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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

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APPENDIX/ANNEXURE

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- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

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DETERMINANTS OF SMALLHOLDERS' PARTICIPATION IN LOCAL BASED SEED PRODUCTION SYSTEM: THE CASE OF ONION SEED IN EAST SHOA ZONE OF THE OROMIYA NATIONAL REGIONAL STATE, ETHIOPIA

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ABSTRACT

Lack of access to improved seed is one of factor for low adoption and thus low crop productivity of farmer in Ethiopia. In order to solve farmer access to improved varieties of vegetable seed, Ethiopian Institute of Agricultural Research involved in facilitating a relatively easily accessible source by improving farmer seed systems through which improved varieties of vegetable seed produced locally by farmer. However, seed supply from this seed system is still low to meet the demand of farmer the region. This study aim to examine determinates of small-scale vegetable producing farm households' decision to participate in improved onion seed production in East Shoa Zone of the Oromia regional state, Ethiopia. The article makes use of data obtained from a random cross-section sample of 80 small-scale farmers and apply Heckman econometric model to analyze the data. This model helps us to incorporate possible sample self-selection bias and to separate the decision made by farmer. Results of the study show that, experience in cultivation of improved onion varieties, access to credit, land and livestock holding play a significant role in determining household decision to participate. Once household decide to participate, an increase in the land allocation to onion seed took place when the area under irrigation increased, when the household had access to training, when an incentive from market through price increased and increase in family size. An increase in age of household head decrease both the likelihood of participation and land allocated to onion seed production. Improving marketing outlet for seed and vegetable, access to credit and training is important to promote seed production by small scale farmer.

KEYWORDS
local based seed production; Hickman model; improved onion seed varieties.

1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Increasing agricultural productivity perhaps remains the most important determinant of economic growth and poverty reduction, and hence, provides a key to millennium development goal (Solomon *et al.,* 2010). This is especially important in Sub-Saharan countries of Africa, where agriculture underpins the livelihood of the majority of poor but agricultural productivity has continued to decline over the last decades and poverty levels have increased (Olwande *et al.,* 2009*).* Thus, the path out of poverty trap in these counters depends on the growth and development of the agriculture sector. Achieving agricultural growth and development will not be possible without yield enhancing technical options because it is no longer possible to meet the needs of increasing numbers of people by expanding areas under cultivation (Shiferaw *et al.*, 2008).

Fertilizer and improved seed are generally most important yield enhancing technologies. Of all technologies, improved seed is critical basic input in agriculture (Monyo *et al.,* 2003). Failure to use appropriate seed, while investing sufficiently on other inputs and management practices, usually yields against expectations. Since the physical and genetic quality of seed can affect production, positively or negatively, for many seasons into the future (Tripp, 2003). Therefore, as a powerful agent of change, improving the genetic and physical properties of seed can be a means of overcoming production constraints, thereby making a difference in the lives of the poor (Pichop, 2007).

Availability of quality seed of improved varieties at required amount and affordable prices to farmer is important to accelerate the adoption of these varieties. Hence, the programs that multiply and market improved seed need to ensures that quality, availability, and affordability to smallholder (Jones, 2007). Empirical evidence also indicate that enhancing access to improved varieties of seed to farmer is an integral factor for stimulating technology uptake and increasing agriculture productivity in smallholder agriculture (Asfaw *et al.,* 2010). Nevertheless, smallholders striving to benefit from this improvement in technology and to respond to increasing demand for food are often frustrated by lack of access to quality seed of preferred types and varieties. According to Tripp, (2003) weak seed supply system in many Sub-Saharan countries of Africa has been identified as limiting factors for widespread adoption of improved varieties.

In smallholder agriculture, the seed supply system comprised of two sources. The primary seed source is what farmers save from previous harvests and others, usually local varieties. It comprises all forms of seed production, exchange, storage and savings through which farmers produce, disseminate and access seed (Cooper & Cromwell, 1994). The advantage of informal seed sources are that seed quality is known, the seed is readily available and it is cheap (Tripp, 1994). Another component of the seed system is the modern component (formal seed system), associated with the provision of improved varieties.

Even though informal seed systems prove very valuable to supply large quantities of seed, they appear to have neglected some quality aspects (Lipper *et al.,* 2005) and characterized by costly storage (Lewis & Mulvany, 1997). Modern component of the seed system is also characterized by positive transaction costs to access, indicated by factors like costly supplementary inputs, costly experimentation, seasonal liquidity and family labour constraints (Moser & Barrett, 2003). It also confined to only a few crops, or supplies inappropriate varieties. Positive transaction costs in the already existing seed system constitute an imperfect seed system, which leaves room for improvement in terms of provision of a relatively easily accessible source.

Recent literature has identified a number of strategies for overcoming the high transaction costs smallholders face to access improved seed (Dawit *et al.,* 2006; Tripp, 2003 and Mintewab, 2005). One example of such strategy is local based seed production, an institutional arrangement that offer farmers' participation in production and distribution of improved seed for local market. The method is based on the assumption that production of improved varieties by farmer can contribute in alleviation of poverty in many way; One, by producing improved seed in environment that the crop grow will improve the adaptability of crop to the environment Second; it increase the seed security by improving access to seed, Third; improve the income of the farmer who are involved in production of seed by generating lucrative profit.

In the case of Ethiopia, Melkassa Agricultural Research Center (MARC) of the Ethiopian Institute of Agricultural Research (EIAR) has been promoting vegetable seed production in East Shoa. The Institute provides training to farmers in vegetable seed production and organizes them in Farmers Research Group so that they can engage in seed production ((Dawit *et al.,* 2005). The aim was to improve farmer seed systems through which improved varieties of vegetable seed is

accessible to farmer vicinity. The benefit of local based seed production for country like Ethiopia, under which the dominant part of vegetables are produced from imported seeds is more, by saving foreign currency, reducing seed price, increasing farmer income from increased crop productivity (Dawit *et al.,* 2005). Besides improving, availability vegetable seed, to address the long-term need, to improve food security and livelihood of poor farmers in remote areas of Ethiopia, production of high-value commodities such as vegetable seeds, is also promising strategies to promote economic growth and poverty reduction (Moti, 2007).

As use of farmer based seed production approaches grows, there is a need to understand how they affect the smallholder. There has been little empirical verification to date. However, a recent review found mixed evidence of the effectiveness of farmer based seed multiplication in facilitating poor farmers' access to seed and poverty reduction. As noted by Tripp (1994), the existence of the seed scheme may do little to local community in improving the price of seed supply in their immediate vicinity, because the seed is usually transported out of the area for processing and distributed using the national input distribution network, which may or may not cover the local area.

Subsistence agricultural producers also face several barriers that make it difficult for them from participating in seed production. According Tripp **(**2003), smallholders' capacity to produce seed efficiently and on a modest scale may be limited by their lack of resources (land, labor, time, and capital). For example, to cultivate one ha of onion seed, it requires 80-90 qt of mother bulb as input (Lemma, 1998) which is expensive. Moreover, the availability of training and extension service which could make an endeavor more likely to succeed, which may also present additional barriers to participate as vegetable seed production is a highly technical and skillful operation. According to FAO (2004), local based vegetable seed enterprises have contributed to increase in production by 20-30% and have generated 2-3 times more income than cereal crops from the same piece of land, other production factors remaining the same. Similar result is also found in India by Sudha *et al* (2006), where Commercial vegetable Seed Production by farmer increase income of producer and provide employment generation. Seed has also enhanced the family welfare through increased income to the family, helping the farmers to reinvest into agriculture, providing better living and health conditions to the family and attaining better status in the society. Therefore, small and poor farmers in remote areas are motivated to engage in vegetable seed production and marketing.

Hence, it is fact that the seed sector appears to hold enormous untapped potential for smallholder seed producers and, in particular, opportunities to alleviate poverty trap through devising strategies that will enable increased entry and sustained profitability from emerging seed markets. Thus, it is imperative to create favorable conditions so that a greater number of farmers can take advantage. One of the most important steps towards this goal is understand factors that determine whether households are participating or not and, how this factor affect level of participation would, help to design policy that aim to motivate and increase the participation of farmer in the seed sector. Nevertheless, so far studies on the determinants of farm household decision to participate in local based vegetable seed production in Ethiopian are limited to support policy makers. Thus, identifying these factors is necessary if there is a need to address and to create a capacity that will enable to realize the advantage of local based vegetable seed production in the country.

1.2. OBJECTIVES OF THE STUDY

The general objective of this study is to understand the factors that increase farm household decision to participate in local based onion seed production by small-scale vegetable production systems. Accordingly the specific objectives are**:**

- To identify factors that determine the probability of farmers` decisions in the participation local based onion seed production.
- To identify factors that affect the intensity of participation in local based onion seed production by vegetable producing farm household.

2. METHODOLOGY

2.1 STUDY AREA

The study was conducted in two districts of East Showa Zone of Oromia Regional State of Ethiopia. East Shoa zone is located in the southern parts of Oromia Region State. East Shoa Zone has an area about 14,050 km^2 that is divided into 11 districts and three administrative towns. The estimated population of the zone in 2006 was about 1,357,522 2,475,945 (economically active age group 15-64 was about 52.4%); and the average family size per household was about 5.2 person (CSA, 2006). The two study areas, Adama and Dugda broa districts are located in the eastern and southern parts of Oromia regional state of Ethiopia. Dugda bura is located between $8^0$01'to $8^0$25'N Latitude and $38^0$32'to 39^0 04'E Longitude, and Adama distract lies between $8^0$14'-$8^0$14'N latitude and $39^0$4'-$39^0$25'E longitude.

The 2008 national census reported a total population for Adama and Dugda bura distract of 155,321 and 144.849, respectively. Their total areas are respectively 1,007.66 and 73657 square kilometers. These zones are among the surplus producing parts of the country and they supply a considerable volume of vegetables to other parts of the country and for the export markets. They have relatively better marketing networks due to their proximity to better roads and irrigation sources

2.2. DATA AND SAMPLING

To identify the factors that influence household decisions to participate and the level of participation in local based onion seed production, a multistage stratified random sampling technique were used to select districts, *Kebeles* and draw farm households. In the first stage, purposive sampling was used to select sample districts from Eastern Shoa Zone. Accordingly, Adama and Dugda Bora were selected as the study site, where onion and onion seed is an important cash crop. These districts represent one of the major vegetable crop growing areas in the country where improved varieties are adopted by farmers. However, smallholder producer in Ethiopia particularly, district face challenge due to low productivity and high price of imported seed. Under the current situation, the dominant part of vegetables is produced from imported seeds, which have low quality and high price. Even if, research results showed that almost all types of vegetable seed can be produced in the country, production and productivity by smallholder constrained lack of access to quality seed (Lemma, 1998). Vegetable seed production depends on location and growing season, and these districts were identified as ideal place for onion seed production in Ethiopia based on experimental result found by MARC.

In the second stage, from selected districts, five *Kebeles* with onion seed production experience is selected. In this process all *Kebele* administrations with experience in seed multiplication were first identified in consultation with MARC and woreda BoARD in Adama and Dugda Bora. Then, two *Kebeles* from Adama and three *Kebeles* from Dugda Bora district were selected for the study using simple random sampling. Sampling of households was carried out considering two sampling frame: participant and non- participant categories giving the relative homogeneity of the sample respondents in terms of their participation status in onion seed production. A farmer who is engaged in onion seed production in 2008/9 production season is considered as participant in seed production. Finally, 40 sample respondents from each stratum were selected randomly with a total sample size of 80 households.

Both primary and secondary data sources were used for this study. The primary data were collected from farmers using a semi structured questionnaire. Information on household, farm and institutional characteristics, which are expected to explain farmer decision behavior regarding participation in local based onion seed production, was collected. Secondary information that could supplement the primary data was also collected from published and unpublished documents.

2.3. METHODS OF DATA ANALYSIS

2.3.1 ECONOMETRIC MODEL SPECIFICATION

The main aim of the study is to examine factor that increase farm household decision to participate in local based onion seed production. The decision to participate and the extent of participation in improved seed production represent two decisions, although they might simultaneous in time. Accordingly, the decision taken by household on "how much land to allocate in seed production?" follows the decision to produce onion seed (participation) along with respective potential determinant factors. However, land allocated to cultivate onion seed is observed only for a subset of the sample population, the potential exists for the sample selection problem referred to as incidental truncation, *i.e.,* households with seed production observations are likely not to be a random subsample of the population. Statistical analyses based on those non-randomly selected samples can lead to erroneous conclusions and poor policy. For the purpose of identification of the determinant factors Tobit and Heckman's sample selection model can be employed.

The traditional approaches to deal with data that have too many zeros, yielding a censored dependent variable, has been to use the standard Tobit model, originally formulated by Tobin (1958). The model permits incorporation of all observations including those censored at zero, without considering the sources of the zeros. As this ignores the zero observations due to respondents' non-participation decisions, applying the Tobit model imposes the assumption that all the zeros arise from other factors alone (such as economic and demographic characteristics of the respondents) (Newman *et al.,* 2003)

Heckman (1979) proposes a model that addresses the problem associated with the zero observations generated by non-participation decisions, arguing that an estimation on a selected subsample (i.e., censored estimation) results in sample selection bias. The model overcomes this problem by undertaking a two-step estimation procedure (known as *heckit*). In this estimation, a full sample probit estimation is followed by a censored estimation carried out on the selected subsample. While the first estimates the probability of observing a positive outcome (known as the selection or participation equation), the second estimates the level of participation conditional on observing positive values (known as the conditional equation) (Wooldridge, 2006). The model assumes that different sets of variables could be used in the two-step estimations. As opposed to the Tobit model, Heckman's (1979) model considers the zero observations to arise mainly from respondents' self-selection. In other words, this means that all the zeros come from the respondents' deliberate choices.

Hence, in this study, the specifications of the empirical models used to determine the factors influencing households' decision to enter into local based onion seed production and their level of participation in the seed production conditional upon their entry into the participation follows the selectivity models. In selectivity models, the decision to participate in the local based seed production can be seen as a sequential two-stage decision-making process. In the first stage, the probability of participation was modeled by Maximum Likelihood, from which inverse Mill's ratio is estimated. In the second-stage, the estimated inverse Mill's ratio (IMR) is included as right-hand variable in the corresponding intensity of participation model (Maddala, 1983). Specifications for the empirical probit and regression models are discussed next. Standard probit model to assess the household decision to participate or not in local base seed production follows random utility model and its specification is given below following Wooldridge (2006). The Probit model is specified as;

$$Z_i^* = \beta_i X_i + \mu_i \qquad 1$$

Z_i = 1 if Z_i^* >0

Z_i = 0 if Z_i^* < 0

Where, Z_i* is a latent (unobservable) variable representing households' discrete decision whether or not to participate in the local based seed production, it is associated with the desired level of participation or utility derived from seed production; Z_i : is a discrete response (dependent) variable for status of households' participation in the local based onion seed production which takes on the value of 1 if the household participates and, 0 otherwise; β is a vector of parameters to be estimated which measure the effects of various explanatory variables on the household's decision whether to participate or not: U_i random error term with zero mean and constant standard deviation.

The sample selection bias, what Heckman (1979) refers to as the inverse of Mill's ratio, is computed from the parameter estimates of the selection equation for each observation in the selected sample (Greene, 2003), and is represented by:

$$\lambda_i = \frac{\phi(Z_i)}{\Phi(Z_i)} \qquad (2)$$

Where, ϕ and Φ are the density and distribution functions, respectively. The estimated Inverse Mills Ratio (λ_i), used as an additional regressor in the second stage, in the model of level of participation in local based seed production using land allocated to seed. The significance of the inverse mills ratio in the level of participation model is the test for sample selection bias. The null hypothesis is that there is no sample selection bias, i.e. μ =0. If a simple t-test suggests that μ is not statistically significantly different from zero, then we can conclude that sample selection bias is not a problem. More precisely level of participation model is specified:

$$Y_i^* = \beta_i X_{2i} + \mu\lambda_i + \eta_i \qquad (3)$$

Where; Y_i is the amount land allocated to onion seed production, X_{2i} are the explanatory variables determining the amount land allocated to seed production; β_i and μ unknown parameter to be estimated; η_i the error term in the second stage.

According to Wooldridge (2006) the first stage of Hickman model must contain at least one explanatory variable that is not included in the second stage of model, which is known as identification restriction; therefore, a variable must be found which affects the decision to participate on seed production activities but does not affect the level participation (land allocated). The purpose of exclusion variables is to reduce the correlation among the regressors in the second-step estimation.

Variance inflation factor (VIF) and Contingency Coefficients (CC) were used to test for collinearity among continuous independent variables and for dummy or discrete variables respectively (Gujarati, 1995).

2.3.2 VARIABLES USED FOR THE EMPIRICAL MODEL

Once the analytical procedures and their requirements are known, it is necessary to identify the potential explanatory variables and describe their measurements. Accordingly, key variables that are expected to have influence on households' decision to participate in production of improved onion seed, and condition on participation, their level of participation are explained below.

TABLE 1: DESCRIPTION OF VARIABLES INCLUDED IN THE MODEL

Variable	Variable Description	Variable Measurement
AGE	Age of the households head	Number of years
EDUCATION	Education level of households head	In grade level
EXPERIENCE	Experience in production of improved onion varieties	Number of years
FMSIZ	Household size	In man-equivalent
CREDIT	Whether a household received credit during the cropping year.	Dummy(1=Received,0 otherwise)
LAND	Size of cultivated land owned	Hectares
Leasd Land	Total size of Land leased-in during cropping season.	Hectares
TLU	Total livestock owned excluding oxen.	Tropical livestock unit
OXEN	Oxen owned by respondent.	Number
TRAINING	Whether a household participate in training	Dummy (1=Received, 0 otherwise)
NON/OFF-INCOME	Amount of annual income from Non/off farm actives.	Birr
PRICE	Lagged price of seed in the market	Birr
MARKET	Distance from the household to nearest market.	Kilometers
IRRGLAND	Proportion land under irrigation	Hectares
Woreda	Whether a household live in Adama or Dugda Bora district.	Dummy(1=Adama,0 otherwise)

3. LITERATURE REVIEW

There is a large empirical literature showing that socio-economic characteristics of farm decision makers and farm households influence production decision making. One strand of the literature uses various measures of human capital (experience, years of schooling) as explanatory variables (Huffman, 2001). A second strand of literature introduced farmers' risk attitudes as a factor influencing decision making, and researchers have hypothesized that attitudes toward risk and other attitudes that affect decision making vary across farmers, perhaps systematically with wealth, education, experience and other personal characteristics (Sunding and Zilberman, 2001). Another strand of literature is based on the household production model, where in production decisions are modeled as non separable from other household decisions (Strauss and Thomas, 1995). According to this approach, any feature of the farm household (e.g., family size and composition, demographic characteristics, financial characteristics, etc.) could impact farm production decisions. In this section, we review some empirical studies undertaken in the past that related to this study is presented.

Gezahagn (2008) in his is study in the SNNP region in Ethiopia identifies major factors that determine the seed multiplication by farmers using Tobit econometric model for four major crops (wheat, coffee, apple and potato). The study found that access to credit and oxen ownership is important factors that increase the propensity to participate in seed production. In same way, human capital variables such as literacy; information sources such as agricultural extension, and distance from market and main road influence significantly farmers' participation decisions and intensity in seed multiplication. Farmers with more land had a higher probability of adoption, probably because they are wealthier and have more land to experiment with improved seed multiplication. Extension visits also resulted in a higher probability of adoption by raising farmers' awareness of new wheat varieties. However, this study did not recognize the potential sample selection bias and the difference in key variable influencing two decisions.

Teklewold *et al.* (2006) conducted a study using Cragg's double hurdle model to determine factors influencing the rate and intensity of adoption of poultry technology by assuming that the two decisions processes were separate. Results of the studies indicate that there were different sets of factors behind the decision to adopt and the decision about to which extent to do so.. In the same way Shiferaw *et al.* (2008), uses the augmented double-hurdle model for technology adoption under seed access constraints and the economic impacts of improved pigeon pea varieties in Tanzania. The study identifies the crucial role of seed access (local supply), extension, education, participatory decision making, capital, and household assets in determining adoption decision of farmers. Asfaw *et al.* (2010), follow the same analytical model to analyze the determinants of adoption and intensity of Chickpea technologies in Ethiopia. They also estimate the causal impact of technology adoption on market integration by utilizing treatment effect model; regression based on propensity score as well as matching techniques to assess results robustness. The result of the analysis demonstrated that knowledge of existing varieties, perception about the attributes of improved varieties, household wealth (livestock and land) and availability of active family labor force play a significant role in enhancing the level of adoption of improved chickpea varieties. The study also revealed that integration into output market is also positively associated with household wealth and availability of active family labor force and negatively associated with age of household head and distance to main market.

The factors that influence household decisions to produce cooking banana for market in southeast Nigeria were examined by Tshiunza *et al.* (2001) using Tobit. Tobit regression analysis revealed that the price and the ripening stage at sale of cooking banana, as well as the presence of middlemen in the marketing chain were the most important determinants of the proportion of cooking banana planted for market. This indicates that cooking banana growers readily respond to market forces. Age and gender ownership of cooking bananas also influenced the proportion of the crop planted for market. Increased involvement of wholesalers and processors in the marketing chain of the crop will probably enhance its market in the region. A study by Ouma (2006) was undertaken to identify key factors in the adoption of improved maize seed and fertilizer as well as the intensity of use of improved maize seed and fertilizer. Logit econometric models were used to explore factors influencing adoption and Tobit models for intensity of use of the improved varieties and fertilizer. Access to credit was positively related to adoption and intensity of use of the two inputs. Extension contacts positively influenced the likelihood of adoption of improved maize seed, while amount of planting fertilizer used positively influenced both the adoption and intensity of use of improved varieties. Distance to market negatively determined the adoption and intensity of use of fertilizer. In addition gender and access to hired labour had negative impacts on the intensity of use of fertilizer.

More recently, Messay (2010), employed the double-hurdle model to analyze the determinants of household decision to participate in local seed multiplication, and the level of participation decision, once they decide to participate in seed multiplication. According to this study access to hired labour, distance to the main road, access to input supply and field day visit impacted the first binary decision of whether or not to participate in wheat seed multiplication farming. Only distance to the main road were found to determinants of farmers' participation negatively and significantly related to the in seed multiplication. On the other hand, intensity of farmers' decision to participate on the seed multiplication was influenced by number of oxen owned, access to complementary input and field day visit.

4. RESULTS AND DISCUSSION

4.1. HOUSEHOLD, FARM AND INSTITUTIONAL CHARACTERISTICS

Table1 presents the descriptive statistics of selected household, farm and institutional characteristics of sampled households by participation status in seed production. Some of these characteristics are explanatory variables of the estimated models that we will be presented further on.

From total sampled (80) farm households about 50% are participants i.e. planted improved onion seed varieties for seed production during 2008/9 cropping season. The amount of land that used to produce improved onion seed varieties is about 0.36 ha for seed producer households. Average age of sample households head is about 43.31 years and 7.5% female- headed. The results show the existence of significant difference in the age and gender of the household head between participants and non-participants although the group does not vary in terms of their marital status and family size. The average years of farming experience in the production of improved onion varieties is 7.80 years and the difference is statically significant suggesting the importance of previous experience with the yield enhancing technology or familiarity with the onion seed production for participation in seed production. Since improved varieties crops

have been produced for a longer period, it is believed that smallholders have the technical know-how and experience in the production of these commodities. Thus, new seed production enterprise selection for this crop could not constrained by lack of knowledge.

TABLE 2: DESCRIPTIVE STATISTICS OF SAMPLE HOUSEHOLDS

Variables	unit	Non-participants	Participant	t-value
Household characteristic				
Age	years	46.6	40.02	-2.65***
Family size	count	6.37	7.16	1.16
Education level	count	3.9	6.72	3.61***
sex	1/0	0.88	98	2.85**
Experience in onion	years	6	7.8	2.5***
Experience in seed	years		3.03	
Farm characteristic				
Labor availability	AEV	2.96	3.51	1.71
Non/Off income	Birr	1532.2	4968.25	3.21***
Rain fed land	ha	0.74	1.39	2.40**
Irrigated land	ha	0.45	0.9	3.40***
Non oxen tropical livestock unit	TLU	4.47	6.46	2.33**
Oxen	number	2.13	2.6	1.66
Ownership of pump	1/0			
seed land	ha		0.36	
Institutional characteristics	1/0			
Access to extension	1/0	55	72.5	2.61
Training	1/0	27.5	52.5	5.20**
Formal Credit	1/0	35	55	3.23*
Market distance	Km	7.75	8.2	-0.43

***, ** and * indicate statistically significant at 1%, 5% and 10% probability levels, respectively.

Education level of the heads of households is also important in influencing production decision by farm households. The result depicts that there is statistically significant difference between them, where participant have better level of education achievement, on average about 6.72 years of formal schooling, than non participant who had on average 3.90 years of formal schooling. The participants groups are also distinguishable in terms of productive assets holding whereby by participants own more irrigated land, ran-fed land, livestock and ownership of water pump. And households with larger asset holding are likely to be wealthier. This suggests that household wealth might be correlated with decision to participate. No significant difference is observed in number of oxen.

Farmers' knowledge and technical skills regarding seed production might be one of important factors that influence decision to involve in this sector. Hence, Access to training is one means to impart knowledge and develop skill of farm household and result also depict a systematic association between decision to participate and access to these services. However, there is no significant difference in terms of access to extension that usually involves in general agriculture although non participant households were located relatively nearer to market places. Fifty seven percent of participants had access to credit from formal institution compared to 45% of non participants in the year of 2008/9 GC. The chi-square test showed a significant difference between access to credit and participation in seed production. Moreover, significantly larger proportion of seed produce also engages in off-farm employment. The simple comparison of the two groups of smallholder suggests that participants and non-participants differ significantly in terms of some proxy household, farm and institutional characteristics.

4.2. SEED PRICE AND QUALITY ADVANTAGE OF ONION SEED BY FARMER

Table 3 (appendices) summarizes the relative advantage of locally produced seed in terms of price and germination. The farmers in the study area have expressed different views about the importance of the vegetable seed production in reducing price. From total seed producer, about 58% of them claimed that their seed price low as compared to the available seed on the market while only 47.5% of the non producers claimed the same response. Their differences were found to be statistically insignificant.

The survey also indicated that 27 percent of participant and 30 percent of non participants considered the locally produced seed price expensive. However, almost all farmers prefer seed produced by farmer due to high germination rate as compared to market seed (Table 2). Study by Mulugeta (2007) in East Shoa indicates that poor quality of seed forced farmer to use high seedling rate, aiming to compensate for poor germination. Hence, to avoid additional cost from using high seed rate and possible lose due to poor germination, farmer are willing to pay high price to those farmer who are recognized by community as best seed producer. According to Table 3, only six of the farmers were observed to show they are indifferent as far as the seed are of good quality.

4.3. ECONOMETRICS RESULT

4.3.1. DETERMINANTS OF PARTICIPATION IN LOCAL BASED ONION SEED PRODUCTION

Prior to the estimation of the model parameters, the presence of multicollinearity problem among the independent variables was checked. This was done using variance inflation factor (for all variables) and contingency coefficient (only for dummy variables). The result shows that the data had no serious problem of multicollinearity, and then the data analyses were carried out using STATA version 9. The results of probit model for determinants of household decisions to participate in onion seed production is presented in Table 4. The table reports the estimated coefficients, Z-value, Marginal effects (the effect of a unit change in each independent variable on the probability of participation) and some goodness of fit measures for the model.

TABLE 4: MAXIMUM LIKELIHOOD ESTIMATES OF THE PROBIT MODEL

Category	Variables	Coefficient	Z - Value	Marginal Effect
Household	Age	-0.1652***	-2.6100	-0.0624
characteristic	Education	0.0262	0.2700	0.0099
	Experience	0.2289**	1.9100	0.0865
	Non/Off-Income	0.0001	0.9100	0.0000
	Labor availability	0.3144	0.9800	0.1188
Farm	Leased-in Land	1.0625	1.6400	0.4016
characteristics	Irrigated land	1.2736	1.2500	0.4814
	Land	1.0663**	2.2900	0.4031
	Oxen	-0.5606	-1.2500	-0.2119
	TLU	0.2543**	2.2300	0.0961
Institutional	Training	-0.2588	-0.3800	-0.0984
characteristics	Credit	1.3748**	1.9800	0.4751
	Extension	0.3339	0.5100	0.1273
	Market	-0.0148	-0.2300	-0.0056

	Woreda	1.9257***	1.7800	0.6350
	Cons	-0.0627	-0.0300	0.0000

Number of observation = 80 Prob > chi2 = 0.0000 LR chi2 (15) = 69.58
Log likelihood = -20.659906 Pseudo R^2 = 0.6274
Predicted success: Participants =85.71%, Over all predicted Success = 87.50% Non-participants =89.47%
***, ** and * indicate statistically significant at 1%, 5% and 10% probability levels, respectively.

Various goodness of fit measure was checked and validate that the model fits the data. First, the log-likelihood ratio test is applied to assess overall joint significance of the independent variables in explaining the variations in farm household likelihood to participate in seed production. The null hypothesis for the log-likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness-of-fit of the probit model are statistically significant at 1% probability level. This shows that jointly the independent variables included in the probit regression model explain the variations in the household's probability to participate in seed production. Second, the McFadden's Pseudo-R^2 is calculated and the obtained values indicate that the independent variables included in the regression explain significant proportion of the variations in the household's likelihood to participate. The probit model explains 63% of the variations in the likelihood of households' decision to participate. Third, the correct prediction rate of the probit model is obtained. The results also showed that probit model predicts about 87.5% of cases correctly in to participant and non-participant categories. The correctly predicted participants and non-participants of the model were 85.71% and 89.47%, respectively. The probit regression estimates confirm that the probability of participation is influenced by a wide range of factors.

From household characteristics, age of the household head is observed to decrease the likelihood of household decision to participate. This implies as age of the head increase, the propensity to participate in production of onion seed decrease. The logic for negative effects of age on propensity of participate is not unreasonable, given the notation of life cycle in which younger people tend to be more innovative, motivated, and energetic, whereas older people become satisfied with the status quo (Doss, 2006). This negative effect of HHH age is consistent with Yami (2010) for wheat seed varieties in Ethiopia.

Experiences in improved onion production were used as proxy in farming experience in terms of modern technology and familiarity to onion seed technology, and turned out be as expected, a positive relationship with likelihood of household decision to participate in seed production. Those households who have been engaged in cultivation of improved crop varieties for longer period of time are more willing to participate in seed production of this crop variety than farmer with short experience or late adopter. Since those farmer with longer previous experience in production of improved varieties of crops it is believed to have the technical knowhow and experience in the production of these commodities. Thus, introduction of new seed production enterprise of this crop is more likely to happen, because they gain more benefit as they are in better position to understand the production method/technique and the advantage of seed cultivation than inexperienced households. As noted by Marra et al. (2003) risk associated with adopting a new technology can be associated to a lack of knowledge on how to use it, a lack of experience using it, and uncertainty about the potential benefit of the innovation.

Farm characteristics measure wealth, both in terms of capital endowment of factors of production and as a buffer to mitigate any production and market related shocks, are cited as influential determinants of agricultural production (Schultz, 1964). In this study, two of the farm characteristics variables were found to be significant, namely, farm size, and total livestock owned.

The likelihood of cultivating onion seed increases with landholdings. This is consistence with hypothesis, households with larger farm size are likely to be wealthier, with the ability to self finance the purchase farm input and can afford to take greater chance which makes investment in new technology feasible, such as onion seed production (Moser & Barrett, 2003). A 1% increase in farm size increases the probability of participation in seed production by 40 percent.

The coefficient of total livestock holding is observed to influence positively the decision to participate in onion seed production and statistically significant at 5% probability levels. Livestock ownership can serves the farmer as buffer against any unexpected risk that might associated with the participation in new enterprise like onion seed production and also helps farmers to minimize their liquidity constraint to participate. These results for total available land and livestock are in agreement with similar studies by Gezahagn (2008), who identified size of cultivated land and livestock as the most prominent variable explaining participation decisions by farm household in wheat and apple seedling multiplication.

Participation in capital market (borrowing from formal institution) has positive correlation and significant at 5% level; suggesting that relaxing liquidity binding constraints among vegetable producing households through access to credit will significantly increase their probability of participation in local based onion seed production. The most important implication related to the impact of access to credit is related to nature of onion seed production which is characterized by longer gestation period and cash intensive enterprise. This further aggravated by need to purchase the mother bulb, which is normally more costly than the onion seed (amount required to plant per ha). This indicates why access to credit is observed as an important determinant of participation in onion seed production. Similar results were found by Gezahagn (2008) for improved wheat seed and Yami (2010) for improved potato variety by farmer.

Finally, District dummy coefficients have a negative sign and statistically significant. Farm household who live in Dugda Bora district are less likely to participate in seed production than farmers in Adama district, as indicated by the negative coefficient on WOREDA. This may be related to the existence of Melkassa Agricultural Research Center (MARC) in the Adama district and this makes the farmers in this district beneficiary of training, pre-extension demonstration and improved seed distribution trials. Moreover, Adama district is strategically located in terms of its geographic proximity to the major vegetable market in Ethiopia. Since an increase access to market for vegetable drive to increase demand to seed and existence for market may motivate farmer to participate in seed production.

4.3.2. FACTORS AFFECTING THE INTENSITY OF ONION SEED PRODUCTION

This section presents the second stage of Hickman's econometric model estimation results and presented in Table 4. With a Heckman two-step approach, the first step is to estimates a Probit model of participation in the seed production as a function of those variables that likely also determine level of land allocated, conditional on participation, as well as one or more exclusion restriction variables (Wooldridge, 2006). Thus, the first stage must contain at least one explanatory variable that is not included in the second stage, which is known as the identification restriction; therefore, a variable must be found which affects the decision to participate but does not affect the level of land allocated to seed production. The econometric identification is made possible in the study by inclusion household characteristic variable namely access to extension. This variable is not expected to influence level participation. Justification for the Heckman procedure is found in the study as the Inverse Mill's Ratio coefficient is significantly positive, indicating unobserved characteristics in the farmers' decisions to participate in local based onion seed influencing the intensity of participation.

A series of household related factors were found to be significant in explaining the intensity participation once the decision to participate is made by household. The amount of land allocated to onion seed production is found to be a decreasing function of the household head's age and increasing function of the number of active labour force. The positive effect of labour availability on the amount of land allocated to seed production can be explained by the fact that onion seed production is labor intensive agricultural enterprise which demands good deal of labor as major input.

In the study area, given poor labour market functioning, households with relatively more active labour force would encourage them to cultivate more land under onion seed than households with less active labor force. For instance, every additional member in the household (AEV) causes about a 0.102 ha increase in the amount of land allocated to onion seed production by keeping all other variables constant. The significant positive effect of this variable also suggests how family labour is important in developing countries (Solomon *et al.* 2010).

TABLE 5: SECOND STAGE ESTIMATION RESULTS OF HECKMAN MODEL

Category	Regressor	Coefficients	Z – Value
Household	Age	-0.0221***	-3.3100
characteristics	Experience	0.0231	1.6300
	Off income	0.0000***	3.8900
	Labour availability	0.1030**	2.6500
Farm characteristics	Irrigated land	0.4547***	3.9700
	Farm size	-0.0131	-0.4600
	Oxen	0.0066	0.1700
	TLU	-0.0081	-0.8200
	Leased-in land	-0.0153	-0.4500
	Market	0.0077	0.8200
Institutional	Credit	0.0743	0.8800
Characteristics	Seed price	0.0031***	4.6500
	Training	0.2897***	3.6200
	Woreda	-0.2350	-1.2500
	_Cons	-0.3753**	-1.8200
	Lamda	0.17424**	1.76

N = 40 Probability value = 0.0000 Wald chi2(15) = 76.29 Rho = 1.0277

***, ** and * indicate statistically significant at 1%, 5% and 10% probability levels, respectively.

As expected, the study found household resources endowment (share of irrigated land) to have a highly significant influence on the decision to allocate land to onion seed production by seed producer. This imply that participant who own larger share of farm size with irrigated land will allocate more land to seed production than who own small irrigated land for example a percentage increase in the ratio of irrigated land owned increase land allocated to onion seed by 0.45 ha, holding other variables constant. Market price of onion seed was also found to increase the land allocated to seed production, once participation decisions are made. This result supports hypothesis that land allocated to onion seed production is indeed responsive to market signals. Higher seed prices can be expected to lead a higher land allocation for seed by participant, since farmer cultivation effort responds positively to expected prices.

An interesting result is that household's participation in training influenced the land allocated to seed production positively. This is mostly due to the reality that participants who are involved in seed production training would get more knowledge and skill related to agronomic practices, harvesting, storing and handling methods of onion seed production. Training also enhances farmer's ability to distinguish technologies that generate opportunities for economic gain from those that do not (Wozniak, 1984). This in turn increases their ability to manage more amount of land allocated to seed. This evidence suggests that the existence of appropriate farmers' institutions promoting training is an essential component to enhance farmers' participation in seed multiplication. This finding is in conformity with earlier studies conducted elsewhere in Ethiopia (Yami, 2010; Gezhaegn, 2008).The availability of off farm income was found to have positive and significant influence on intensity of participation in onion seed production. The result confirms the hypothesis, in the case were income earned by household members, with the assumption this diversification may lead to risk reduction in household decision making and, with it, increased propensity to undertake higher-risk activities, notably allocate more land to seed. As risk and desire to invest in the farm are inversely related, such diversification can increase incentive to invest.

5. CONCLUSIONS

The general goal of the study is to understand the factors that increase vegetable producing farm household decision to participate in cultivation onion seed with intention to supply for local market. By doing so, the study went to assess factors that can help in identifying key growers who could be encouraged and supported to emerge as individual small-scale entrepreneurs dealing in seed production and distribution. It is not likely that all farmers will end up as successful growers. For this purpose, primary data were collected from 80 farm households drawn purposively and randomly from two districts of East Shoa Zone.

Hickman's two-stage econometric model is utilized in the study to analyze determinants of participation and intensity of participation decision made by farm household. Using these model have advantages, it separates the first discrete decision of whether or not to engage in production of onion seed from the continuous decision of how much land is needed by the household. Furthermore, the model helps to overcome the possible sample selection bias.

Farmer participation decision model (Probit) result showed that the likelihood of participating in onion seed production was significantly influenced by household characteristics related variables such as age of the household head and farming experience in terms of improved varieties cultivation. Farming experience was associated positively whereas age of the head associated negatively with participation decision. Those households who are headed by young farmer with longer year of experience in cultivation of improved onion varieties were found to be fast participant to seed production.

Results from participation decision model also confirm that the decision to participate related to household wealth indicator variable. Those households with more cultivated land and livestock were found to have high propensity to participate in onion seed production. Ownership of this asset helps to relax the household's liquidity constraints. Moreover, households with large farm size can experiment by allocating small land to seed production. Participation in capital market had positive correlation to the decision to participate; suggesting that relaxing liquidity binding constraints among vegetable producing households through access to credit will induce the cultivation onion seed to market by households. This is mostly related to nature of onion seed production which characterized by longer gestation period and regular cash out flow to purchase agrochemical /or farm operation.

Once household decide to participate an increase in the land allocation to onion seed took place when the area under irrigation increased, when the household had access to training, when an incentive from market through price increased and increase in family size. An increase in age of seed producer decrease the land allocated to onion seed production. Moreover, the coefficient associated with the inverse Mills' ratio was found to be significant, indicating that the influence of unobservable factors in the farmers' decisions to participate in local based onion seed production.

6. IMPLICATION

From household characteristics, age and farming experience is found to explain the heterogeneous household decision to participate in local based onion seed production. Those farmers who have long experience in cultivation of improved onion varieties were found to be fast participant and allocate more land to seed production. This imply knowledge of improved crop varieties is important pre requests to participate in local based improved seed production, since farmer who knew and cultivate improved seed for long period may probably have good knowledge. Thus, targeting young and experienced farmers in the intervention of local based seed production is probably advisable, as young and experienced farmers tend to be more flexible in their decisions to participate new ideas and agricultural enterprise more rapidly.

The results of the study indicate that although credit access increases the likelihood of participation, it did not influence the amount of land allocated to onion seed production. This have two implication, at first the importance of credit as it increased framer participation in seed production, but it also indicates that loan sizes may be too small for making a significant impact on the cultivated area or loan used for other activates. This may be related to nature of vegetable seed production which is characterized by cash intensive, long gestation periods and risky entrepreneur. Consequently, small scale seed producer may experience long periods of cash flow deficit during the seed production phase, and they require long term financing of operations. However, most of credits providing

institution offer small and short-term loan to the farmer. This may not induce in allocating more land to seed production. Thus, In order to improve farmer participation in local based seed would require making credit available to farmers to address the long gestation period and high mother bulb costs.

The decision to allocate more land under seed production is found to be influenced by market price of seed. This implies market forces are relevant in explaining the intensity of local based seed production and that farmer become more willing to participate in production of improved seed to market when they expect to receive better price. The effects of seed prices have potentially important implications for the design of local based seed production. Policies and project design that can affect seed price may increase participation, and thus land allocated to seed and supply too. Thus, improving marketing out let for seed produced and crop output is important. Farmers' associations that specialized in seed production should be promoted to enable seed farmers to compete for better market prices. The results also suggest us for organization involved in project aimed at promoting seed production by small scale farmer should endeavor to create awareness for participating in the way that they consider local based seed production project as commercial enterprise rather than development project.

The transfer of knowledge and information concerning seed technology including training that could to develop the skill of farmers found to be important in increasing the land allocated to seed multiplication activity. This implies capacity development of producer will bring significant change in land allocated to seed as it enhances the ability to cultivate more land. Smallholder farmers who multiply seed need to be thoroughly trained in all aspects of seed multiplication.

Access to irrigation is found to influence the intensity of participation. This implies lack of irrigated land and equipment inhabited farmer from increasing land under seed production. The most important conclusion that can be drawn from the results of the thesis is that there is a pressing need for more water resource development efforts in the region. Thus, supporting farmer either in building small scale irrigation scheme and/or providing loan to purchase farm equipment needed to irrigate land improve the producer amount of seed production. The results also have an implication that farmers with smaller acreage under irrigation are likely to require special participation incentives such as training to improve their access to technical information. This may encourage them to allocate more land.

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