

# Analysis of Potato Seed Supply System in the Potato-Dominated Smallholder Farming System in West Arsi Zone, Oromia National Regional State

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## Abstract

In Ethiopia, lower productivity of potato production has been one of the significant contributors to food insecurity. Considerable efforts have been made by the government, NGOs and researchers in generating, introducing and disseminating appropriate potato technologies to boost the production and productivity of potato. The objective of this study was to identify the status and performance of potato seed supply and factors that determine potato seed supply system in West Arsi zone. A multi-stage random sampling procedure was used to select 120 sample potato producers and 21 traders using probability proportional to size. Descriptive statistics and econometric model were used to analyze data. In West Arsi zone, informal, and alternative potato seed systems co-exist which accounts for 83.71 and 16.29%, respectively. Access to market information and credit service plays an important role in accessing of improved potato seed supply system by smallholders' farmers. Therefore, any interventions that make farmers access to above mentioned service of the households have better enhances farmer's access to potato seed in the area. Farm income effect farmer's access to potato seed supply system. Therefore, household farm income should be increased to enhance access of potato seed supply systems. Meanwhile land allocated for potato production and potato yield obtained have a positive effect on farmers access to potato seed supply system. Therefore, land allocated for potato production should be increased by using rent-in and shared-in land to enhance access of potato seed supply systems and potato yield have to be increased by using different agricultural technologies.

**Keywords:** Potato, Seed supply, Seed quality, Seed tuber, *Solanum tuberosum*

## 1. Introduction

Ethiopia is one of the fastest growing economies in Africa. In the last decade, the Ethiopian economy registered a growth of 11 percent per annum on average in Gross Domestic Product (GDP) (MoFED, 2014) compared to 3.8 percent in the previous decades (World Bank, 2015). This growth has largely been supported by a relatively high growth in the agricultural sector. The importance of agriculture in Ethiopia is evidenced by its share in GDP (43%), its employment generation (80%), share of export (70%) and providing about 70% raw material for the industries in the country in 2012/13 (UNDP, 2013). Thus, it is not surprising that policy action in Ethiopia is largely based on influencing the dynamism of the agricultural sector.

In GTP-II period, agriculture will remain the main driver of the rapid and inclusive economic growth and development. It is also expected to be the main source of growth for the modern productive sectors. Therefore, besides promoting the productivity and quality of staple food crops production, special attention will also be given to high value crops, industrial inputs and export commodities. To this end, addressing constraints entrenched in the agricultural development and marketing systems will be given utmost emphasis and priority (NPC, 2016).

Vegetables and root crops took up about 1.69% and 1.82% of the area under all crops at national level respectively which is very low in area coverage when compared to grain crops that cover 81.27% at national level. Potato shares 0.53% from all crops at national level as well as 29.21% area coverage out of vegetable crops respectively. Potato also production in quintals contribute 19.90% to total vegetable crop production at national level. The average national productivity of potato was 13.768 where as 9.77ton/ha in West Arsi zone which is even less than the national average productivity (CSA, 2017).

Regardless of the good environment and efforts made to the sector yield of potato is suffering from being low. According to Geldermann and Elmar (2013), the average potato yields in Sub Saharan Africa stand at 7.8 tons per hectare, while it is 6-8 t/ha in Ethiopia. However, in rare cases yields of 25 tons/ha are, being attained by progressive farmers using best production practices, under the same rain-fed conditions as their neighbors who attain yields of 5-6 tons per hectare. This yield gap can be attributed to the use of low quality potato seeds, poor disease management, inadequate soil fertility management and inadequate seed and ware potato storage conditions (Hirpha et al., 2010; Emanu & Nigussie, 2011). Accordingly, Works have been done on varietal development in collaboration with some international organization (CIP) which resulted in the release of 29 improved varieties nationally. Potato is short duration crop of 3-4 months that can yield up to 50t/ha worldwide and up to 30-35 t/ha in research station in Ethiopia (Endale et al., 2008b). However, the same scholar indicated that average tuber yield of potato was almost constant between 6-8 t/ha in the last 20-30 years under farmers condition in Ethiopia. Further, the crop under farmer's production level is suffering of major challenges in retaining and accessing quality seed potato due to the existence of long single rain fed growing season in most areas, virus and pathogen affected planting material, low productivity, poor storage condition and high levels of rural poverty.

According to the Bezabih and Mengistu (2011) West Arsi is a major potato producing zone in Oromia National Regional state that smallholder farming has diversified from staple food subsistence production into more market oriented and high value commodities. As indicated by the same authors, Shashemene district is hub for potato seed supply source used in the SNNPR and Tigray regions where seed and ware potato are produced twice in a year without using supplementary irrigation. Potato is a major food and cash crop produced in Shashemene district (DOA, 2016). Further, the area is seen as a hub for seed and tuber potato supply system in the country. Therefore, in response to answer the above defined problems this project will make effort to minimize risk related to the commodity and enhancing the productivity to bridge the research gap with the following research activates have different objectives.

The supply of any seed material depends on the availability of seed from the formal and the informal sectors, and their ability to develop and provide seeds of the cultivars needed to the local producers (Yealembirhan, 2007). The seed system in Ethiopia consists of the formal seed sector, the informal (farmers') seed system, as well as the occasional emergency seed programs, which are often operated by some NGOs and relief agencies (Belay, 2002).

Generation and transfer of improved technologies are critical prerequisites for agricultural development particularly for an agrarian based economy such as of Ethiopian. Despite the release of several technologies, particularly of improved crop varieties, there has been limited use of improved seeds by the majority of farmers (CSA, 2010). According to Adane et al. (2010) unavailability of quality seeds at the right place and time coupled with poor promotion system, is one of the key factors accounting for limited use of improved seeds, which further contributing for low agricultural productivity. Poor availability and promotion of improved seeds is due to inefficiency of the seed systems of the country. According to the Abebe and Lijalem, (2010) report the major challenges of the seed system of the country are;- lack of proper linkage between different actors involved in seed systems, inadequate supply of good quality seed at affordable prices, focus on few crops (maize & wheat) in the formal system and other beneficial crops (such as pulses, vegetable especially potato & oilseeds) remain orphan, low level of private sector involvement in the formal system, inefficient seed promotion, distribution and marketing mechanisms, weak variety release and weak seed quality assurance system.

### *1.1 Statement of the Problem*

Potato has been considered as a strategic crop by the Ethiopian government aiming at enhancing food security and economic benefits to the country. As the population grows rapidly, increased productivity of potatoes can improve the livelihood of smallholder potato producers and is required to meet the growing demand (Gildemacher, 2012). In addition, potato is regarded as a high-potential food security crop because of its ability to provide a high yield of high-quality product per unit input with a shorter crop cycle than major cereal crops like maize (Adane et al., 2010). In areas where there is relatively good market infrastructure, potato has become the leading cash crop and one of the most important food security crops to farmers (Agajie et al., 2010).

The economic growth strategy of Ethiopia places high priority on improving agricultural productivity to achieve household food security, alleviate poverty and stimulating growth in non-farm activities. These plans have been targeted toward making the country free from foreign aid by ensuring farmers reap maximum benefits from the agricultural sector (MoFED, 2015). The plan aims to achieve these objectives among other things by increasing agricultural productivity through the promotion and dissemination of improved agricultural technologies on selected food crops (Abebe et al., 2013). Considering potato as one of the strategic crop aiming at enhancing food security and economic benefits to the country, Ethiopian government has worked with International Potato Center (CIP) partner to introduce many new cultivars over the past three decades to promote adoption of improved potato varieties even though most Ethiopian farmers still grow older local cultivars (Kolech et al., 2015).

National Potato Research Program of Ethiopia with collaboration of CIP and other stakeholders have released more than 29 improved potato varieties to enhance its productivity (MOA, 2012). Despite of such release, adoption of improved potato varieties is still very low. Nationally, about 77% of Ethiopian potato land is planted to local cultivars each year (Kolech et al., 2015). As indicated by the same authors, 70 to 90% of Ethiopian farmers grown at least two local cultivars each year. Different research centers (ATARC, HARC and KARC) with the collaboration of Shashemene DOA introduce, promote and disseminate improved potato varieties. According to Bezabih et al. (2014) Shashemene is the dominant local potato varieties grown district. Habtamu et al. (2010) indicate that only 30% of potato producer farmers use improved potato varieties for production in Shashemene district.

Vegetables are integral part of the farming system in Ethiopia. They are grown as sole or intercropped, rainfed or irrigated and plays crucial role in the economy of the country. Its demand is growing, implying the need for concerted effort to improve its productivity through sustainable supply of high yielding vegetable varieties (Bezabih *et al.*, 2014). Potato has been considered as a strategic crop by the Ethiopian government aiming at enhancing food security and economic benefits to the country (Gildemacher, 2012). However, potato yields are relatively low in developing countries (FAO, 2013). This is true in Ethiopia in general and West Arsi zone in particular which is 13.77 and 9.77ton/ha, respectively (CSA, 2017).

98.7% of potato seed supply in Ethiopia is through informal (farmers) seed system and only 1.3% through alternative supply (Adane *et al.*, 2010). Having in mind the importance of integrating the formal seed sector to that of the informal seed sector, in recent years' research, extension and development programs in Ethiopia have adopted farmer-based seed production and marketing scheme (FBSPMS), participatory approaches that unify the efforts of various stakeholders concerned with agricultural development with the aim of overcoming formal research-extension linkage weaknesses and improve localized seed availability on a sustainable basis begun to surface (Gezhaegn, 2008). One of these approaches has been community-based secondary seed multiplication schemes, whereby farmers' roles are shifted from passive recipients to that of active seed producers, and eventually serve as secondary seed sources and disseminators.

As a result, research and development practitioners developed different models for effective seed delivery. The overall objective of different seed supply models was to ensure seed security by enhancing the availability and accessibility of seeds. To this regard, participation of farmers in seed production could be considered as an alternative strategy in securing the seed demand of the majority of the small holder farmers. Thus, farmers will be trained to produce quality seed for their own use and for local seed provision to explore opportunities for small-scale seed enterprise. So, based on this idea farmer-based seed production and marketing schemes is designed as an alternative strategy to increasing farmers' access to and the availability of seeds of improved varieties in the study area after factors influencing them to produce improved potato seed identified. This, in fact, affects the process of technology adoption and efficiency of potato production.

However, there were no comprehensive earlier studies which investigated on the status and performances of potato seed supply system in the study area. Virtually, no study has been done on factors affecting potato seed supply among potato producing farmers in West Arsi zone. Thus, there is a little knowledge about the level/status of seed supply and the underlying factors affecting them in West Arsi zone. This study, therefore, aims at assessing the status and determinants of potato seed supply, with a view to filling the existing knowledge gap.

### *1.2 Research Questions*

- What is the status and performances of potato seed supply systems in West Arsi zone?
- What are the factors determining potato seed supply system in west Arsi zone?

### *1.3 Objectives of the Study*

The overall objective of this study was to assess the status and performance of potato seed supply and factors influencing potato seed supply in West Arsi zone, Oromia National Regional State, Ethiopia.

#### **Specific objectives of the study**

- ✓ To describe the status and performance of potato seed supply systems in the study area
- ✓ To identify factors that determines potato seed supply in west Arsi zone

## **2. Methodology**

### *2.1 Description of the Study Area*

This study was conducted in selected districts of West Arsi zone, Oromia region. West Arsi zone is one of the major potato growing zones of Oromia administrative region, Southern Ethiopia. The districts were selected based on the potato production volume.

### *2.2 Data Types, Sources and Methods of Data Collection*

Both primary and secondary data source were used for this study. This research was primarily

based on primary data generated through cross-sectional survey during 2018 production season. The primary data was collected using structured questionnaire, key informant interviews, and focus-group discussions. **Semi-structured questionnaire:** semi-structured questionnaire was used to collect primary data on potato seed supply related information. Both closed and open-ended semi-structured questionnaire prepared to generate the required information. Prior to the actual data collection, semi-structured questionnaire was pre-tested to ensure clarity, validity, and sequence of the question. The questionnaire was pre-tested in each selected *Woreda* and revised according to the feedback obtained. Then, the final semi-structured questionnaire was employed to collect data from the sample potato producing farmers. **Key informant interview:** This was used to collect more information from some key informants on pertinent issues. This helps to understand better the issues that could be raised and to triangulate the answers provided by the respondents. To obtain the views of key informant interviewees, checklists were prepared and information was collected through unstructured interview. Key informant interview was conducted with government officials and development agents in each sample *Woreda* of West Arsi zone. **Focus-Group Discussions (FGD):** This was made on the issues related to potato seed supply system among potato-dominated smallholder farmers operating in the potato-dominated farming system. This helps to take into account different points of views and helps to strengthen or argue against some answers of farmers based on the results obtained. Accordingly, with the help of checklists/unstructured question discussions was held with selected potato producing farmers to get some general information about potato seed supply system in the selected *Woredas* of West Arsi zone.

To complement the primary data, secondary data was collected from both government and Non-Government Organizations (NGOs). The major sources of secondary data was from both published materials and online resources such as Central Statistics Agency (CSA), Food and Agriculture Organization (FAO) data base and West Arsi zone agriculture office.

### *2.3 Sampling Procedure and Sample Size*

The study was based on the data that was obtained through a farm household survey administered to sample farm households drawn through multi-stage sampling techniques. The three-stages that involve the selection of (1) sample *Districts*, (2) *Kebeles* and (3) smallholder farmers are as follows:

**Stage 1:** In the first stage, four *Districts* was purposively selected based on potential of potato volume of production from 12 districts of West Arsi zone with the collaboration of West Arsi zone agricultural office expert.

**Stage 2:** In the second stage, two potato growing *Kebeles* was selected from each of the four selected *Districts* using simple random sampling method.

**Stage 3:** In the third stage, 120 farm households were randomly selected from lists of names of household head in the *Kebeles* using simple random sampling. Accordingly, a sample of one hundred and twenty (120) farming households were collected based on sample determination formula of Yamane (1967) as follows:

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

Where, n = is the sample size of potato producer households, N= total number of households producing potato in the districts, e= level of precision considered 9%.The probability proportional to size were to select sample farmers from each selected *Kebeles* of the study area.

#### *2.4 Methods of Data Analysis*

In this study, descriptive and inferential statistics and econometric models were used to analyze data.

##### *2.4.1 Descriptive Analysis*

Descriptive statistical tools such as average, ratios, percentages, frequencies, etc. were applied to describe household and farm characteristics of the study areas while inferential statistical methods such as  $\chi^2$ , t -tests was used to see the relationship b/n variables of interest.

##### *2.4.2 Econometrics Model*

The purpose of this section is to describe the analytical models for estimation of source of potato seed supply inefficiencies and its determinants. Probit model was used to analyze factors that determine potato seed supply inefficiency.

### **3. Result and Discussion**

#### *3.1 Description of Seed Potato Farmers*

Seed potato farmers allotted substantial area of total operated land for potato production, i.e., 44.21% (0.42 from 0.954 ha). Of the total land area allotted for potato production more than 46% was allotted for seed potato production indicating that seed potato production was among the most important agricultural activities in the zone. The area of rented in land and the area of land allotted for seed potato production were almost equivalent indicating farmers rented in land mostly to seed potato Table 1.

Table 1. Demographics, agricultural land, production activities of seed potato farmer

Items	Mean±Std. dev.	Range
Age	37.64±11.6	18-63
Experience in potato production	17.17±9.73	2-40
Household size	8.56±3.51	1-18
Own land holding (ha)	0.95±0.58	0.125-2.25
Rented in land (ha)	0.18±0.39	0-2
Sharecropped land (ha)	0.056±0.18	0-1
Land cultivated under potato (ha)	0.42±0.17	0.125-0.75
Land allocated under potato seed (ha)	0.196±0.136	0.063-0.75
Experience in seed potato production (years)	4.56±2.13	2-12
Average potato yield (qu/ha)	97.325±51.74	20-240
Actual seed potato yield (qu/ha)	69.05±36.67	10-160

### 3.2 Types of Seed Potato Systems

Seed systems can be defined as the ways in which farmers produce, select, save and acquire seeds (Sthapit et al. 2008). In West Arsi zone, we identified two seed potato systems, namely informal, and alternative. Both of the systems are briefly explained below. The informal seed potato system is a seed potato system in which tubers to be used for planting are produced and distributed by farmers without any regulation. This seed system exists in all potato growing districts of West Arsi zone. It is the major seed potato system. As the study result show that it supplies 83.71% of the seed tubers required in study area. The seed tubers supplied by this system have poor sanitary, physiological, physical and genetic qualities (Lemaga et al. 1994; Mulatu et al. 2005a; Endale et al. 2008a; Gildemacher et al. 2009a). The alternative seed potato system is a seed potato system that supplies seed tubers produced by local farmers under financial and technical support from NGOs and breeding centers. As the study result revealed that the alternative seed potato system supplies about 16.29% of the total supply (Table 2).



There is no local seed business project/specialized potato seed growers/community-based local seed growers in West Arsi zone. There is no also primary cooperative producers participate on potato seed tuber production. Formal seed system doesn't participate on potato seed suppliers in the zone. The main source of potato seed during planting time for potato production was from West shoa zone especially from Jeldu district. As information source of zonal agricultural office indicate that market channel of potato seed tubers was 1, producer from jeldu district → cooperative → customer; II 2, producer from jeldu district → collecting assemblers → customer; 3, producer from jeldu district → wholesaler → customer. Both local and improved potato seed varieties used for production in zone. Regarding to marketing issue (Unbalanced buyers and seed suppliers, absence of seed promotion and insufficient understanding of market mechanism). There are three potato seed tuber production method in the zone such as by-product of ware potato, by positive selection and by a separate plot for potato seed production. In general potato seed production based on market push has to change to customer oriented through strength market linkage (potato seed producer and customer).

Table 2. Potato seed supply system exist in West Arsi zone

No	Seed system existed	Mean±Std. dev.	Remark
1	Informal	83.71±34.235	
2	Integrated	16.29±33.889	

### *3.3 Current Status of Seed Potato Systems in West Arsi zone*

The main characteristics describing the current status and performance of seed potato systems in West Arsi zone are summarized in Table 3.

#### *3.3.1 Seed Potato Production and Storage*

##### *3.3.1.1 Seed Potato Production Methods*

Generally, in West Arsi zone, there is few separate plot and management for seed potato production. Mostly, potato tubers are sorted into ware and seed immediately after harvest. For most potato producers seed potato is usually considered as the by-product of ware potato. Only some farmers in the West Arsi zone of Oromia have recognized the problems of using part of ware potato as planting material, such as disease transmittance and resulting yield loss. Some farmers practice positive selection and some also grow seed potatoes on a separate piece of good quality land. In our survey in 2010, 28.33% of the farmers in the west Arsi zone area produced seed potatoes by positive selection, whereas 7.5% of the farmers produce potato seed by negative selection. 24.17% zone farmers produced seed potato on separate plots (Table 3).

### 3.3.1.2 Seed Potato Storage Methods

Seed potato storage is a common practice in all potato producing areas of West Arsi zone. Farmers store seed potato by leaving the tubers in the soil un-harvested (postponed harvesting); by other traditional storage methods like in a local granary, on bed-like structures or the floor in their house. Because of storage and other post-harvest problems Ethiopia loses 30– 50% of its potato production (Endale et al. 2008b) which is true for study area. As the study result revealed that in West Arsi zone, 1.66% of the potato farmers leave seed potatoes in the soil harvested. 71.67% of the farmers use traditional mechanism of potato seed storage like local granary/*Gotera* in the study area. 10% and 16.67% of the farmers use sacks and bed like structure for potato seed storage, respectively. Seed and ware potatoes are stored side by side in the same store or home. In the Shashemene district, farmers cover stored ware and seed tubers with teff straw to protect the tubers from sun light. They use a thicker cover for the seed than for the ware. The farmers increase the thickness of the seed tuber cover a few weeks before planting. The farmers believe that an increase in the thickness of the cover will help the seed tubers to break dormancy and thereby encourage sprouting.

### 3.3.2 Seed Quality

In this section we discuss the following aspects of potato seed quality: purity, genetic quality, health, size, physical damage and physiological age. In Ethiopia in general and West Arsi zone in particular, quality of seed tubers is a serious problem because of varietal mix-up, poor storage mechanisms, prevalence of diseases and pests and poor knowledge of seed selection. In all potato growing areas of West Arsi zone most farmers use seed potatoes of unknown origin. Farmers obtain their seed tubers usually from the local market if they do not set aside tubers from their own previous season production. As the study result indicate that, 55.83% of farmers selection potato seed quality depends on size, whereas 28.33% depend on purity/free of mixed variety, the remained based on color and others which accounts for 10% and 5.84%, respectively.

### 3.3.3 Seed Availability/Access and Distribution

There are several sources of seed potato in West Arsi zone: own savings, local open markets, village markets, breeding centers, NGOs, vegetable traders, district market and out of district market, specialized seed potato growers, relatives and friends. Seed tubers from most of these sources were originally not specifically designated for seed, but were simply produced as potato tubers that can be used as ware and seed. However, there are efforts underway to produce seed tubers by specialized seed growers even though its number is very low which 3.85% is. In the study area 58.65% of farmers get access of improved potato seed variety out of zonal market especially from Holeta town which accounts for 27.88%. According to the survey report of 2010 E.C. 76.67% of farmers face the problem of improved quality potato seed access.

There are also about 18 improved potato varieties grown in Ethiopia. However, according to Gebremedhin et al. (2008) and Mulatu et al. (2005a), not all the 18 varieties have been widely distributed and grown by farmers due to the very limited capacity of the alternative seed

supply system in the country.

Nevertheless there is difference in the proportion of tubers of improved and local varieties that are used as seed. For instance, our survey indicated that, 3.85% was used for consumption and 8.66% was used as gift (Table 3). Without distinguishing between improved and local varieties, 15.38% and 58.65% of the total produce of tubers were sold as seed and ware, respectively whereas 13.46% kept as own seed stock. In the study area 56.73% of the potato producer farmer use improved potato seed, of which Gudane variety accounts for 52.98%. From the total local potato seed utilized (43.27%) Nachi Ababa accounts for 22.12% in the study area Table 3.

### 3.3.4 Information Flow

Farmers can obtain information on name, source, yielding ability, marketability and food quality of varieties and production practices from various sources, such as family members, neighboring farmers, extension agents, NGO employees, researchers, and potato traders. Study result indicate that about 60.83 % of the farmers in the study area of West Arsi zone obtain information on the aforementioned characteristics of varieties from farmers in their own community. Majority of the farmers (83.33%) in the study area of West Arsi zone obtained information on improved potato technologies from different research center such as Adami Tulu Agricultural Research Center (ATARC), Kulumsa ARC and Holeta ARC whereas 15% obtained it from fellow farmers and only 1.67% from the agricultural office bureau. Research Centers are the major sources of information for seed potato technologies.

Table 3. Summary of seed potato production and supply systems in West Arsi zone

<b>Item</b>	<b>Current status in W/Arsi zone</b>	<b>Remark</b>
<b>Seed system</b>		
Formal	None	Not exist
Alternative	FRG and few specialized seed growers	Supplies 16.29%
Informal	Major	Supplies 83.71%
<b>Seed source and % of farmers using this source</b>		
Own saving	13.46	
District market	15.38	

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Out of district market	58.65	Holeta town accounts for 27.88
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Specialized seed growers	3.85
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Other source	8.66
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#### **Type of potato variety available and % of farmers using this type**

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Local (%)	43.27	Nachi Ababa accounts 22.12%
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Improved (%)	56.73	Gudane accounts 52.88%
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#### **Have you been growing improved potato seed?**

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Yes	51.89
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No	48.11
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#### **Source of improved varieties (% of farmers)**

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Own saving	13.46
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District market	15.38
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Out of district market	58.65	Holeta town accounts for 27.88
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Specialized seed growers	3.85
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Other source (NGO)	8.66
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#### **Utilization of total yield generated from improved varieties (% of total production)**

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Kept for own seed	13.46
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Sold as a seed	15.38
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Consumed at home	3.85
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Sold as ware	58.65
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Gift	8.66
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**Mechanism of farmers producing potato seed (%)**


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On separate pilot	24.17
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Side by ware potato land	33.33
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On garden	4.17
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Other method	38.34
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**Availability/access of high quality seed tubers**


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% of farmers facing problems in getting high quality seed	76.67
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**Seed renewal**


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% of farmers who renewed	33.65
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Number of seasons until seed renewal)	2
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**Seed production method (% of potato farmers)**


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Part of ware (by-product)	40
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Positive selection	28.33
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Negative selection	7.50
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On separate plot	24.17
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**Seed storage methods (% of farmers)**


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DLS	0	Not exist
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Postponed harvesting	1.66
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Local granary/store/ <i>Gotera</i>	71.67
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Jute sacks	10	
Bed-like structure	16.67	
<b>Seed quality</b>		
Purity	28.33	Mixed
Size	55.83	potato producer farmers used medium
Color	10	
Other	5.84	
<b>Production and productivity</b>		
Land cultivated under potato (ha)	0.42	
Average potato yield (qu/ha)	97.325	
Land allocated under potato seed (ha)	0.196	
Actual seed potato yield (qu/ha)	69.05	

Source: Survey result of 2010 E.C.

### 3.4 Factors that Determine Potato Seed Supply/Access/Availability in West Arsi zone

Number of observation = 120

LR  $\chi^2(12) = 22.91$

Prob >  $\chi^2 = 0.0285$

**Log likelihood = -70.90**

Pseudo  $R^2 = 0.1391$

Access	Coefficient	Std. Err.	z	P>z	[95% Conf.	Interval]
Market info	0.582**	0.269	2.17	0.030	0.0553	1.108
Market access	0.282	0.337	-0.84	0.403	-0.941	0.378
Extension	0.085	0.290	0.29	0.770	-0.484	0.654
Credit	0.659*	0.391	-1.69	0.091	-1.425	0.106
Income	0.542***	0.111	-4.89	0.001	-0.259	0.175
Age	0.004	0.0244	-0.17	0.865	-0.0520	0.044
Grade	0.0208	0.0405	0.51	0.608	-0.059	0.1003
Family size	0.045	0.056	0.79	0.428	-0.066	0.1550
Experience	0.0009	0.025	0.040	0.969	-0.0471	0.049
Potato land	1.418*	0.823	1.72	0.085	-0.1955	3.0313
Potato yield	0.0048*	0.0028	1.73	0.083	-0.00065	0.0104
Distance	0.1046***	0.0043	24.53	0.002	-0.0038	0.0129
_cons	0.774	1.497	-0.52	0.605	-3.7082	2.1594

\*\*\*, \*\*, \*: implies statistical significance at 1%, 5%, and 10% levels, a = Natural logarithm, Log pseudo likelihood = -70.902, Pseudo  $R^2 = 0.1391$ , Wald  $\chi^2(12) = 22.91$ , Prob >  $\chi^2 = 0.0285$ , N = 120, Source; model result, 2010 E.C.

**Market information:** Access to market information statistical significant at 5% level. Being access to market information increase the probability of potato seed supply access of households by 58.2%.

**Access to Credit:** Consistent with *prior* expectation, access to credit of the household head, which is one of the important indicators of capital, has a positive and significant effect on access of potato seed varieties at 1% level of significance, implying that the likelihood of access to potato seed supply system increases with farmers' access to credit. Being access to credit service of the household head increases the probability that a farmer access to potato seed supply system by 65.9%. Use of cash credit in potato production is one of the important factors that affect the potato seed supply system. It affects the ability of a farmer to obtain the necessary inputs at the right time and in suitable quantities. This, in turn, substantially affects efficiencies of potato seed supply system. Thus, a positive relationship was expected between

the use of credit (cash) and potato seed supply system.

The consistent with *prior* expectation, annual farm income significantly and positively affected access of potato seed supply system at 1% level of statistical significance. The result implies that for each additional farm income by 1 unit, the households would 54.2% more likely to access potato seed supply system, keeping other factors constant. Farmers with higher annual farm income are found to be better access of potato seed supply system as compared to those with lower annual farm income levels. The possible reason, among others, could be due to the fact that having higher farm income reduces financial constraints for purchasing improved potato seeds required for potato production.

**Land allocated for potato production:** The size of land allocated for potato production hypothesized to have both positive and negative impact on the access of improved potato seed supply system. The consistent with *prior* expectation, land allocated for potato production significantly and positively affected access of potato seed supply system at 10% level of statistical significance. The result implies that for each additional hectare of land allocated for potato production by 1 ha, the households would 141.8% more likely to access potato seed supply system, keeping other factors constant. Farmers with higher land allocated for potato production are found to be better access of potato seed supply system as compared to those with lower land allocated. Some studies suggested that small farm size is expected to be more access to efficient potato seed supply system than large frames because of its less expensive and less transaction costs. But some others oppose to this, they argue that larger farmer is more likely to employ improved agricultural technologies, used as a capital base and enhances the risk bearing ability of farmers and hence could be more access to potato seed supply system than small farms due to its advantage of the economic scale and scope associated with larger sizes (Beyene, 2004; Hussein, 2007).

**Potato yield:** The consistent with *prior* expectation, potato yield obtained significantly and positively affected access of potato seed supply system at 10% level of statistical significance. The result implies that for each additional increment of potato yield per hectare by 1 quintal, the households would 0.48% more likely to access potato seed supply system, keeping other factors constant. Farmers with higher yield gained from potato production are found to be better access of potato seed supply system as compared to those with lower yield gained.

**Distance to the nearest market center:** Distance to the nearest market center is used as proxy for assessing the accessibility of the market to farmers. Consistent with *prior* expectation, distance to the nearest market significantly and positively affected access of potato seed supply system at 1% level of statistical significance. The result implies that for each 1km od distance reduction, the households would 104.6% more likely to access potato seed supply system, keeping other factors constant. Proximity of farmer's house to the market is hypothesized to have a positive effect on potato seed supply system.

## 5. Conclusions

In this study we describe the state of affairs of seed potato systems in West Arsi zone and we attempt to elicit the main areas of improvement and the main steps to be taken in the roadmap



towards these improvements. With regard to the current status of seed potato systems we conclude that there are two seed potato systems operating in in the study area, i.e. the informal, and alternative whereas formal potato seed supply system neglected or don't exist, have problems in undertaking their functions as a seed system.

More specifically we conclude:

- Seed tubers supplied by the informal seed potato system (supplies 83.71% of seed tubers used in the study area of the zone) are deemed to be poor in health, unsuitable in physiological age, poor in genetic quality, impure (varietal mix-up), physically damaged and inappropriate in size. Besides, in the informal seed potato system, seed tubers are produced usually as part of ware and stored under poor conditions. In this seed system farmers usually use varieties of unknown origin and improved varieties are not available to the majority of the farmers. Lack of awareness about the availability and use of improved technology and practices has also impeded adoption of potato technologies.
- The alternative potato system, which co-exists with the informal seed system in the study areas, supplies better quality seed tubers than the informal seed potato system. However, the amount of seed tubers supplied by the alternative seed potato system is very small (16.29%) and thus the system still has limited impact on improvement of potato production in the study area.

The most important problems of the seed systems in West Arsi zone seem to be the insufficient seed tuber quality and the unavailability of seed tubers of improved varieties. The main objective of this study was intended to identify the status and performance of potato seed supply system in West Arsi zone and determine the factors affecting potato seed supply system in the study area of West Arsi zone, Oromia National Regional State, Ethiopia. The model output result shows that access to market information, access to credit service, annual farm income, land allocated for potato production, potato yield and distance to the nearest market center have positive influences on farmer access to potato seed supply system.

## **6. Recommendation**

Access to market information and credit service plays an important role in accessing of improved potato seed supply system by smallholders' farmers. Therefore, any interventions that make farmers access to above mentioned service of the households have better enhances farmer's access to potato seed supply systems in the study area.

Farm income has a positive effect on farmer's access to potato seed supply system. Therefore, household farm income should be increased to enhance access of potato seed supply systems. Meanwhile land allocated for potato production and potato yield obtained have a positive effect on farmers access to potato seed supply system. Therefore, land allocated for potato production should be increased by using rent-in and shared-in land to enhance access of potato seed supply systems and potato yield have to be increased by using different agricultural technologies.

- To improve the informal seed potato system increasing awareness and skills of farmers,

improving seed tuber quality, and improving market access is the best solution.

– To improve alternative seed systems availing new varieties, designing quality control methods and reducing cost of seed production as solution to solve the problem.

– To improve the overall seed potato supply in the study area, there should be co-existence and a good linkage of the three seed systems, and development of self-regulatory and self-certification in the informal, alternative and formal cooperative seed potato systems. As a continuation of this study several studies are underway. These include analysis of options to improve the seed tuber quality and designing of an improved seed potato supply chain.

## 7. Improving the Seed Supply System

Despite the availability of superior improved seeds varieties, their supply and distribution have often been limited. In this line, the seed multiplication and distribution activities should be strengthened. This can be realized through, among others, improving the capacity of the available seed multiplication and dissemination systems and encouraging the involvement of private sector in seed multiplication, the public being limited to the overall supervision of the seed quality being produced and other regulatory measures.

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