

# Effect of Varying Seed Size on Seed Yield and its Contributing Traits in Potato

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**ABSTRACT:** The effects of varying seed size on seed yield and its contributing traits in potato were investigated during the years 2015-16 and 2018-19 at University Seed Farm, Ladhawal, PAU, Ludhiana. The objective of the study was to find out the suitable size of seed tubers and intra-row spacing for potato seed production. Four seed sizes viz., < 40 g, 40-70 g, > 70 g and half cuts of tubers  $\hat{A}$ 100 g were evaluated and the results implicated that the small sized and seed sized tubers gave the best results with respect to tuber length, tuber diameter, tuber volume and tuber weight per plant. The maximum number of tubers per plant was obtained by small sized and cut tubers. The effect of seed sizes were noticed non-significant for average tuber weight. Seed yield was noted maximum when small sized tubers (2015-16) and seed sized tubers (2018-19) were used. The total yield was higher when small sized tubers (< 40 g) in 2015-16 and seed sized tubers (40-70 g) in 2018-19 were used. From the present investigation it is evident if small sized tubers were used, the cost of production would be less. Farmer's practice of using cut tubers for seed production was found more costly and labour intensive as compare to the practice of using small sized tubers.

**Keywords:** Cut tubers, Intra-row spacing, Oversized tubers, Seed size, Seed yield, Small size, Total yield

One of the major constraints for the successful potato production is the high cost of seed potatoes which is the most valuable and critical input and accounts for 50-60 per cent of the total cost of potato production. The future projections suggest that in India, the area under potato crop will rise to 2 Mha and production will reach approximately 50 Mt. Thus to meet the seed requirements for increasing area, the approximate required quantity of seed potato will be 0.26mt. Most of the farmers in India use their own potato seed with their own technology, but are able to satisfy only 20-25% of the total certified seed demand of the country [1].

The seed yield in potato depends on potato tuber size as the smaller seed accommodates the higher plant population which not only increases total yield and specific gravity but also reduces the incidence of hollow heart [2]. The yield increase is attributable to more tubers being produced with higher planting density although tuber size is decreased because of increased inter-plant competition with closer spacing. The small and medium sized tubers are preferred by the farmers engaged in small scale cultivation to reduce the seed cost [3], but it is also reported that planting large sized tubers increases the

tuber number and yield per plant over small sized tubers [4-5].

It is recommended to go for closer spacing to obtain higher percentage of seed sized tubers, but as per recommendation the spacing between rows cannot be varied with mechanical potato planters. Thus there is requirement of studying the effect of varying intra-row spacing on percentage of suitable seed sized tubers.

## MATERIALS AND METHODS

The present studies on effect of seed size on seed yield and its contributing attributes in Potato (*Solanum tuberosum* L.) were carried out at University Seed Farm, Ladhawal, Punjab Agricultural University, Ludhiana. The study was conducted in two independent years i.e. 2015-16 and 2018-19. The experimental material for the present study comprised of cultivar Kufri Pukhraj. The experiment was conducted in split plot design. Four different seed sizes i.e. undersize tubers with weight less than 40 g (S<sub>1</sub>), seed size with tuber weight was 40-70 g (S<sub>2</sub>), oversize tubers with weight more than 70g (S<sub>3</sub>), Cut tubers, the oversize tubers weighing more than 100 g were cut in half before sowing (S<sub>4</sub>). The plot size was

5m x 3m. All cultural practices were adopted as per Package of Practices of Cultivation of Vegetable Crops, Punjab Agricultural University Ludhiana [6]. The parameters related to the seed size viz., specific gravity of tubers (g/cc), tuber length (mm), tuber diameter (mm), tuber volume (cc), number of tubers per plant, average tuber weight (g), weight of tubers per plant (g), seed yield (g) and total yield were observed. Five randomly selected tubers were used to determine the specific gravity by weighing the tubers in air and then in water. The displacement method was followed for calculation. The parameters like tuber length and tuber diameter were measured with the help of Vernier calliper and average was worked out. The tuber volume was calculated by water displacement method. The set of 50 randomly selected tubers were dipped in distilled water and the volume of water displacement was recorded. The average volume per tuber was worked out in cubic centimetres. For calculating number of tubers per plant, five competitive plants were harvested from each plot and number of tubers was counted. Average tuber number per plant was calculated by dividing total number of tubers with number of plants harvested. Average tuber weight was calculated by dividing the total tuber yield per plant by total number of tubers per plant. It was measured in grams. Another parameter related to seed size i.e. weight of tubers per plant was derived by dividing the total yield per plot to the number of plants per plot and it was measured in grams. Average tuber weight was calculated by dividing the total tuber yield per plant by total number of tubers per plant. It was measured in grams. The total yield was computed by multiplying total number of tubers with average tuber weight. The yield obtained from each unit plot was converted into per acre yield and expressed as q/acre. Seed yield were obtained by observing the seed sized tubers viz. 40-70 g from the total yield. The yield obtained from each unit plot was converted into per acre seed yield. Percent seed sized tubers explained the

percentage of seed sized tubers obtained from the total yield. The split plot design [7] analysis was carried out. The statistical analysis was carried out by using CPCS-I computer package.

## RESULTS AND DISCUSSION

The data recorded on various parameters related to seed yield and its contributing traits; tuber length (mm), tuber diameter (mm), tuber volume (cc), number of tubers per plant, average tuber weight (g), weight of tubers per plant (g), seed yield (g) and total yield were analysed and presented (Table 1 and 2). The findings of each parameter have been discussed below.

### Tuber length

The effects of varying tuber size on tuber length are presented (Table 1 and 2). The perusal of the data revealed that the tuber length of 45.28mm (2015-16) and 45.37mm (2018- 19) was observed when cut tuber used for sowing the crop. These results were at par with the tuber length obtained when small sized tubers used for crop sowing. The tuber size obtained by small sized tubers and cut tubers was observed quite similar [8]. Therefore, use of small sized tubers instead of cut tubers is more economical for seed production. The cost of production can be reduced by the use of small sized tuber however; use of cut tubers for sowing purpose is labour intensive.

### Tuber diameter

The present investigations revealed that the tuber diameter has significant effects with respect to different seed sizes (Table 1 and 2). However, maximum tuber diameter was found when oversized tubers and seed sized tubers were used in the year 2015-16 and 2018-19 respectively. The maximum size of tubers obtained by by oversized tuber might be attributing to the fact that larger tubers have more reserves for each sprout [9].

**Table 1.** Effect of varying seed size on seed yield and its contributing traits during 2015-16 in potato variety 'Kufri Pukhraj'

| Seed size              | Tuber length (mm) | Tuber diameter (mm) | Tuber volume (cc) | Tubers/plant | Av. tuber weight (g) | Tuber Wt./plant (g) | Seed yield (q/acre) | Yield total (q/acre) |
|------------------------|-------------------|---------------------|-------------------|--------------|----------------------|---------------------|---------------------|----------------------|
| Small size tubers (S1) | 45.30             | 63.22               | 45.1              | 7.77         | 48.65                | 380.91              | 88.49               | 113.4                |
| Seed size tubers (S2)  | 46.90             | 68.71               | 44.0              | 7.55         | 47.55                | 363.06              | 84.85               | 107.6                |
| Oversized tubers (S3)  | 47.28             | 74.09               | 43.7              | 7.54         | 47.22                | 357.64              | 84.02               | 107.2                |
| Cut tubers (S4)        | 45.28             | 64.78               | 44.2              | 7.63         | 47.91                | 366.57              | 86.25               | 110.4                |
| Mean                   | 46.19             | 67.70               | 44.25             | 7.62         | 47.83                | 367.05              | 85.90               | 109.7                |
| CD (p=0.05)            | 0.642             | 1.40                | NS                | 0.155        | NS                   | NS                  | NS                  | NS                   |

**Table 2.** Effect of varying seed size on seed yield and its contributing traits during 2018-19 in potato variety 'Kufri Pukhraj'

| Seed size              | Tuber length (mm) | Tuber diameter (mm) | Tuber volume (cc) | Tubers/plant | Av. tuber weight (g) | Tuber Wt./plant (g) | Seed yield (q/acre) | Yield total (q/acre) |
|------------------------|-------------------|---------------------|-------------------|--------------|----------------------|---------------------|---------------------|----------------------|
| Small size tubers (S1) | 45.41             | 63.27               | 43.1              | 7.42         | 47.75                | 354.83              | 83.73               | 105.7                |
| Seed size tubers (S2)  | 46.92             | 68.82               | 45.6              | 7.40         | 49.12                | 364.81              | 85.19               | 110.5                |
| Oversized tubers (S3)  | 47.68             | 74.27               | 44.0              | 7.28         | 47.67                | 348.73              | 82.62               | 104.3                |
| Cut tubers (S4)        | 45.37             | 64.82               | 43.8              | 7.48         | 47.89                | 358.48              | 86.49               | 108.5                |
| Mean                   | 46.35             | 67.80               | 44.13             | 7.40         | 48.11                | 356.71              | 84.51               | 107.3                |
| CD (p=0.05)            | 0.633             | 1.33                | 1.90              | NS           | NS                   | NS                  | NS                  | NS                   |

NS= Non-significant

**Tuber volume**

The effects of seed size were non-significant for tuber volume in 2015-16 however significant results were found in 2018-19. It was reported that maximum tuber volume (45.6 cc) was obtained when seed sized tubers were used and minimum was 43.1 cc in the year 2018-19.

**Specific gravity (g/cc)**

Specific gravity was found non-significant with respect to seed size in both years. It was revealed that use of different seed size had non-significant effect on specific gravity [8].

**Number of tubers per plant**

Number of tubers per plant was significantly different with respect to seed size in 2018-19. Among various seed sizes the small sized tubers and cut tubers gave maximum number of tubers per plant in 2015-16 and 2018-19 respectively. It was revealed that the number of tubers per stem decreased with increasing seed size and reduction of spacing [10].

**Average tuber weight (g)**

It is evident from the study that seed size has no significant effect on the average tuber weight however; small sized tubers and seed sized tubers gave the maximum average tuber weight in 2015-16 and 2018-19 respectively. Similar results were found that confirmed that seed size had a positive but non-significant effect on average tuber weight [11].

**Weight of tuber per plant (g)**

The non-significant effects on weight of tubers per plant were found with respect to seed size in both the years although maximum weight of tubers per plant 380.91 g and 364.81 g were found when small sized tubers and seed sized tubers were used in 2015-16 and 2018-19

respectively. However, the maximum weight of tuber per hill was obtained from whole tubers [12].

**Seed yield (q/acre)**

Seed size had no significant effect on the seed yield in both the years. Although, maximum seed yield (88.49 and 86.49 q/acre) were found when crop was raised from small sized tubers and cut tubers in 2015-16 and 2018-19, respectively. Maximum seed yield was obtained by the use of small sized tubers followed of cut tubers [13].

**Total yield (q/acre)**

Seed size had non-significant effect on total yield. Although, maximum total yield (113.4 and 110.5 q/acre) were found when small sized tubers and seed sized tubers were used in the year 2015-16 and 2018-19. These non-significant effects were observed with respect to tuber size on the total yield [13].

**CONCLUSION**

From the present investigation it was concluded that among various tuber sizes small and seed sized tubers gave maximum seed and total yield followed by cut tubers. Therefore, better to narrow down the seed rate to 12-15q/acre. Cut tubers gave slightly less seed yield as compare to small and seed sized tubers for seed production is quite effective but equal or slightly better results can be obtained by the use of smaller or seed sized tubers.

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