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Nature of Local Seed Potato System in Northwestern Ethiopia

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ABSTRACT

Potato (*Solanum tuberosum* L.) is one of the most important tuber crops in Ethiopia having the potential of improving the livelihood of smallholder farmers. The majority of the smallholder farmers secure their seed potato from the informal seed system although this system has serious problems related to quality issues. The current study stemmed from the consideration of these issues with the objective of describing the local seed potato system in the context of Northwestern Ethiopia. The findings of the study indicated that the seed potato supplied by this system is of inferior quality in terms of all components of the system. In other words, the seed potato supplied in this system is with sub-optimal production and storage practices, long seed renewal period, physical and genetic impurity, disease infection, small sized and dominated by local cultivars. Therefore, interventions to be made by concerned stakeholders (seed producers, farmers, research, extension, policy makers, etc.) to improve smallholder potato farming system in Northwestern Ethiopia as well as in similar situations need to focus on addressing these factors.

Key words: Potato, smallholder farmers, local cultivars, informal seed system, seed quality

INTRODUCTION

Potato (*Solanum tuberosum* L.) belonging to the family Solanaceae, is an important food and cash income sources globally (Fekadu *et al*., 2013). It ranks third as the world most important staple food crop after rice and wheat (Stewart and McDougall, 2012). It is increasingly recognized that potato is inexpensive and nutritive food security crop, since it produces more dry matter, protein and calorie per unit area and per unit of time than the major cereal crops (Lutaladio and Castaldi, 2009). Recognizing its role in attaining food security, integration of potato including other tuber crops into the food system is currently getting attention by the research and extension systems in Ethiopia.

As a highland country located in the tropics, Ethiopia has very conducive edaphic and climatic conditions for the production of high quality seed potato. The crop can potentially be grown on about 70% of the 10 Million hectare of arable land in the country (FAO, 2008) located within altitude ranging from 1800-2500 masl and receiving an annual rainfall of more than 600 mm. Nevertheless, the national average productivity of potato is only 8.03 tons ha^{-1} which is by far lower than the world average productivity of 16.02 tons ha^{-1} (Fekadu *et al*., 2013). Out of the 199,899.80 ha allocated to root crops in the main season of 2011/2012 in Ethiopia, potatoes

occupied 59,508.67 ha (29.8%) (CSA, 2012). Potato is grown by approximately one million smallholder farmers in four major areas viz., the central, the eastern, the northwestern and the southern highlands of the country. The major constraints faced by these smallholder farmers include the lack of improved, high yielding, disease-resistant and good quality seed potato varieties. Hence, access to good quality and improved seed potato varieties is widely recognized as fundamental to ensure increased production and productivity (Schulte-Geldermann, 2013).

Smallholder farmers access their seed potato from three important sources in Ethiopia viz., informal (smallholder farmers), alternative (cooperatives, community-based seed enterprises, NGOs, etc.) and formal (licensed growers, cooperatives, or seed enterprises) seed potato systems (Hirpa *et al*., 2010). Despite the presence of these types of seed systems, the latter two systems supply only 1.3% of the total seed tubers required annually in the country, while the remaining largest portion is supplied by the informal seed system (Gildemacher *et al*., 2009b). Having said so much about the importance of the seed potato system, we now turn to the analysis of the local seed potato system currently operating in Northwestern Ethiopia.

MATERIALS AND METHODS

Study area: The study presented here was undertaken in two Kebele Administrations (KAs) (lower administrative unit in Ethiopia), *Aguta-Wonjela* and *Kesa Chewisa* of *Guagusa Shikudad* and *Banja* districts, respectively, in Awi zone of the Amhara region, Ethiopia. Awi zone is situated between 10°23'N and 10°85'N latitudes and 36°35'E and 36°57'E longitudes with an altitude ranging between 1800-3100 masl. It has a mean annual rainfall of 1,750 mm and a mean monthly temperature that ranges from 17-27°C. Major staple crops grown in these two districts include potato, teff (*Erogrostis tef*), maize, wheat (*Triticum aestivum*) and barley (*Hordeum Vulgare*). The two KAs were selected purposively taking into consideration their accessibility, serious problem of seed potato quality and health.

Study design: The study used qualitative research design where qualitative data were collected and descriptively analyzed using relevant techniques of qualitative content analysis (Mayring, 2000). Data were generated from both primary and secondary sources. Primary data was generated through iterated unstructured individual interviews (with farmers, potato traders, agricultural experts and development agents), focus group discussions with farmers and a series of field and market observations whilst secondary data are obtained by reviewing scientific journals, proceedings and project reports. Participants for focus group discussions were selected on the basis of a preliminary understanding of wealth status, gender, age and experience in potato cultivation in consultation with local development agents. A total of six focus group discussions were organized and held (two per study site: *Aguta*, *Wonjela* and *Kesa*), each group composing eight to ten discussants comprising representatives of the three wealth statuses, both sexes and varying age categories and thus each focus group is heterogeneous. Each group discussion was held after carrying out a series of individual interviews to generate and document new insight related to the study at hand. To collect the data required for this study voice recorder, photo camera and field and interview notes were employed.

Framework for the seed system analysis: Farmers of the study sites often have two alternative systems to secure seed potato for a given production season viz., formal and informal seed systems. It is noted that over 80% of the smallholder farmers in developing countries rely on the latter

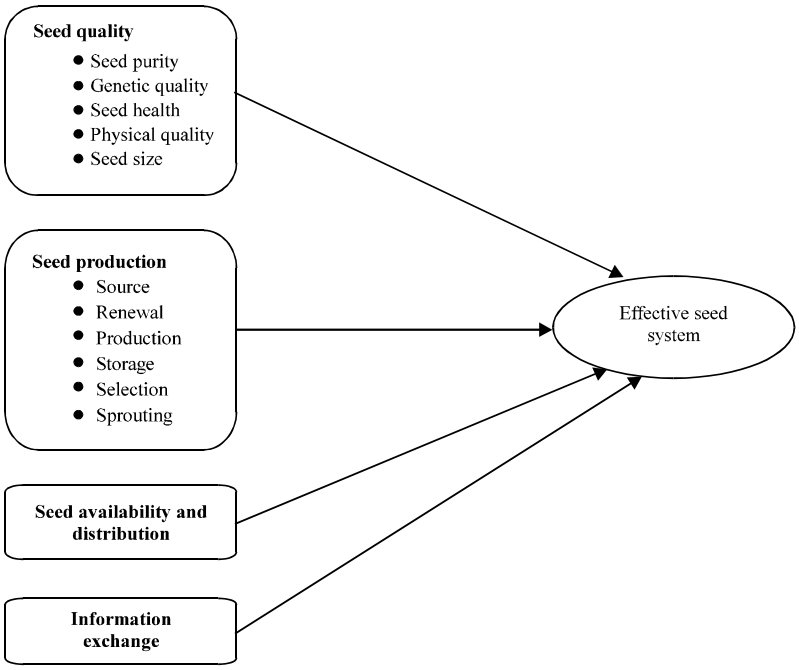

Fig. 1: Framework for understanding seed potato system (adopted from Weltzien and vom Brocke, 2001)

system (Louwaars and de Boef, 2012), which also holds true in the current study sites. The operational definition of a seed system adopted for this study is that, "... a system that embraces the mechanisms by which farmers produce, store, select, disseminate and procure seeds." To analyze the seed system, different authors, for instance, Weltzien and vom Brocke (2001), indicate the need to make a diagnosis of the different functions of the seed system described with the framework in Fig. 1.

RESULTS AND DISCUSSION

Seed potato production

Potato production seasons: In most Irish potato producing areas of Ethiopia, including the study sites, two rainy seasons are distinguished; the main rainy season ("Meher", June to September) and short rainy season ("Belg", February to March). It is known that the "Belg" season is usually associated with short and unreliable rainfall (Gildemacher *et al*., 2009b). In addition to these two rainy seasons, potato is also produced using irrigation in the study sites. These production seasons allowed potato to appear in the market throughout the year. Irrigated potato cultivation during the dry season is also very important since the incidence of late blight is less severe due to low humidity. With this respect, farmers usually preferred to use potato produced during the dry season as seed tuber. Potato produced during the main rainy season is also very crucial for smallholder farmers because of the fact that it matures at the time of food shortage.

Local classification of potato seed: Farmers locally classify potato they are using for seed purpose into three viz., '*abat zer*', '*enikuaye*' and '*wiha geb*' (in Amharic, local language). These types of seeds were also frequently observed in the market places. '*Abat zer*' is a type of seed that

is planted in March and harvested after a year of stay in the field. Because of its long stay in the soil and sunlight, this type of seed usually shrivels as a result of loosing moisture. Even though '*Abat zer*' potato is left un-harvested in the soil for long time, most often farmers practice relay cropping following the last hoeing of potato. The relay crops include white lupine, maize, faba bean, field pea, *Brassica abyssinica*, etc. Moreover, farmers mentioned a number of reasons for planting these crops on seed potato which include:

- To improve soil fertility
- To overcome shortage of land, that is to increase land productivity per annum through intensification
- Time after the last hoeing is favorable for these relay crops
- These relay crops do not need frequent oxen ploughing and need less external inputs reducing labor demand and cost of production
- To protect family members from harvesting the seed potato for consumption purpose and
- To use relay crops as a shed for potato tubers so that they do not germinate under open sun condition

Farmers with access to irrigation water do not have the interest to produce '*abat zer*', because of the possibility of producing crops on the same land two or three times a year. Farmers in rain fed areas usually produce this type of seed. However, '*Abat zer*' is mostly demanded by those farmers who access irrigation water due to the fact that the seed will easily emerge when it gets water. This understanding of farmers is found to be in agreement with the finding of Worku *et al.* (2013) in that as the age of seed tuber increases, time required for the seedling to emerge decreases. Farmers relate and justify this cultivation practices as one way of escaping the problem of disease during the main rainy season, because the plant often matures when rainy season sets on.

'Enikuaye' seed is a type of seed potato that is produced using residual moisture. It is usually planted in August and harvested in December. This potato serves farmers as a seed for rain fed production season. '*Wiha geb*' seed is a type of seed potato that is produced using irrigation water and used as an input to the residual production (for '*enikuaye*').

Production of such types of seeds ('*Abat zer*', '*enikuaye*' and '*wiha geb*') is also found to differ across wealth groups. According to information obtained from focus group discussion, '*Abat zer*' is mostly produced by farmers with higher wealth status. This is related to the fact that medium and rich farmers have relatively large size of landholding and better financial capacity to rent-in land for a long time. However, the '*enikuaye*' and '*wiha geb*' seeds are produced by all kind of wealth groups.

Seed potato source and renewal: The seed potato system in Ethiopia is characterized by limited availability and use of commercially traded high quality seed (Gildemacher, 2012). The informal seed potato system in the country supplies about 98.7% of the required seed tuber by smallholder farmers (Gildemacher *et al.*, 2009b). In the current study sites there is no practice of separate production, management and storage of seed and ware potato. Seed potato in the smallholder farmer's cropping system is the by-product of ware potato, that is, farmers leave the potato that cannot be used for sell and consumption in the soil to be used as planting material. Most farmers usually renewed the seed stock that they are using as planting material after 3 to 4 years (that is, from 6-8 production seasons) of use. The study of Gildemacher *et al.* (2009a), however, reported a seed renewal period of three seasons in Ethiopia.

The smallholder farmers propagated potato vegetatively by tubers and the seed tuber for planting is obtained from different sources. For the majority of smallholder farmers in the study sites, own produced and saved tubers is the most important source of seed because of its known quality, timely availability and economic attractiveness. However, this source has different problems with regard to sanitation during storage and degeneration as a result of tuber-borne diseases. In this respect, medium and rich farmers of all the study sites were found to have good understanding of the negative effect of using part of ware potato as planting material. It seems however that they do not practice positive selection and allocate separate plot for seed tuber production.

The other equally important source of seed tuber is the one obtained through the social relationships with neighbors, friends and relatives in the same and neighboring localities. These sources supply good and known quality seed because it is related with the existing moral economy of the society. But because of the high level of disease infestation in the study sites, some farmers usually prefer to receive seed through purchase or sharecropping (that is, a contractual relationship between a farmer who owns a plot of land and another farmer who supply necessary production inputs (seed, fertilizer, etc.) to divide the produce into two equally) arrangement from farmers outside their locality. This preference is associated with receiving planting tuber with relative good health and agronomic characteristics; which in turn is related with differences in agro-ecological with zones of acquisition and less disease pressure. To secure seed with good characteristics, farmers usually use information related with vegetative progress of the crop obtained through their social networks. Sometimes, farmers themselves may physically go to the neighboring localities to monitor the progress of the crop at vegetative stage. Once convinced, farmers may request the owners of good looking potato to leave reserve seed for sell after harvest.

Seed obtained through sharecropping arrangement is also a good source of seed especially for poor farmers who do not have money to buy seed and other inputs from the market. However, for those who do have money the local market is important but the quality of the seed source is unreliable. This was a repercussion of the fact that in the market there is low trust on seed quality between buyers and sellers. As a way of minimizing mischievous act in the local market, farmers usually use their own knowledge and kinship networks to obtain better quality seed that could enable them to create trust and confidence of obtaining higher yield in the ensuing production season. According to Sperling and McGuire (2010), farmers have mostly preferred to use their social ties and networks to secure seed because they wish to avoid transaction costs associated with requesting and obtaining quality seed.

Seed selection criteria: Farmers usually exercise some level of rational behavior in using informal seed supply chain to minimize their risk and maximize benefits (Sperling and McGuire, 2010). Farmers in our study sites do not practice in-field selection of the best plants for seed; but they use different product and variety related criteria for selecting their potato seed from harvested tubers. By far the most frequently cited criterion pursued by farmers is potato size. They said in Amharic that, "sheqen zer mezirat enimeritalen mikinyatum zer yigefal". This is to say that they usually prefer to plant small sized seed because it enables them to cover large spaces or plots. This preference is directly related to the reduction of cost of production. The other important criterion mentioned is seed variety. Farmers in the study sites mostly preferred to plant *Ater Abeba* because of its varying important attributes including resistance to disease and pest infestation, good cooking quality, early maturity, long shelf life and drought tolerance. However, Ermiase *et al.* (2007) noted that this cultivar did not stay productive for long in the region due to loss of clonal fidelity.

Equally important criterion stated by farmers in the selection of potato seed is the level of sprout. They usually prefer to purchase and plant medium sprouted seed. Because highly sprouted seeds have already finished their food and as a result there is nothing to feed the emerging plant. Besides, long sprouts are highly liable to damage and splitting-off from tubers. The seed with no or low level of sprout is also not preferred; because it has not finished its dormancy when sowing and as a result it takes more time to emerge and to be harvested. Still some farmers used to mention the area where the seed originated as important selection criterion. This is related with the problem of more disease infestation in some localities than others. Few farmers also mentioned potato grown on reddish soil (that is, on Nitosoil) is preferable for seed purpose. This, according to respondents, is related with the moisture content and agro-ecology of the source. Potato obtained from such type of well drained soil is expected to have medium level of moisture content which is one of the preferred attributes of potato seed.

Seed potato storage: Potato postharvest loss in Ethiopia is estimated to range from 30-50% (Endale *et al.*, 2008b), while in the current study sites it is estimated (by focus group discussion) to reach 20-30%. The lion's share of this loss is associated with storage problems. The most prevalent mode of potato storage methods in the study sites include storing tubers loose on in-house floor, bed like structure located under roof, postponed harvesting (leaving the potato unharvest in the soil for sometime or until next season), sacks and pits. From those modes of storage, in-house floor is the most common in the study sites. In this case farmers heap the harvested potato loosely in untidy, less ventilated and dark bedroom and/or floor of house salon.

Some farmers are also found to store their potato on the bed-like structure. In relation to this, study done by Hirpa *et al.* (2010) showed that 33% of the farmers in Banja district are found to use this structure. The use of this type of storage structure is also found to vary across seasons. That is, during rainy cold season farmers use this structure to store the harvested potato and then transferring it to in-house floor during dry season to protect it from spoilage and drying. This is true because most farmers in the study sites own houses with corrugated iron roofs, so that it creates high temperature and low humidity in the stored potato during dry season. In addition, they usually prepare the bed-like structure near the house ceiling. This modes of differentiated temperature in different periods of storage will affect storage shelf-life of potatoes thereby causing increased transpiration (water loss) and respiration (dry matter loss) (Wustman and Struik, 2007).

A study by Gildemacher *et al.* (2009a) shows that, 50% of potato farming households in Ethiopia practiced postponed harvesting. Farmers practicing such storage method in the study sites used to store their seed for up to six months. Other studies (for example, Endale *et al.* (2008b) also witnessed that in cooler highlands using such method, potato tuber can be kept for up to four months without major quality deterioration. But this method is associated with the problem of accumulation of tuber-borne diseases (Endale *et al.*, 2008a). The practice of such storage method was also found to vary among wealth groups. That is, most of the time medium and rich farmers, who do have relatively sufficient landholding size in areas where there is no access to irrigation water, are found to practice such storage method.

The last type of storage practiced by smallholder farmers in the study sites is the pit method. This method is practiced by very few farmers that cultivate the local cultivar Muziye or Agew-dinich. They store this variety in a pit to protect it from drying so that it will be used as a seed for the next production season.

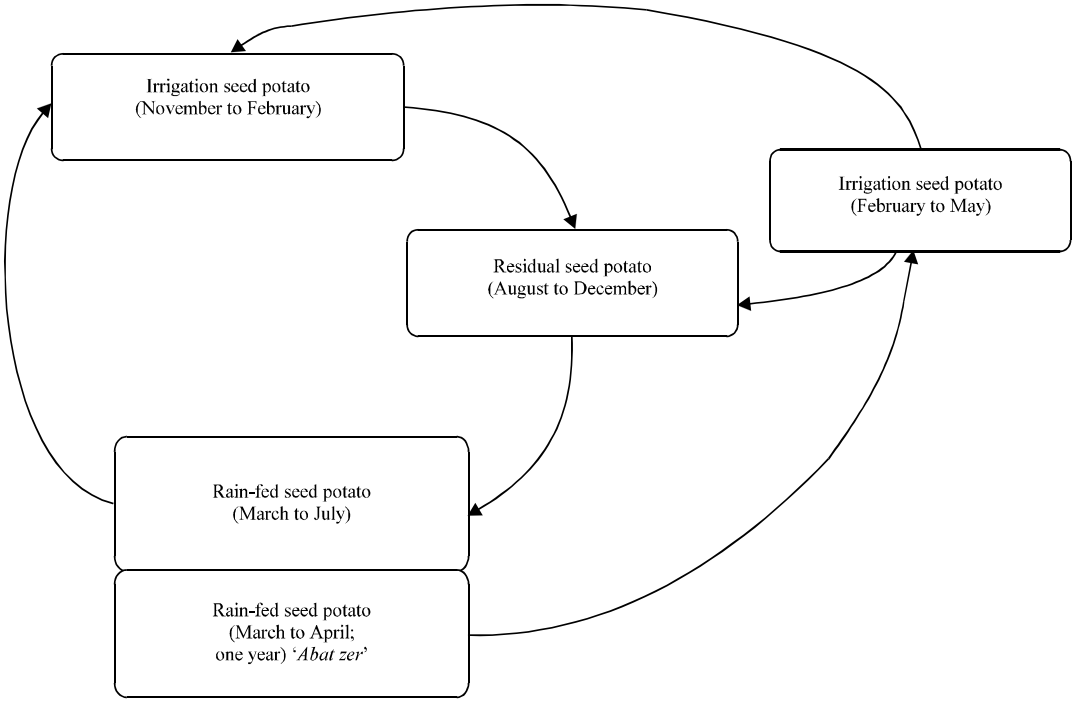

Fig. 2: Seed cycle

Notwithstanding their widespread use, these traditional storage methods have contributed to reductions in seed quality through weight loss, excessive sprouting and pest and disease infestation (Gachango *et al*., 2008). Moreover, these storage methods are associated with different problems viz., heaping loosely or stacked in sacks that creates pressure on individual seeds, storing in untidy and limited space that limits ventilation or aeration, storing potato in the same room with household members (no differentiated storage), placing household appliances on the stored potato and storing in areas where there is no light. In addition to the above stated problems, farmers do not clean the premises well between storage periods. This poses the risk of contamination or creates the possibility of disease transfer from one season to the next.

Potato seed sprouting: Potato growing farmers in Ethiopia do not remove haulms which greatly improves sprouting of potato seed (Alemayehu, 2011). Farmers usually applied different techniques to break dormancy and stimulate timely sprouting of seed potato. Those who do access irrigation water in their land mostly require optimally sprouted seed than those without access to irrigation. In those plots with no supplementary irrigation farmers prefer to plant less sprouted potato seeds to wait for the rain fall. To assure the readiness of seed potato for planting on time, farmers in the study sites usually practice different sprout facilitation methods like putting the potato into sacks and covering the potato with dry soil, grass or crop residues before two to three weeks prior to planting time (Fig. 2).

Irrigation (February to May) to residual (August to December): Potato produced using irrigation in the production period of February to May serves farmers as seed input for the residual production (August to December). Here the gap between the two production seasons is not enough to break the dormancy of the seed potato. Temperature, water supply and the photoperiod during

storage are important environmental factors that regulate sprouting behavior (Sonnewald, 2001). As a result, farmers practice sprouts facilitating mechanisms mentioned above because of cold weather and short gap for breaking dormancy. Moreover, potato produced in this production period serves as an input to the second round of irrigation-based production (November to February).

Residual (August to December) to rain fed (March to July): Even though the gap between these two production periods is not sufficient enough for breaking tuber dormancy, the sprout facilitation effort of farmers coupled with warm weather could facilitate sprouting.

Rain fed '*Abat Zer*' (March to April) to irrigation (February to May) and to rain fed (March to July): The tuber remained in the soil for long time feeding its own stored food and which has also finished its dormancy period is either planted immediately after harvest or kept for a couple of weeks. Farmers in the focus group discussion said that, "... because *abat zer* has already finished its milk, it has a higher rate of emergence especially when it gets water immediately after planting". It seems that the possible accumulation of diseases on such types of seeds as compared to others and its effects on yields are rarely understood by the farming community.

Rain fed (March to July) to irrigation (November to February): The gap between these two production periods is enough for normal sprouting even at the current storage practice of smallholder farmers.

Irrigation (November to February) to residual (August to December): The gap is too long and very few farmers keep seed produced using irrigation (November to February) to use for residual (August to December). This type of seed is locally called by farmers '*Enikuaye*'.

Rain fed route: In the rain-based potato producing areas (March to April, *Abata zer*), rain fed (March to July) and residual (August to December) potato production periods are important. Seed potato produced under rain fed (March to April) season serves as an input for the following year rain fed (March to July) potato production after one year of stay in the soil. But for the residual (August to December) season farmers get the seed from the market.

Seed tuber quality

Seed potato purity: The observations made in the field and at market places indicate that farmers in the study sites use and sell potato seed cultivars of unknown origin and quality. Moreover, it is found out that no farmer selects better varieties during planting and sale of the ware and seed potato. These observations corroborate the findings of other studies (Hirpa *et al*., 2010; Schulte-Geldermann, 2013).

Genetic quality: It is known that potato variety improvement researches in Ethiopia have been carried out by the federal as well as regional research centers. Over 18 improved varieties, which are suitable for diverse environments, were released during the last two decades (Temesgen *et al*., 2007). However, the uptake of these improved varieties by farmers was very low (Tufa, 2013). Regardless of efforts made to increase the uptake, smallholder farmers in the country as well as in the current study sites were found to utilize mainly local varieties that have low productivity. According to Gildemacher *et al*. (2009a), improved varieties comprised only 1.3% of the total supply of potato seed in the country, a paradox confronting potato production.

The genetic quality of a given variety is also a function of its food and processing quality (Hirpa *et al.*, 2010). In fact, on the basis of dry matter and starch content stability, Abebe *et al.* (2012) identified *Gorebella*, *Ater Abeba* (commonly grown variety in the study sites), *Challa*, *Belete* and CIP-396004.337 varieties as relatively stable for processing while *Menagesha*, *Bulle* and *Ararsa* varieties as suitable for table purposes.

Seed potato health and physical quality: *Late blight* (*Phytophthora infestans* (Mont.) de Bary) and *bacteria wilt* (*Ralstonia solanacearum*) are the most important economic diseases that affect potato producing highland areas of Ethiopia. Due to these diseases an estimated loss of up to 70% of potato production is often observed (Mekonen *et al.*, 2011). According to information obtained from focus group discussions, these diseases are one of the most challenging problems of potato cropping system sometimes resulting in complete crop failure. Other problems include different cultural production practices; for example, use of degenerated, bruised, old and exhausted, dried and deformed seeds, inadequate use of improved seeds, poor storage practices and incidence of insect pests like potato tuber moth (*Phthorimaea operculella* (Zeller)) and cutworm.

By emphasizing on the effects of potato diseases, a farmer underlined that "... although we know that plots around home are more fertile, we are forced to plant potato at some distant plots because of the disease pressure. These types of plots are relatively less fertile and thus require the application of inorganic fertilizers". This means that the problems of seed potato diseases have started forcing farmers to change garden based potato cultivation to field based potato cultivation. This change in farmers' decision of locating potato production from garden to field in turn has necessitated the use of inorganic fertilizers (Urea and DAP) and has caused a rise in the cost of production of potato. Given the limited availability of arable land for crop production, potato production has begun competing with major field crop production that requires farmers to make production decisions on the basis of the considerations of comparative advantages and competing interests.

Seed potato size: In the smallholder potato cropping system of Ethiopia, it is customary to use inferior sized tubers as a planting material after consuming and selling the medium and large sized tubers (Mulatu *et al.*, 2005). As witnessed in all the study sites, during individual interviews and focus group discussions, farmers usually prefer to use small sized seed potato since a larger area of land can be planted at low cost of seed. In addition to this, farmers do not spend time sorting seed tubers on the basis of size for marketing purposes and hence labor is saved.

Moreover, it is found out that the level of understanding about the effect of tuber size on productivity is low among poor farmers although that level is high among medium and rich farmers. With regard to this varying level of understanding, in the focus group discussion farmers said in Amharic that, "Mar bihon gucha yibeqal ehil bihon gezim yibeqal". This is equivalent to saying, "If it is a good honey, one comb is enough; and if it is a good crop, even the output from one-fourth of a hectare is sufficient". This idiomatic expression is used by the farmers to indicate the possibility of producing good yield from a given land size, if quality seed with appropriate size is used. Therefore, from this it can be inferred that poor farmers' potato farming practice in the study sites is dominated by the use of small sized seed tubers with coverage orientation. However, small sized tubers may have problems of delayed emergence, low sprout number and vigor and disease infection (Hirpa *et al.*, 2010).

Seed availability and distribution

Available varieties and their distribution: As discussed in the above section farmers sourced their seed tubers from different informal seed sources that are dominated by the distribution of local cultivars. In these sources, seed potato is the residual of consumed and sold tubers. Improved potato varieties are not well known and extended to the users in the Amhara region (Abate, 2007), although there are more than 18 improved varieties (Temesgen *et al*., 2007). Farmers acknowledged during the group discussion that lack of adaptable improved variety is the most important problem affecting their productivity. Field and market observations also indicated limited availability of improved seed potato varieties. In the nearby town markets only *Tolicha*, *Same'un*, *Jalene*, *Gera*, *Guasa*, *Ater Abeba*, *Muziye*, *Ayito* and *Jiga* cultivars are observed. Among these varieties *Ater Abeba* is the most commonly supplied and traded cultivar. However, this variety was introduced into the country from Europe in 1980's (Abate, 2007).

The seed tubers produced in the study areas are sold in the town markets to other farmers and traders in the same locality and to those that come from distant areas. The traders usually make distribution of the seed tubers to distant users. Discussion with traders indicated that destination markets for the produced potato include Gonder, Dessie, West Gojam and Wollega. Moreover, there are no specialized seed potato growers.

Price situation: Local informal markets reflect the type (ware or seed) and quality of potato by showing price differential. During non-planting times the price of these two types of products are almost equivalent ranging between Ethiopian Birr (ETB) 140 to 200 per quintal (equivalent to USD 7.47 to 10.67 per quintal). However, during planting times the price of ware potato remained relatively stable while the price of seed potato showed high variation. The price of seed potato in the market ranges between ETB 240 to 360 per quintal (equivalent to USD 12.81 to 19.21 per quintal) two to four weeks prior to planting times and when planting time further approaches good quality seed may cost up to ETB 500 per quintal (equivalent to USD 26.68 per quintal). This is especially so during August (residual moisture), November (irrigation) and March (rain fed) planting seasons. Moreover, when farmers purchase seed from neighboring localities using their social networks, they pay a price premium of ETB 10-20 per quintal (equivalent to USD 0.53 to 1.07 per quintal) above the market price for good quality planting material.

The price of potato seed in the study sites is a function of different factors, the most important being quality of seed, delivery time (planting or non-planting time; working or non-working days), quantity of seed delivered to and demanded in the market (number of farmers who supplied and demanded seed potato) and type of seed variety. It is during non-planting times that the traders collect good-looking tubers to store and sell when the demand for seed escalates.

Information flow: Information on different variables of seed potato including variety name, price, quality, productivity, market and variety related characteristics, improved production methods, etc. is very vital for improving potato productivity. With these respect farmers in the study sites obtain information on potato technology from different sources including development agents, NGO projects (SoilPot, SG-2000, Sustainable Land Management and FAO), Adet Agricultural Research Center, relatives in the same and other localities and fellow farmers. From these sources, the information obtained from Adet Agricultural Research Center is found to be very crucial by farmers for it is mostly accompanied with participatory field trials. Equally important is the information obtained from development agents, nonetheless, it is more of theoretical. Market could also be one

potential source of information but in the current study sites there is no means of flow of information from seed traders to buyers. In the market, transaction is made based on trust. This is found to be in agreement with the finding of (Gildemacher *et al*., 2009b).

CONCLUSION

The local seed potato system currently operating in Ethiopia is supplying the lion share of the seed potato required by smallholder farmers. However, this system has different product specific quality problems. In all components of the seed system, the seed supplied is of inferior quality that has direct implication on production and productivity. Provision of low quality seed is the result of factors like the use of low quality seed input, sub-optimal production practices, unavailability of improved seeds and information gap. Moreover, in the smallholder potato farming system, there is no separate production and management of seed and ware potato. Therefore, improvement of the local seed potato system basically demands that stakeholders put efforts to change the above factors for the better.

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