**Research & Development**
2022; 3(2): 79-82
http://www.sciencepublishinggroup.com/j/rd
doi: 10.11648/j.rd.20220302.12

# Participatory Demonstration and Evaluation of Potato (*Solanum tuberosum* L.) in Wondogenet District, Ethiopia

**Wasihun Alemnew Worku**

Agricultural Extension and Communication Research, Wondogenet Agricultural Research Center, Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia

**Email address:**
wasihunmariam13@gmail.com

**To cite this article:**
Wasihun Alemnew Worku. Participatory Demonstration and Evaluation of Potato (*Solanum tuberosum* L.) in Wondogenet District, Ethiopia. *Research & Development.* Vol. 3, No. 2, 2022, pp. 79-82. doi: 10.11648/j.rd.20220302.12

**Received**: March 1, 2022; **Accepted**: March 31, 2022; **Published**: April 9, 2022

**Abstract:** The study was conducted in Wondogenet district, Sidama region, Ethiopia. Potato is a critical crop in terms of income source food security and job opportunity. Potato seed supply has not been addressed only by seed companies, production of quality potato seed from closely supervised seed producer farmers is important to decrease disease transmission, timely supply of seed and increase yield. The main objectives of this study were to create awareness on importance of improved potato seed variety and assess farmers' perception on the potato traits and improved seed production. Demonstration site and host farmers were selected purposively based on representativeness and accessibility to other non host farmers. The data was collected through measurement and group discussions and analyzed by using SPSS software. T-test analysis result indicated that, planting improved seed variety have positive yield advantage over locally recycled seed. The majority of farmers select Belete variety based on their traits like high yield, large tuber size and tuber uniformity and Agazer variety also preferred based on its disease resistance (late blight), early maturity and drought tolerance. Therefore, agricultural stakeholders give high attention of for improved seed multiplication and availability to improve potato productivity and food security.

**Keywords:** Potato, Improved Seed, Demonstration, Farmer Saved Seed

## 1. Introduction

Potato is the fastest growing staple food crop and source of cash income for small holder farmers in Ethiopia (Beliyuand Tederose, 2014; [11]. It is a critical crop in terms of food security [12]. It provides significant amounts of nutritional value for small-scale rural farmers such as protein, vitamins, macro-and micro nutrients [3] on the human diet. In Ethiopia, demand for potato is increasing because of an increase in urbanization and a change in consumption patterns towards processed products like potato chips [8].

According to [13], expanding potato production to new farmers within potato grow in areas and introducing potatoes to new areas are among the strategies aimed at increasing potato production in Ethiopia. High cost and low supply of potato seed are the problems to potato production and productivity in Ethiopia [6]. Use of over recycled or potatoes from previous harvest as seed leads to low potato productivity and yield. This is due to transmission of seed borne disease and collapse of seed potatoes [14, 7]. Nevertheless, seed potato supply has not been addressed only by seed companies, production of quality potato seed from closely supervised seed producer farmers is important to decreased is ease transmission, timely supply of seed and increase yield. Due to the absence of a formal and responsible body for the production of quality seed-tuber, farmers have been using various approaches to enhance farmers' access to improved potato varieties (4).

Wondogenet agricultural research center has been evaluated two potato varieties at Wondogenet district. As a result, farmers saved seed and Belete varieties were demonstrated to the study areas. Belete variety was new for farmers and showed a good performance with respect to marketable tuber yield, large seed size and tuber uniformity.

The specific objectives of this study were to:

Evaluate yield difference between improved seed and farmers saved seed.

Assess farmers' preferred potato traits.

Analyze financial feasibility of potato production under farmers' production conditions.

# 2. Methodology

### *2.1. Description of the Study Area*

The study was conducted in Wondo Genet, Sidama region, Ethiopia. The altitude and longitude of district is 7°1′N 38°35′E with an elevation of 1723 amsl. In Sidama region, more than 89% of the population are rural and the dominant livelihood practice is agro forestry. Three agro-ecological zones are found in the region, Qolla, Woyna Dega and Dega, ranging from 500 – 3500 above sea level to the highest. Wondo Genet lies in the Woyna Dega zone which has an altitude of 1500 – 2500 m a.s.l., an annual rainfall of 1000 – 1800 mm and a mean annual temperature of 15 – 20°C. The district has thirteen Kebele administrations, which are village administrations [15]. The study was carried out in Gara rekita and Havela wondo kebeles.

### *2.2. Site and Farmer Selection*

Demonstration site and host farmers were selected purposively based on representativeness and accessibility to the host farmers. The district was predetermined and two villages namely, Havela wondo and Gara rekita selected for the study. Host and respondent farmers also selected purposively considering voluntariness to manage and handle the process. For demonstration five farmers were participated and five farmers also used as control groups. Host farmers were provided improved seed (Belete) and control farmers supplied local seeds by themselves but, closely supervised and collect the data. Follow up has been done for both groups until harvest and field day had been conducted at appropriate time when the crop was at good growth stage.

### *2.3. Experimental Design*

Two groups were used to compare yield difference between improved potato seed and local seed. Five host farmers planted Belete variety which seed was supplied by the research center and five control farmers sow locally recycled seed variety. The land sizes for each farmer were 0.25ha.

The spacing was 30cm between plant and 75cm between rows. NPS and Urea fertilizer (100kg/ha) was applied. All necessary agronomic management practices were done by farmers with close follow up by the researcher and district development agent.

### *2.4. Data Collection and Analysis*

The yield data was collected through measurement. Preference of farmers on the potato traits was collected by group discussions, while cost of inputs and price of produce were collected using farmers interview. Both qualitative and quantitative methods were to analyze collected data. The quantitative data were encoded by SPSS soft ware version 20 and analyzed using descriptive statistics. Independent sample T-test was used to analyze and compare mean yield difference. For farmers preference analysis nonparametric analysis was used to select more concerned traits on the potato varieties. Partial budget analysis was used in order to evaluate and compare profitability among the varieties.

$$\Pi = TR - TPC \quad (1)$$

$$TR = TY * PQ \quad (2)$$

$$CBR = TR/TC \quad (3)$$

Π=Net profit obtained, TR=total revenue from product, TPC=Total production cost (seed cost, fertilizer cost and all costs incurred during management practice), TY=Total Yield, PQ=price per quintal, CBR=cost benefit ratio, TR=total revenue, TC=Total Cost.

# 3. Result and Discussion

### *3.1. Yield Performance*

The result of this study indicated higher yield difference between improved and farmers saved seed (table 1). The analysis of result showed that the yield of improved seed variety (Belete) recorded a minimum of 30 t/ha and maximum 40 t/ha with an average of 35.8 t/ha. The locally recycled seed revealed the minimum of 19 t/ha, maximum 32 t/ha and an average yield of 26.6 t/ha. The study is in line with the result of (2) in Ethiopia.

***Table 1.*** *Result of descriptive statistics (t/ha).*

| Variety | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Belete | 5 | 30 | 40 | 35.8 | 3.76829 |
| Local | 5 | 19 | 32 | 26.6 | 5.17687 |

Yield Advantage

The use of improved seed variety had positive yield advantage over the local seed variety in all demonstration sites in wondo genet district (table 2). The mean tuber yields of potato were recorded 35.8 t/ha and 26.6 t/ha from improved seed and locally recycled seed respectively.

The t-test analysis (t=3.213, p=0.012) is indicated a significant yield difference between improved seed (Belete variety) and local seed. Similar report was studied by [10; 2] in Chencha district, Ethiopia and [15] reported similar result in Wollega zone, Ethiopia. In general, the overall result suggests that using improved seed variety have positive yield advantage over local seed.

***Table 2.*** *T-test result.*

| Variety | N | Mean | Std. deviations | t-value | p-value |
|---|---|---|---|---|---|
| Belete | 5 | 35.8 | 3.76829 | 3.213 | 0.012 |
| Local | 5 | 26.6 | 5.17687 | | |

### *3.2. Variety Preference*

Field day was conducted to evaluate the varieties and create awareness on the use of improved potato variety seed to surrounding farmers and agricultural stakeholders. Hence, the totals of 145 (122 male and 23 female) participants were invited on the event, among those participants 32 respondents were asked to evaluate and fill the questionnaires on the

preferences of varieties. Yield performance, disease resistance, drought tolerance, early maturity, tuber uniformity and tuber size were traits highlighted by respondents to select a good potato variety. The respondents consisted from farmers, development agents and experts were participated for data collection process. The majority of farmers select Belete variety based on their traits like high yield, large tuber size and tuber uniformity and Agazer variety also preferred based on its disease resistance (late blight), early maturity and drought tolerance. The detail result of farmers' preference on the potato variety are indicated Table 3.

***Table 3.*** *Farmer's perception on the variety.*

| No. | Variety selection criteria | Variety | |
|---|---|---|---|
| | | Belete | Agazer (farmers saved seed) |
| 1 | Yield performance | 5 | 2 |
| 2 | Disease resistance | 2 | 5 |
| 3 | Drought tolerance | 3 | 4 |
| 4 | Early maturity | 2 | 5 |
| 5 | Large Tuber size | 5 | 2 |
| 6 | Tuber uniformity | 4 | 4 |
| | Total score | 21 | 22 |
| | Rank | 2nd | 1st |

### *3.3. Partial Budget Analysis*

Table 4 and Table 5 show operational costs and benefits of potato producers who used improved seed variety and local seed variety. On the time of data collection price of potato was 9000 ETB/tone. On the two varieties, the high benefit was gained on the improved seed variety (208,700ETB/ha) as compared to local variety (145,900ETB/ha). The difference was 62,800 ETB per hectare over the local seed. In the study area, the marginal rate of return of potato production indicated a profitable that is greater than 1. The finding was in agreement with result of [5].

***Table 4.*** *Production cost (ETB/ha).*

| Variety | Labor | Seed | Fertilizer | chemical | Total cost |
|---|---|---|---|---|---|
| Belete | 60000 | 36000 | 9000 | 8500 | 113500 |
| Local | 60000 | 20000 | 9000 | 4500 | 93500 |

***Table 5.*** *Net benefit and marginal rate of return.*

| Variety | Av. Yield (t/ha) | TC | TR | NB | MRR |
|---|---|---|---|---|---|
| Belete | 35.8 | 113500 | 322200 | 208700 | 6.5 |
| Local | 26.6 | 93500 | 293400 | 145900 | 6.1 |

## 4. Summary

Method and result demonstration was conducted in Wondogenet district, Sidama, region to evaluate yield and farmers preference of improved and locally recycled potato varieties. The yield performance Belete variety have significant advantages as compared to locally recycled Agazer seed variety. Based on traits such as, early maturity, drought tolerance and disease resistance Agazer variety also preferred by farmers. Belete variety was recommended for further scale up and potato production in its merits of high tuber yield, large tuber size and tuber uniformity traits. Therefore, agricultural stakeholders give high attention of for improved seed multiplication and availability to improve potato productivity and food security.

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