

Performance of Sprout Cutting and Aeroponic Minituber of Potato (*Solanum tuberosum* L.) in *In Vivo* Condition of Central India

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Abstract An experiment was conducted during 2014-15 with potato sprouts and minituber as planting material. Four type of planting material. viz. top cut of sprout (3-4 cm), middle portion of sprout (3-4 cm), bottom portion of sprout (3-4 cm) and remaining aeroponic minituber (weight 3-20 gm) of variety K. Lauvkar were planted under net house conditions. Experiment was planted in completely randomized block (CRD) design with three replications. Non-significant differences for emergence per cent and compound leaves/plant was recorded among the planting materials. Plant height was significantly higher in plants developed from tuber part (36.0 cm).

Significantly higher tuber number (14) and weight/plant (437 g) was recorded in minituber over other sprout cutting. Non-significant difference was recorded in mean tuber weight among planting materials. Tuber number (146) and weight/plot (3.86 kg) were significantly higher in minituber portion over other sprout parts. Since seed multiplication rate in sprout portion is low in the range of 6.0-10.7, hence seed multiplication from sprout portion can also be integrated in basic seed multiplication program to enhance good quality seed availability.

Keywords Aeroponic minitubers, Sprouts, Seed production, Potato.

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Introduction

Potato is one of the most important vegetatively propagated crops all over the world and its importance is increasing. For maintenance and multiplication of desirable seed material sprout cutting is important one among different rapid method of multiplication [1] which consists of isolating sprouts into single buds to be planted in the field for increasing tuber numbers. Sprouts of potato tu-

bers can effectively be used for propagation of potato, which is yet to be standardised [2]. Use of detached sprouts from seed potato tubers is an alternative method for potato propagation. This technique allow reduction in the import and the production of new basic minitubers, enhancing up to 200% the productivity rate for each unit of imported potato seed. Therefore, sprout planting can be an important advance in the production process of basic seed potatoes [3].

Rapid multiplication technique such as single node and sprout cutting and leaf bud cutting have been developed for the use in screening germplasm, disease elimination and seed program. These techniques have been adopted to shorten the multiplication cycle. Combined the use of sprout, single-node and stem cuttings to produce large number of cuttings transplanted in the field for further multiplication [4]. Sprouts are removed from selected tubers, then cut in to pieces with one or more node on each, rooted in fine sand and can be transplanted directly to the field or pots in the plant house [5]. Bangladesh Agriculture Development Corporation claimed that sprout cutting is highly effective to produce virus free foundation seed potato without affecting the production capacity of the mother [6]. Four to nine plants per mother tuber can be raised depending upon the variety and the type of sproutlings and it is possible to increase further the number of plants by taking multiple cuttings from long sprouts [7]. Each sprout cutting originates minitubers that can be directly planted in the field [8]. Therefore, sprout planting can be an important advance in the production process of basic seed potatoes.

Aeroponics is the process of growing plants in an air mist environment without the use of soil or an aggregate medium. There is a tremendous scope to increase healthy seed production vertically by adopting aeroponic technology of seed system where increase in multiplication rate from 5 : 1 to 50 : 1 can be achieved. Tubers are harvested sequentially as they attain the desired size. These minitubers are sequentially cured at decreasing humidity and temperature and stored at 2-4°C and used for planting in the next generation [9]. In the present study long sprouted (10-12 cm) aeroponic minitubers of early variety

Kufri Laukar were collected from CPRI, Shimla which were kept in cold store. There is scanty information about performance of sprout cutting under Indian conditions. Hence present study was undertaken to generate information on the above mentioned aspect.

Materials and Methods

An experiment was conducted at the Central Potato Research Station, Gwalior (MP) during 2014-15. Long sprouted (10-12 cm) aeroponic minitubers of variety *Kufri Lauvkar* were collected from CPRI, Shimla. Every sprout was cut into three pieces with a sharp sterilized knife or blade. The cutting was done carefully so that every piece should contain at least one node and dipped in 0.2% Dithane M-45. Thus four type of aeroponic seed material viz. top portion of sprout (3-4 cm), middle portion of sprout (3-4 cm), bottom portion of sprout (3-4 cm) and remaining minituber (weighing 3-20 gm) of variety *Kufri Lauvkar* were planted under net house conditions. Seed bed was prepared by making one inch thick layer of well decomposed farm yard manure and sand in the ratio of 1 : 1 on the top of the bed under single door insect-proof net house. The three types of sprouts (Top, middle and lower portion) were planted at 30 × 10 cm spacing and remaining minituber in 30 × 15 cm spacing in 2 m row length in 2 rows (1.2 M² plot size) during second week of November. Experiment was planted in completely randomized block (CRD) design with three replications. Other packages of practices were followed as per recommendation for seed potato crop. Data on germination/establishment was recorded 30 DAP. Plant height and compound leaves were recorded after 50 DAP. Yield attributing parameters viz. number and weight of minitubers/plant, mean tuber weight, number and weight of tuber/plot, per cent <3 g tubers both by number and weight were recorded after harvesting. Data was analyzed statistically and means were separated according to the least significant differences (LSD) at 0.05 level of probability.

Results and Discussion

Non-significant difference for/establishment per

Table 1. Effect of sprout and whole tuber on growth and yield parameters.

Planting material (sprout cutting / minituber)	Growth attributing parameters				Yield attributing parameters				Per cent <3g minitubers	
	Emer- gence (%)	Plant height (cm)	Compound leaves /plant (No.)	Num- ber of mini- tuber/ plant	Wei- ght of mini- tuber/ plant (g)	Mean mini- tuber weight (g)	Num- ber of mini- tuber plot (1.2 M ²)	Weight of minituber (g)/plot (1.2 M ²)	by number	by weight
Sprout top portion (3-4 cm)	80.00	29.3	14.3	6.0	175	29.84	112	2.90	26.76	3.64
Sproutmiddle portion (3-4 cm)	74.17	21.0	12.7	6.7	190	29.33	96	3.37	34.48	5.62
Sproutlower portion (3-4 cm)	82.50	17.0	12.7	10.7	270	26.93	111	2.42	25.07	3.49
Minituber (3-20 g)	71.79	36.0	17.0	14.0	437	31.12	146	3.86	27.10	2.74
SEm±	2.65	2.93	2.10	1.43	29.61	3.72	5.98	0.23	2.43	0.44
CD @ 0.05	NS	9.72	NS	4.75	98.07	NS	19.79	0.77	NS	1.47
CV	5.95	19.67	25.69	26.61	19.14	21.99	8.89	13.96	14.85	19.90

cent was recorded among the planting materials, but highest emergence was recorded in plants developed from lower portion (3-4 cm) of sprout (82.50%) and lowest in plants developed from tuber part (71.79%). Basal portion of sprout recorded significantly higher plant stand (46.12%) than tip cutting of long sprout (34.8%) [7]. Plant height was significantly higher in plants developed from tuber part (36.0 cm) followed by plants developed from top portion (3-4 cm) of sprout (29.3 cm) over plants developed from lower portion (3-4 cm) of sprout (17.0 cm). Plant height was significantly higher in whole tuber (57.7 cm) than whole sprout and tip and basal cutting of long sprout [7]. Non-significant difference for compound leaves/plant was recorded among the planting materials, but highest was recorded in plants developed from tuber part (17.0 Table 1. The number of shoots, stem girth, height and number of leaves per plant from individual sprouts were less than from other planting-materials viz. whole tubers, half tubers (base end) and quarter pieces [10]. This confirms the present finding for growth parameters i.e. plant height and compound leaves. The less growth attributing parameters in sprout cutting may be attributed to deficiency in the reserve material required for proper growth of the plant.

Significantly higher number and weight of minituber/plant was recorded in plants developed from tuber part (14.0 and 437g) followed by lower portion (3-4 cm) of sprout (10.7 and 270 g) over

tuber developed from top portion (3-4 cm) of sprout (6.0 and 175 g). Non-significant differences were recorded in mean tuber weight, but highest was recorded in tuber part (31.12 g). This is in agreement where number and tuber were significantly higher in whole tuber (54 and 625 g) than whole sprout and tip and basal cutting of long sprout [7]. Plant developed from sprout cutting of 4-5 cm long with single node produced about 4 tubers, weighting up to 81.2 g, with a mean tuber weight of 21.4 g [2]. Seed yield ratio was highest (1 : 5.6) in plants from half tubers (top end), closely followed by individual sprouts (1: 5.1) [10]. In present study, tuber number in the range of 6.0-10.7 and weight in the range of 175-270 g/plant were reported in sprout cutting portion with mean tuber weight from 26-30 g. This suggests minitubers produced from sprout cut can be easily used for further multiplication in Gen-1.

Number and weight/plot was significantly higher only in minituber produced from minituber part (146 and 3.86 kg) over all other sprout portions and lowest was recorded in minituber produced from middle portion (3-4 cm) of sprout (96 and 2.37 kg). Yields from sprout cuttings in field experiments were 10 to 18 t/ha which were 33% lower than from healthy seed tubers. Whole tuber, whole sprout, basal cutting of long sprout recorded significantly higher tuber weight over tip cutting of long sprout [7]. In the present study also 25-39% less yield (on weight basis) was reported from sprout part than minituber part. Thus we can integrate the sprouts in basic seed

multiplication under aeroponic seed production. Yield per hectare was low for individual sprouts than for plants from whole tubers or half tubers, but it was on par with quarter pieces of tuber [10]. Non significantly higher <3 g minitubers were produced from middle portion (3-4 cm) of sprout (34.48%). Similar trend was observed for weight but significant increase in <3 g minitubers were reported in middle portion (3-4 cm) of sprout (5.62%).

Conclusion

Production potential of sprout portions is less than minitubers with seed multiplication rate in the range of 6.0-10.7, hence sprout cutting also can be integrated with basic seed production after proper health evaluation of sprouts for viruses for increasing seed production rate.

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