organizational set up among farmers and development of infrastructure, market information and market institutions Ministry of Agriculture and Rural Development (MoARD) [1].

Declines in household food production are commonplace for about 60 percent of the rural population in tropical and sub-tropical countries. Therefore, there is a vital need for these countries including Ethiopia to increase agricultural productivity with sustainable management of its natural resource base to satisfy the increasing demand of food. Food production can be increased through use of various inputs like improved seeds, fertilizers, insecticides, pesticides, and irrigation. Hence, whether it comes from rainfall or irrigation, water means life in agriculture. Irrigation water increases agricultural production through both the expansion of cultivable area beyond that possible under rain-fed agriculture and higher crop yields [2].

Furthermore, irrigation has been playing an incommensurable role in widening the horizons of crop choice decisions to produce diversified types of crops. In irrigation agriculture households pursue different cropping strategies depending on their access to financial and human resources, level of knowledge and skills, and dependence on agriculture as a source of income [3]. Taking all the facts in mind, the Ethiopian government has been working on small and large dam nurtured irrigation project operations and expansions to improve agricultural productivity and production [4].

According to FAO [5] on average, crop yields per hectare under irrigated agriculture are 2.3 times higher than rain-fed agriculture.

According to EE, 2011 as cited in [2] Ethiopia in terms of land productivity on irrigated farms, the recent report on Ethiopian economy shown that the average cereals, pulses and oilseeds productivity was lowest at 1.7, 1.3 and 0.3 tons per hectare respectively, while the highest productivity was obtained in sugarcane root crop (8.5 tons), fruits (8 tons) and vegetable (4 tons) per hectare. Ethiopia has a variety of vegetable crops grown by small farmers in different agro-ecological zones, mainly as a source of income as well as for food. Commercial producers are also involved in the production, processing and marketing of vegetable. At the farm level, decision-making is basically the function of the household or the enterprise manager. They set simple and clear objective like, say, maximizing net financial return and then their decision would be to harvest crops that enable to attain their objective [6].

However, for commercialized farmers, the economic capabilities of the crop appeared significantly more influential and the decisions are often of better quality and more innovative. This indicates that the decision-making structure will vary considerably not only between different socio-economic systems but also between different stages of economic development within the same system. Therefore, Freedom to take decisions at the farm level with adequate research and information facilities will help to promote innovation and raise production. As a result, a scientific study of crop choice decision making in irrigation agriculture at the farm levels has become important.

Ethiopia has highly-diversified agro-ecological conditions which are suitable for the production of various types of fruit and vegetables. However, the contribution of horticultural crops both to the diet and income of Ethiopians is insignificant. With the aim of enhancing agricultural development, the Government considers various projects, including small-scale irrigation mainly through rainfall harvesting and home gardening, to be of crucial importance. As a result, vegetable and fruit production is being more widely adopted, primarily to ensure food security and promote production of high-value crops for the market and improving the living conditions of smallholders [7].

Therefore, smallholders' farmers in the study areas lack making decision subject to varying factors on how to allocate resources on arranging alternative crop in view of improving productivity of agriculture thereby

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addressing food insecurity of the areas though regulation of water distribution, extension advice, input supply and monitoring of schemes are in place. Hence, irrigation can have effect on crop choice decision and crop yield of the farmers. There is no documented empirical literature in the study area pertaining factors influencing the determinants of farmers' crop choice analysis under irrigation and non-irrigation situation. To fill this gap, this study has a propensity to assess the determinant factors affecting farmers to choose crops with access to irrigation in the study area [8,9].

METHODOLOGY

Sampling technique and sample size determination

Multistage stratified sampling design was used to select the respondents. First, Alamata woreda was purposively selected because of its potential for access to irrigation, and thus potential for high value vegetable crops production for market. Therefore, this study was carried out in Alamata district which comprises 8 irrigation user and 2 non-irrigation users rural Kebelle's. Out of eight (8) irrigation user Kebelle's of Alamata district two Kebelle's namely, Kulugzie lemlem and selam bekalsi Kebelle's were selected purposively by considering the irrigation potential and its representativeness in reflecting the realities of small-scale irrigation users in the district. Then the total household of each kebelles was stratified by vegetable growers and non-growers. Finally, 130 households consisting of 80 male and 50 female irrigation users were selected using simple random sampling technique from the specified peasant associations.

To determine sample size this study applied a simplified formula provided to determine the required sample size at 95% confidence level, degree of variability=0.05 and level of precision=8% (0.08).

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

Where,

n=sample size for the study (130)

N=total number of household head (784)

e=margin of errors at 8%.

Total of 130 households (80 MHH and 50 FHH) respondents were selected and interviewed.

Data type and sources

Both quantitative and qualitative data type was collected from primary and secondary data sources to obtain the necessary information for the purpose of the study. To generate the required primary data from different primary sources, research tools such as household survey questionnaires, key informant interview, and focus group discussions was employed. The secondary data sources used in this study was both hard copies and online materials which included published and unpublished materials, books, Journals and reports.

Methods of data analysis

Descriptive statistics: Descriptive statistics is one of the techniques used to summarize information (data) collected from a sample. Descriptive statistics such as, frequency, mean, maximum and minimum, percentage and standard deviation were employed to analyse the quantitative data. As inferential statistics such as, chi square was used to identify the associations between categorical variables while independent t- test was used to compare mean differences between two groups across the study variable.

Econometric model

Responses to a question in relation to choose of crops, such as whether farmers grow vegetables or not could be 'yes' or 'no', a typical case of dichotomous variable. A variety of statistical models can be used to establish a relationship between factors and choice of crops by farmers. The logit model is simpler in estimation than the probit model. Therefore, in this study a binary logistic regression logit model was used to analyze determinant factors affecting farmers to choose crops with access to irrigation, in Alamata district.

RESULTS AND DISCUSSION

Results of the econometric model

The logit model was employed in this study to estimate the effects of the hypothesized independent variables on growing vegetable crops by farmers. The results of this study confirm a prior expectation in that the decision to grow or not to grow vegetable crops was influenced by the simultaneous interaction of several personal and demographic, socio-economic and institutional factors. As it is presented in Table 1 out of 11 explanatory variables found significant in the descriptive statistics and hypothesized to determine farmers' decision to grow vegetable crops, 9 were found to be statistically significant in the model.

TABLE 1

Econometric results of explanatory variables

Variables	Odds ratio	Robust std. err.	Z	P>|z|
genhh	.0001778	.0004939	-3.11	0.002*
Agehh	55.86584	86.50787	2.60	0.009*
Educlehh	13.99713	22.44437	1.65	0.100*
Famiz	3.553245	2.99563	1.50	0.133
Mrkacc	21.0999	32.18241	2.00	0.046*
Acextser	5.52791	6.031768	1.57	0.117
Acccrid	41.48128	64.13521	2.41	0.016*
Ttnlvs	2.579617	.7941783	3.08	0.002*
Irrlasz	532.7824	842.7908	3.97	0.000*
Diswars	.3517102	.0972869	-3.78	0.000*
Disftc	.1092414	.06023	-4.02	0.000*
_cons	.0000121	.0000794	-1.73	0.084
Selection rule is	Vegetable grower=1			
Number of observation	130			
Prob >F	0.0000			
R-squared	0.9025			

Note: *significant at the 1% level.

Interpretation of econometric result

Gender of the household head: The study result revealed that this variable is statistically significant at 1% significance level that means MHH are more participate in vegetable production than FHH. This implies that females of the study area as females of elsewhere have triple burden (production, reproductive and childcare), and also, they have less access to information about the technology then due to the case of sex difference of household head has influence in the level of income of households.

Age of household head: The age of household head is significant at 1 percent level meaning that, older farmers are more likely to have higher interest to grow vegetables than younger farmers. This shows that older farmers tend to associate more with crops known for their nutritional and health benefits unlike younger farmers whose main interest in an enterprise is income and profitability.

Irrigated land size: The regression result also shows that irrigable land size variable is significant at 1% level of significant and positively related to growing vegetable crops. Many agricultural practices require substantial economic resources, among which land is the most important one. This is because of the reason that, a farmer who owns larger size of land can allocate part of it to try out new practices.

Education level: For this study the education variable (Educlehh) is positive and statistically significant influence on farmers to grow vegetable crops, at 10 % level of significance. The result of this study shows that farmers who have better education are involved more in vegetable production. In many studies, education plays a significant role in skill acquisition and technology transfer and farmers with higher levels of education were likely to be more efficient in the use of inputs than their counterparts with little or no education.

Livestock holding: This variable was found to influence vegetable crops production positively and significantly, that means this variable is consistent with the original hypothesis. This variable is statistically significant at 1 percent probability level. The positive relationship indicates that households with larger livestock holding may have money to spend on any possible costs to use irrigation.

Access to credit: Access to credit influences the decision making of farmers to grow vegetable crops positively and significantly at 5% level of significance which means that an additional unit of credit will increase the level of irrigation user's involvement in vegetable production activities by about 41.48 units. This is because of farm activities require funding and credit is one source of funds.

Access to market information: The output of the model shows that this variable is statistically significant at 1 percent probability level and the coefficient is positively related with growing vegetable crops than others by the household head and the result is consistent with the prior expectation. The positive relation of this variable shows that the probability of growing vegetable crops use of irrigation water by household head is higher when they have access to market information than those household heads who have no access to market information.

Distance to irrigation water sources: The model result shows that the distances of the scheme from the residence of household head is statistically significant at 1 percent probability level and positively related. The result show that a one percent increases in the distance to irrigated water source reduces the probability of growing vegetable by 35.17102 percent. The household heads that live near the irrigation scheme have more chance to use irrigation water and have better probability to cultivate vegetable crops than those household heads that far from irrigation water considering that households near the irrigation scheme do not incur additional costs of transportation and traveling time.

Distance to FTC: Which is taken as proximity to farmers training center is statistically significant at the 1% level of significance and it positively affects Vegetable production involves of the household head. In fact the distance of the FTC constrained the households to get important information on agricultural products and those households that are far apart from the farmers training center might discourage to participate in Vegetable production. The more distant the market the household heads would less probably participate in irrigation.

CONCLUSION

Crop choice decision under irrigation agriculture is widely influenced by serious of household, institutional, social and economic factors. It was primarily attributed to the factors of length of crop maturity period, crop in-home utilization and access to market, as irrigators demand to grow short season crops with a primary concern for home utilization followed by income generation.

In this study, determinant factors affecting farmers to choose crops with access to irrigation in Alamata district has been assessed using data collected by key informants, focus group discussion, and HH survey for this purpose. Primary data were collected from 130 sample households from both vegetable grower and non-growers. In order to explain this binary variable, it is necessary to construct a model that relates the dependent variable to a vector of independent variables. The logit model was employed in this study to estimate the effects of the hypothesized independent variables on growing vegetable crops by farmers. Therefore, Binary Logistic Regression Model was used to identify determinant variables in decision making of farmers to choose crops. From the empirical evidence analyzed by logit model shows that gender of the household (genhh), access to market (mrkacc), education level (educlehh), age of the household (agehh), access to credit services (accred) and total number of livestock (ttlvs), distance to water sources (diswar), irrigated land size (irrlasz) and distance to FTC (disftc) were positively and significantly related with the growing vegetable crops by farmers. The other two variables were not significant. The only difference is that degrees of significances vary for each determinant, some are very strong (1%) and some are slightly strong (10%).

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AUTHORS' CONTRIBUTION

Workie Sahlu was involved in literature search, figures, development of overall research plan, study design, data collection, data analysis, data interpretation hypothesis generation and idea development, she provided the validated questionnaires; Moges Girmay was involved in data collection, data analysis, data interpretation, supervision and data analysis and revision of the paper; and he wrote the paper.

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