



RESEARCH COMMUNICATION

Adoption of potato varieties in West and Kellem Wollega Zones, Ethiopia

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ABSTRACT

Potato (*Solanum tuberosum* L.) is one of the possible food security crops which provide high yield and quality product in short period of time. Due to the lack of clearly known best varieties of it, its adoption to farmers is very less. The present study was conducted to assess the type of potato farmers prefer, adoption of released potato varieties and its management practices in west and Kellem Wollega Zones, Ethiopia. Survey was carried out in Ayira, Yubdo, Hawa Gelan, Dale Wabara and Dale Sadi woreda where four kebeles were purposively selected based on the potato farming potential. Open and close ended interview questions were generated for 384 selected representative farmers. Data was analyzed by SPSS software. The result showed that, 97.6% of the farmers have willing to farm potato. 47.3% and 22.7% of them experienced to farm local potato (land race) and released potato varieties, respectively. Farmers use landrace potato due to less awareness to released potato and accessibility of local potato. 70.1% of farmers responded there is no adoption of released potato in the area. Factors hindering potato farming in the study area are potato disease and lack of released potato. The least method used by farmers is use of resistant potato. Generally, there is scarcity of released potato seeds indicating that there is no its adoption in the study site. This problem is enforcing farmers to use local potato varieties which may not resist above stated hindering factors and make farmers to face food insecurity problems and economic reduction. Therefore, improving locally existing potato or attracting the improved potato varieties from elsewhere to the zones may be a solution of its adoption.

Introduction

Potato fills gap of food scarcity in rural areas of Sub-Saharan Africa since it provides many calories and nutrients. It is grown in wide range of agro-ecological conditions (1). It is high-potential food security crop which provides high yield per unit area in a short period of time (2).

Yield of potato in different parts of Ethiopia is vary i.e., may be high or low due to different factors especially as a result of late blight diseases caused by *Phytophthora infestans* and bacterial wilt caused by *Ryzoctonia solanacearum*. Additionally, scarcity and expensiveness of seed tubers, lack of adapted cultivars and poor farming technology are determinants for low yield in potato (3).

There are more than 30 released potato varieties which provide high yield and resistant to late blight disease than the locally cultivated one. It is highly recommended if farmers accept it for cultivation to improve its productivity. However, most of the farmers prefer to cultivate local potato varieties. The adoption of released potato varieties is very lower in

most potato growing areas of the country where new varieties have been disseminated (4).

Farmers are using rain, irrigation and residual moisture to cultivate potato in both west and Kellem wollega zones. But, modern technology and science of potato seed selection, cultivation and disease protection still dearth in the study site (5). In west and Kellem wollega zones, potato farming is challenging even up to stopping. To find out the reason behind, the present study is conducted to: identify types of potato varieties existing, evaluate farmers' preference to types of potato varieties, evaluate adoption of released potato, evaluate major challenges farmers encounter and to assess practical activities farmers use to protect potato disease in West and Kellem wollega zones, Ethiopia.

Materials and Methods

Description of the Study Area

The study was conducted in West and Kellem Wollega zones of Oromia regional state, Ethiopia, where five

woreda and twenty kebeles were the focus of the study site. These woreda were Dale Sadi, Hawa Gelan and Dale Wabara from Kellem wollega zone and Ayira and Yubdo woreda were from west wollega zone. These woreda were selected purposively as potato cultivation is becoming rare due to some factors.

Sample Size Determination

Sample size was determined by using the formula stated by (6).

$$no = \frac{Z^2 pq}{e^2} \quad no = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} = 384 \dots\dots\dots 1$$

Where, no = sample size, p = proportion of the population (i.e., 50% of the population is estimated in the sample), e = desired level of precision (i.e., the margin of error), $Z = 1.96$ when confidence level is 95%, $q = 1-p$. Since the total population of the study site was above the calculated sample size (9035), it was not necessary to reduce the sample size by using the formula stated by (6).

Data Collection

Survey was carried out and interview was raised for representative farmers selected from each woreda by the guidance of the developmental agents of the woredas. Here, 384 farmers were reached by systematic random sampling method and they were interviewed to collect data about adoption of released potato varieties in area. The interview question in contain the willingness of farmers to farm potato, types of potato they were farming, whether released potato was adopted, factor affecting potato farming and method used to protect potato disease.

Data Analysis

After the collection of data, analyses was followed using a computer assisted software (SPSS software version 22) and the results were tabulated in form of tables and figures and interpreted in percent.

Results and Discussion

This study was carried out to assess adoption of released potato varieties in West and Kellem wollega zones, Ethiopia. Accordingly, 384 respondents were involved to address their opinion about potato farming in the study area. Accordingly, the descriptive statistics of farmers' response regarding to potato is shown in Table 1.

Type of Potato Farmers Cultivate

Most of them (47.3%) experienced to farm local varieties (landrace) and few of them (22.7%) of them farm released potato varieties. However, those who do not know what types of potato they were farming were 29.2% (Fig. 1A-B). This is due to the lack of awareness to released potato (34.5%), accessibility of local potato varieties (33.1%) and unavailability of released potato (20.1%) in the study site (Table 2). This may be due to distance between the study area and different research institutes which releases

potato as the released potato is not reach to these farmers as needed.

Farmers Preference to Potato Cultivation

It is important to understand preference of farmer to potato in different agro-ecologies in the first step for breeding programmes (7). Based on the response of the respondents, 2.4% of them do not prefer to farm potato and 97.6% of them have willing to farm it. As other types of cereal crops were very common in the study area, most farmers had experience to cultivate potato to fill gap of food scarcity and income although there were many factors are encountered. This result is similar to the finding of (8) who found as informal seed potato system is the tubers to be produced and distributed by farmers without any regulation. This is to say most of the farmers has no know how about alternative seed potato varieties. Majority of farmers in Ethiopia still choose to grow local varieties (9) because they have better quality attributes and are better suited to existing management practices (10).

Adoption of Released Potato

The causes of low adoption of improved potato varieties are an important first step for crop improvement in developing countries. The adoption of released potato in the study area varies from place to place. Released potato varieties adopted in a specific area mean that it has been already accepted by farmers and realized for farming. But, in the study area, released potato varieties had not adopted according to response of 70.1% of respondents although 29.9% of the respondents farming it (Fig. 2). This may be due to lack of released potato seeds in the study area as a result of inactively involvement of concerning bodies in distributing and disseminating potato varieties released by different institutions in Ethiopia though 29.9% of them farming released potato which may indicates few awareness about released potato varieties in the study area.

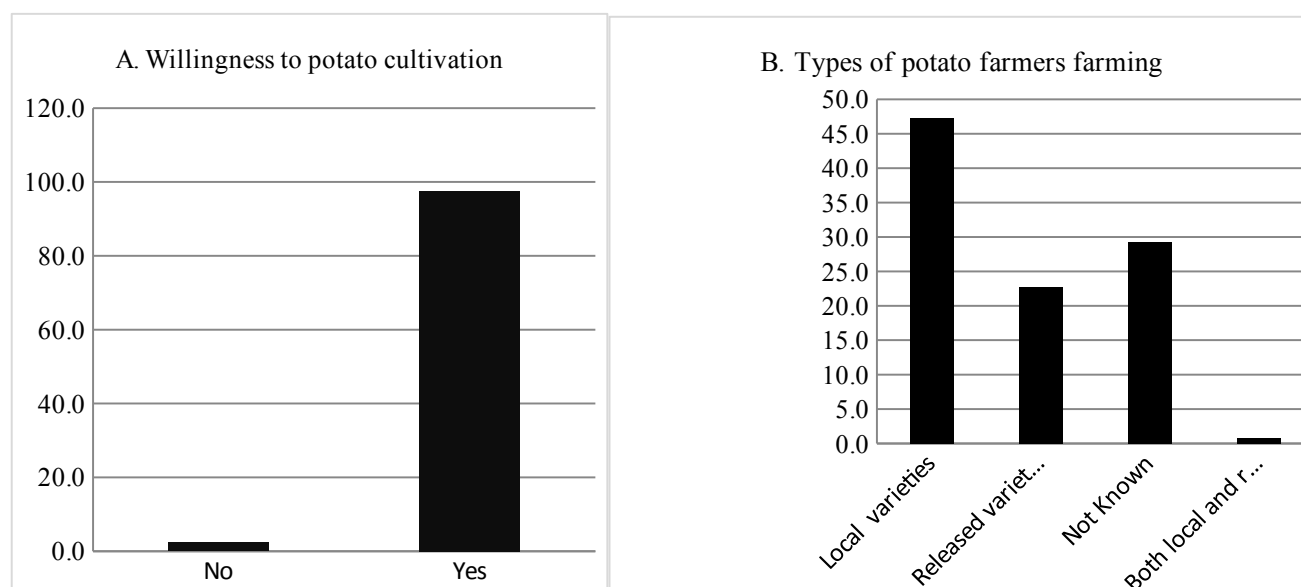
Most of the respondents purchase potato seeds from market which genetic makeup is unidentified or mixed with another (Table 3). The question by (10) "why adoption of new varieties in Ethiopia is low and why most farmers and consumers prefer local potato varieties?" is answered by (9) who explained the reason as poor dissemination and inadequate seed supplies of new varieties limit the adoption. Adoption of improved potato varieties is affected by awareness of the availability and use of improved technologies (8).

Factor Affecting Potato Farming

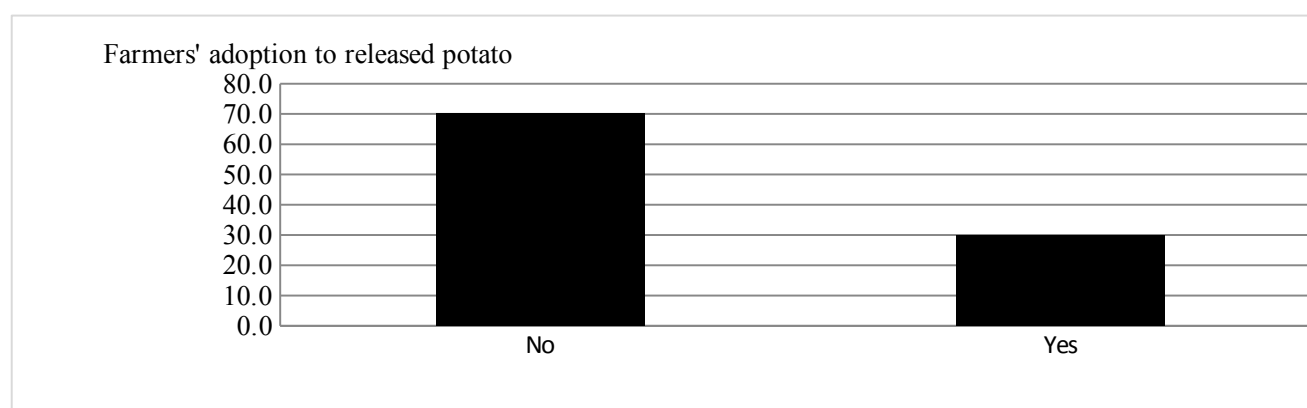
Respondents raised different idea about the factor affecting potato farming in the study area. 44.7% of them reflected as potato disease are the main factor affecting potato farming and 23.7% of them said that lack of released potato. However, 2.4% reflected that as unsuitability of environmental condition for potato farming (Fig. 3). This report is like the report of (5, 12) which says factors like diseases, insect pests (11, 12), unavailability and high cost of seed tubers, lack of well-known cultivars, poor agronomic practices, inadequate storage, transportation and marketing facilities (12) reduce yield of the potato

Table 1. Descriptive statistics of respondents opinion regarding potato farming

	Number of respondents	Statistic	Mean	Std. Er. Mean	Std. Dev	Variance
Preference to potato cultivation	373	364	.98	.008	.154	.024
Types of potato	366	672	1.84	.046	.879	.773
Adoption to released potato	268	80	.30	.028	.458	.210
Factor affecting potato farming	376	896	2.38	.083	1.614	2.605
Method used to protect disease	370	1139	3.08	.069	1.336	1.785

**Fig. 1. A-B.** Farmers willingness and types of potato they farm.**Table 2.** Frequency of farmers reason on why they used potato landrace

Reason of Farming Potato Landrace	Frequency	Percent	Valid %	Cumulative %
Lack of awareness to released potato	96	25.0	34.5	34.5
Accessibility of landrace potato	92	24.0	33.1	67.6
Landrace adaptability	7	1.8	2.5	70.1
Unavailability of released potato	56	14.6	20.1	90.3
All of the above stated reasons	27	7.0	9.7	100.0
Total	278	72.4	100	

**Fig. 2.** Adoption of released potato.**Table 3.** Frequency of farmers sources of potato seeds

Sources of Potato seeds	Frequency	Percent	Valid %	Cumulative %
Market based	163	42.4	68.2	68.2
Research centers	14	3.6	5.9	74.1
Agricultural office	38	9.9	15.9	90.0
NGO	17	4.4	7.1	97.1
Research centers	7	1.8	2.9	100.0
Total	239	62.2	100	

crop. The reason why potato farming in the study site is highly affected by potato disease may be due to farming of local varieties by most farmers in the study site as these local varieties are highly susceptible to disease. Similarly, (13) reported that the main reason associated to this underutilization of potato is the narrow genetic base of the early introductions and the traditional view towards potato as poor man's food and also most of the people use cereals as staple food.

Method Used to Protect Disease

Although disease is the most factors affecting in the study area to farm potato, farmers experienced to control this disease by using different techniques. Traditional control (37%) is most commonly used method by farmers followed by pesticide (24.9%). The least method used by farmers is use of resistant potato (8.9%). Still, it shows that numbers of farmers experienced to use improved potato varieties to control potato disease is very low (Fig. 4). Different kinds of traditional methods farmers are practised to

investigation (Table 4). As stated (5, 13), much research has not been done on this disease in Ethiopia except identification of bacteria and screening of biological control agents and use of resistance varieties.

Conclusion

The result showed that regarding to farmers' preference to potato cultivation, few of the farmers has no willingness to farm potato. However, most of them replied that they have willing to farm potato and are experienced to use landrace potato due to lack of awareness to released potato and accessibility of local potato varieties. Although farmers have willing to farm potato and try to adopt the released potato, there are factors affecting potato farming in the study area. Potato disease is the main problem affecting potato farming and lack of released potato is next challenging. To tackle these challenging factors, farmers are experienced disease controlling

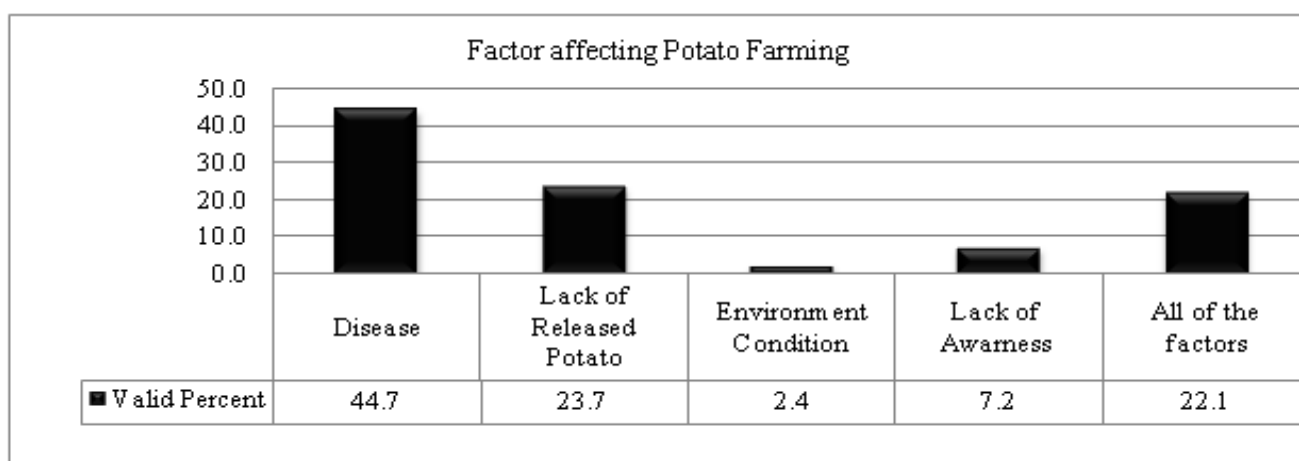


Fig. 3. Factor affecting potato production in the study site.

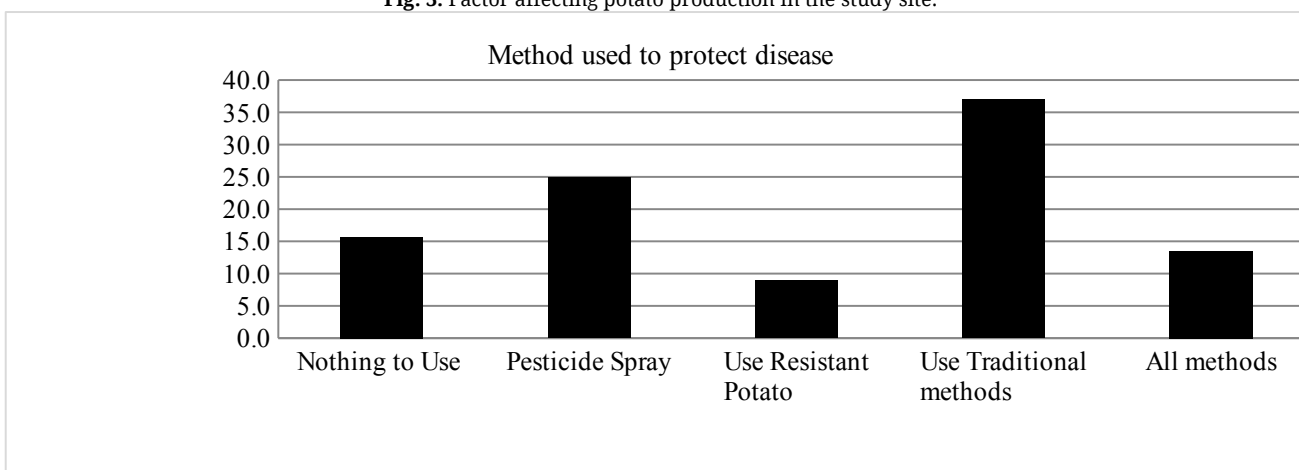


Fig. 4. Method used to protect disease.

control disease. 69.2% and 21 % of farmers use ash and picking out of susceptible potato respectively. Although these two methods are mostly used in the study site by farmers, there are many traditional methods as optional. These are using livestock dung, balancing amount of water in a soil, and spraying crude of hot paper, killing the damaging insects and spraying "bishaan gaayyaa". However, the concentration level they used needs more

techniques like traditional controlling method (using ash and removing damaged potato) are the most commonly used by farmers followed by pesticide. The least method used by farmers is use of resistant potato.

The following recommendations are offered. 1) It is very necessary if concerned bodies like agricultural offices of the woreda create link with different research institutes as they can provide

Table 4. Frequency of traditional methods used by farmers to control potato disease

Traditional Methods	Frequency	Percent	Valid %	Cumulative %
Ashing	99	25.8	69.2	69.2
Removing the damaged potato	30	7.8	21.0	90.2
Using cattle dung	1	0.3	0.7	90.9
Balancing soil water content	2	0.5	1.4	92.3
Ashing and removing the damaged	3	0.8	2.1	94.4
killing the worms	1	0.3	0.7	95.1
Spraying crude of hot paper	2	0.5	1.4	96.5
Spraying “Bishaan Gaayyaa”	2	.5	1.4	97.9
Both using ash and hot paper	3	.8	2.1	100
Total	143	37.2	100	

released potato seeds which adapt to various agro-ecological zones and able to resist disease. 2) It is better if there will be continuous potato multiplication center by woreda agricultural offices in these zones to produce sufficient seeds for these farmers to minimize scarcity of seeds at the time of farming seasons. 3) Scaling up farmers awareness to released potato in the study area is highly recommended and further investigations are needed to screen and characterize the most adapted potato to this agro-ecology by researchers.

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Authors' contributions

Authors of this manuscript contributed equally.

Conflict of interests

The authors express no conflict of interest to this study.

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