

Effects of Pre-Sprouting on the Growth Performance of Potato (*Solanum Tuberosum*(L.)at Wolaita Sodo University

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Abstract

Potato is commonly grown from small tubers and it is common phenomena to see soon sprouted tubers are usually planted without distinction by the effect of using the one type of seed. So the aim of this research is to analysis the effect of pre sprouting on growth performance of potato. This research was conducted at Wolaita sodo University College of Agriculture, Department of Horticulture demonstration site (research field) and it was carried out from March to June 2019. The experimental was laid out in the field by using RCBD (Random complete Block Design) with three replications and four treatments were control treatment, 2cm sprouted, 4cm sprouted. The largest numbers of stem were recorded from treatment 3 (9), The longest height were recorded from treatment 3(73.25) and the shortest height were recorded from treatment 1(control)(50.92),The largest number of 50% of emergence were recorded from treatment 3(16.67) and the lowest number were recorded from treatment 1(control)(10),The largest number of 50% of flowering were recorded from treatment 3(12.33) and the lowest were recorded from treatment 1(control)(6). But number of leaf was non- significant. Since this research is only at specific location, the experiment has to be repeated in different agro ecological location using different varieties.

Keywords: potato, pre-sprout, growth performance

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1. INTRODUCTION

The potato (*solanum tuberosum* L.) Potato is one of the four major food crops of the world and other three crops being rice, wheat, and maize (Indian council of Agricultural research, 2003).and native of tropical South American region where it grows wild in nature and presents the wildest diversity of forms like tuber shape, size, color; test etc.It believed that the cultivated potato originated from its wild ancestors near the lake critical basin in Peru Bolivia region in high mountains. This plant was selected as article of food by the oldest civilization of Mayas and Incase (Indian council of agricultural research 2003).Potato was taken by Spanish explores to Europe about 1540 and was major source of food in Ireland from 1600 to 1845.As Irish Settler brought it back to America in 1791, it commonly called the Irish Potato (Splittoesser, 1990).

Currently potato is one of the major food crops grown in the high lands and Mid-altitudes of western Ethiopia serving as food and source of income to farmers during shortage and when grain deplete from stores. In spite of its remarkable importance the productivity of potato has been low and the national average yield is eight tones per/ha (FAO, 2003).

Ethiopia is endowed with suitable climatic and edaphic condition for potato production and has possibly the highest potential for potato production of any country in Africa and an estimated 70% of the 10 million hectares of the countries arable land is potentially suitable for potato production trend (FAO, 2008).

However still its production trend shows fluctuations with area coverage as well as productivity from year to year. The crop yield in Ethiopia is lower than that of most potato producing countries in Africa. Like Egypt and Zimbabwe. Which produced 21 and16 t/ha respectively (FAO, 2008).in Ethiopia potato covers an area of 69.784 ha and its production and yield were 785800 t and 11.26 t/ha respectively (FAO, 2008).

Potato can supplement the food needs of country as substantial way has provide its worth in feeding the nation in emergency and it is an important crop for the highly populated areas because it produces more dry matter, well balanced proteins and more calories from a unit area of land and time than other major food crops (Indian council of agricultural research 2003).Potato which is one of nature precious gifts is also very common in the dish of most Ethiopians. This importance necessitated the growth and production of many root and tiger crops thought the year often. In 2001/2002The country has acquired a sum of 22,423,972 million bird by exporting 120,497 quintal of root crop (CSA,external trade statistics). The economic and nutritional importance of potato crop has been equator for practicing the agriculture in all regions and growing the crops more than one time in a year (FDRE Central Agriculture Census Commission, 2001).

1.1. Statement of the problem

Both pre-sprouted and non-sprouted tubers are usually planted without distinction by potato growing communities in Ethiopia but the perfect planting material was not identified. Based on the problem notified above, this study was aimed to analyze the effect of different pre-sprouting length on growth performance of potato.

1.2. OBJECTIVES

General Objectives

- To study the effects of pre-sprouting of potato tuber on growth performance of potato.

Specific Objective

- To study the effect of different pre-sprouting stages on growth performance of potato.
- To identify the suitable sprout length for planting material.

2. MATERIAL AND METHODS

2.1. Description Experimental Site

The experiment will be conducted at SNNP regional government in Wolaita zone, experimental site of Wolaita Sodo University south west of Addis Ababa. The experiment will be conducted under field conditions Wolaita Sodo University College of Agriculture and Department of Horticulture demonstration site (research field). In the year of 2011 EC under supplementary irrigation. It is located in the southern part of Ethiopia with 330Km far from Addis Abeba and geographically at 6-49^olatitude and 37-45^olongitude east and at elevation of 1800 *m.a.s.l.* with annual mean rainfall 1212mm. The soil of area is Clay loam with a PH 5-6.4 (WSU students hand book).

2.2 Treatment and Experimental design

The experiment is conducted using RCBD with three replication and four treatments (control treatment, 1cm sprouted, 2cm sprouted, 3cm sprouted). They are placed randomly to each plot in the blocks with a plot area of 6.3m², 4 rows and 6 plants per row, 0.5m and 0.5m spacing between plots and blocks respectively with a total area of 80.3m². All the necessary agronomic practices like watering, weeding and hilling up are applied to all experimental plot equally as per the recommendation to the plant.

2.3. Experimental procedures

The main field is ploughed properly to get a fine soil and it is planted by using the different stages of sprouted potato tuber (variety "gudene"). As a treatment healthy and equal size sprouted tubers are selected and brought to the experimental site from WSU. Then after each sprouted tubers with the required length are planted in the properly prepared ridge at a spacing of 30cm and 75cm between plants and rows (ridges) respectively with a depth of 10cm.

2.4. Experimental Materials

The planting material was Gudene potato tuber.

2.5. Collected Data

Data will be collected on different growth parameters of the crop such as

Date to 50% emergency; Days to emergence was measured of counting the number of days to 50% emergency plants in the plot.

Days to flowering; Days to flowering was measured of counting the number of days to 50% emergency plants in the plot.

Leaf Length (cm): The distance from the base of the petiole to the tip of leaf considered as length of leaf and measured with a meter scale.

Plant height (cm): plant height was measured from the base to the tip of the plant using measuring tape;

Leaf number/plant: The numbers of leaf was counted from selected sample plants at 50% flowering and the average was taken.

Number of stems per hill: Actual number was recorded at 50% flowering. Then an average was taken. Only stems that emerged independently above the soil as single stems were considered.

2.6. Data Analysis

All the collected data on growth parameters were subjected to ANOVA according to method described by (Temedo, 2007). LSD will be calculated for means of treatments with significant level at 5% level of probability.

3. RESULTS AND DISCUSSION

Physiological aging advanced sprout growth, crop emergence, crop establishments and usually improved tuber yield (Burke and O'Donovan 1998). The arrival of developmental stages and their duration is often quite varied, depending on the biological characteristics of a variety, the quality of seed potato, climatic and soil conditions and the agro technical measures used (Christiansen *et al.*, 2006). It usually takes 20-35 days for a potato to emerge in Estonian climate conditions (Joudu *et al.*, 2002), depending on the treatment of seed tubers.

3.1. Date of 50% Emergence

The analysis of variance showed (appendix 1) that sprout length difference significantly affect the growth performance of potato and 50% emergence was recorded in between 11-18 days after sowing and treatment 3 emergences first with high germination number(16.67) and treatment 1(control) should little and late emergence (10) and treatment 1 and treatment 2 had little difference. This result agreement that (High Agronomic Institute Chott Mariem) emergence was faster pre-sprouted tubers treatments compared with the other non-sprouting tubers.

3.2. Date of 50% flowering

As appendix 2 sprouting length influenced 50% of flowering. Accordingly treatment 3 (4cm) should the highest no flowering (12.33) and treatment 2 and 1 had the second and third rank next to treatment 3 recorded in between 5- 6 week after sowing .This indicated that sprout length difference had significant effect on growth performance of potato.

The onset of sprout growth is also determinates by the development stage (physiological age) of the potato tuber (Struik and Wiersema, 1999). The evolution from physiologically young to physiologically old tubers affects sprout of tubers. These include date of emergence, stem numbers, canopy growth pattern. (Christiansen *et al.*, 2006).

The same authors showed that the initiation of flower primordial may commence on sprouts before planting. This means that in some cultivars, and under certain storage conditions, the size of the first level of the main stem of the following potato plants is determined before planting. The determination of sprout behavior during storage contributes to understanding the physiological ageing process of seed potato tubers and can be used to develop appropriate storage strategies prior to planting (Oliveira *et al.*, 2012). Similarly, potato varieties that have reached the end of "normal" sprouting, are recommended for early maturing crops, because tuber initiation starts earlier and the crop matures earlier. But, potato varieties that are at the end of their apical dominance period are recommended for medium and late maturing crops, since they mature later (Carli *et al.*, 2010).

3.3. Effect of sprout length on plant height of potato plant

This study showed that pre-sprouting length of potato tuber had been in the way to show significant influencing on the plant height as it were illustrated in appendix 3. This implies that use different sprout length for planting affect the plant height in a significant way and numerically the study was able to show a different among the treatments in such a way that highest measurement was obtained from teratment3(4cm)and the lowest measurement was recorded control treatment. This result in line with Thomson 1959, described the small sprouts develop tubers instead of plant which are sprouted tubers when planted in the soil put up fast and vigorous growth. From this point of view the experiment performed shows pre-sprouting had significant effect on height of potato plants.

3.4. Effect of sprout length on number of stems per potato plant

The study revealed that there was an influence of sprout length on number of stems emergence per tuber and it was shown in a significant difference at ($P \leq 0.05$) among the treatments (Appendix 4).As a result of these a significant difference was seen in between treatments 1and3 but there was no any tangible significant difference among treatments 1 and 2, treatments 2 and 3. This implies that use of the different sprout length for planting did effect on number of stem in significant way. Accordingly the highest stem number (9) was counted on treatment 3 (4cm) and the lowest count (5.67) was recorded on treatment 1(control) as it was illustrated in Table 1. (Hampson, 1991)Pre-sprouting significantly reduced the number of stems per plant in 1991 with cv. Agria at both sites, in 1992 on average over the cultivars at both sites and in 1993 with cvs.

3.5 Effect of sprout length on number of leaf

The study showed (appendix 5) that using of any sprout length was non-significant on growth performance of potato i.e. using of different sprout lengths had similar effect on number of leaf but there was leaf area difference.

Sprout length had an effect on leaf elongation. The largest sprout length had longer leaf than the other seed tuber sizes. The effect, though not large, is consistent with the generally observed effect of sprout length on vigor of each individual bud on the seed tuber (Struik and Wiersema, 1999). The size of the effect depends on the

range of seed tuber sizes investigated. There was also a significant interaction between seed tuber size and cultivar for this parameter. Such interactions can occur when there are differences between cultivars in seed tuber shape or when the effect of size on the physiological behavior (such as reflected by duration of dormancy or vigour, Van Ittersum, 1992a, b) is not the same for each cultivar.

Table -1 Effect of pre- sprout length on growth attributes of potato

| Treatment (sprouting length) | 50%of emergency | 50%of flowering | PH | NS | NL |
|----------------------------------|--------------------|-----------------|--------|--------|--------|
| 0cm | 10a | 50%of flowering | 50.92a | 5.67a | 80.17 |
| 2cm | 10.67a | 6a | 63.75b | 7.62ab | 88.77 |
| 4cm | 16.67b | 9b | 73.25b | 9b | 110.25 |
| LSD0.05 | 4.61 | 12.33c | 9.65 | 2.56 | 37.69 |
| CV (%) | 16.31 | 2.39 | 9.6 | 15.17 | 17.11 |

Key: similar letters show there is no significant difference among them, and different letters show there is significance difference.

4. SUMMERY AND CONCLUSION

Potato is native of tropical South American region. Potato which is one of natural precious gifts is also very common in the dish of most Ethiopians. Both per-sprouted and non-sprouted tuber is usually planted without distinction by identified. The study was aimed to analyze the effect of different per-sprouting length on growth performance of potato. The experiment was conducted conduct at Wolaita Sodo University south west of Addis Ababa. The experiment will be conducted under field conditions Wolaita sodo University College of Agriculture and Department of Horticulture demonstration site (research field). In the year of 2011 EC under supplementary irrigation. The experiment was conducted using RCBD with three replication and four treatments (control treatment,, 2cm sprouted, 4cm sprouted).The longest height sprout lengthen were recorded by treatment 3 (73.25cm) where as the shortest height was recorded from treatment 1(control)(50.92), influence of sprouts length on number of stems was shown in a significant difference at ($P \leq 0.05$) among the treatment of 1, 3. Accordingly the highest stem number (9) was counted on treatment 3 (4cm) and the lowest count (5.67) was recorded on treatment 1(control) number of leaves development per stem and there was shown in anon-significant different and the highest number of leaves per stem (110.25) was counted on treatment 3(4cm Sprout) and comparatively the lowest count (80.17) was recorded on treatment 1 (control).

The experiment showed that using of 4cm sprouted length was promising for potato production in the study area. But this research was only conducted on growth parameters and it has to be repeated for both growth and yield attributed using different verities.

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6. APPENDICES

Appendix 1 ANOVA Effect of pre-sprout length on 50% of emergence

| Source of variation | DF | SS | MS | F cal | F tab | |
|---------------------|----|--------|-------|--------|-------|----|
| | | | | | 5% | 1% |
| Treatment | 2 | 80.89 | 40.45 | 9.84* | 6.94 | 18 |
| Block | 2 | 14.89 | 7.45 | 1.81ns | | |
| Error | 4 | 16.44 | 4.11 | | | |
| Total | 8 | 122.22 | | | | |

Appendix 2 ANOVA Effect of pre-sprout length on 50% flowering

| Source of variation | DF | SS | MS | F cal | F tab | |
|---------------------|----|-------|-------|---------|-------|----|
| | | | | | 5% | 1% |
| Treatment | 2 | 60.22 | 30.11 | 27.13** | 6.94 | 18 |
| Block | 2 | 6.22 | 3.11 | 2.80ns | | |
| Error | 4 | 4.45 | 1.11 | | | |
| Total | 8 | 70.89 | | | | |

Appendix 3 ANOVA of effect pre-sprout length on plant height

| Source of variation | DF | SS | MS | F cal | F tab | |
|---------------------|----|--------|-------|--------|-------|----|
| | | | | | 5% | 1% |
| Treatment | 2 | 703 | 351.5 | 9.71* | 6.94 | 18 |
| Block | 2 | 91.77 | 45.89 | 1.27ns | | |
| Error | 4 | 144.74 | 36.19 | | | |
| Total | 8 | 939.51 | | | | |

Appendix 4 ANOVA of Effect pre- sprout length on number of stem per plant

| Source of variation | DF | SS | MS | F cal | F tab | |
|---------------------|----|-------|-------|-------|-------|----|
| | | | | | 5% | 1% |
| Treatment | 2 | 20.48 | 10.24 | 8* | 6.94 | 18 |
| Block | 2 | 19.22 | 9.65 | 7.54* | | |
| Error | 4 | 5.11 | 1.28 | | | |
| Total | 8 | 44.81 | | | | |

Appendix 5 ANOVA of Effect of pre- sprout length on number of leaf per plant

| Source of variation | DF | SS | MS | F cal | F tab | |
|---------------------|----|---------|---------|--------|-------|----|
| | | | | | 5% | 1% |
| Treatment | 2 | 2962.21 | 1481.11 | 5.37ns | 6.94 | 18 |
| Block | 2 | 1713.97 | 856.99 | | | |
| Error | 4 | 1103.56 | 275.89 | | | |
| Total | 8 | 7.91 | | | | |