

## GROWTH AND YIELD PERFORMANCE OF POTATO CULTIVARS RAISED FROM LITTLE TUBERS

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### SUMMARY

Little tubers of three cultivars of potato (*Solanum tuberosum* L.) were produced on physiologically old seed tubers by storing them at  $18\pm 2^{\circ}\text{C}$  and desprouting twice during storage. These little tubers, weighing 0.3-1.0 g, were used as seed and evaluated under field conditions in comparison with normal seed tubers weighing 40-60g. Little tubers produced single stemmed plants, which were comparable to normal plants in terms of height, girth and leaves on the main stem. When little tubers were planted at 60x10 cm spacing compared to normal seed tubers planted at 60x20 cm, the number of tubers produced per  $\text{m}^2$  was higher for little tubers in Kufri Bahar and Kufri Sindhuri but in cultivar Kufri Chandramukhi, there was no significant difference. Tuber yield was lower when little tubers were used as seed as compared to normal seed tubers in Kufri Chandramukhi, but, in the other two cultivars there was no significant difference in yield. Results showed that little tubers of Kufri Bahar and Kufri Sindhuri produced on physiologically old tubers during storage can be used to raise a reasonably good crop but this does not hold true for Kufri Chandramukhi.

**Key words:** Growth, little tubers, potato, seed tubers, yield

### INTRODUCTION

Formation of little tubers was reported as a physiological disorder peculiar to potato (Langille 1969) and little tubers could be produced from physiologically old tubers (Dimalla and van Staden 1977). Several environmental factors influence the formation of little tubers on stored mother tubers. It has been shown that little tubers can be produced either by exposing sprouted mother tubers to low temperatures or by repeated desprouting of mother tubers stored at higher temperatures (Ezekiel 1997, Ezekiel *et al.* 2000). It was of interest to see whether these little tubers could be used as seed material to raise a commercial potato crop. Preliminary trials have shows that there are practical problems in handling little tubers weighting less than 0.5 g

which form more than 70 to 90% of the little tubers harvested (Ezekiel *et al.* 2000). Therefore, this study was taken up with the aim of evaluating growth and yield performance of potato cultivars raised from little tubers in comparison with normal seed tubers. The three potato cultivars differ in days required to attain crop maturity.

### MATERIALS AND METHODS

The experiments were conducted at Central Potato Research Institute Campus, Modipuram during 1996-2000. Seed tubers of Kufri Bahar (medium duration cultivar) and Kufri Chandramukhi (short duration cultivar) were planted in the third week of October, 1996. The crop was harvested in the second week of February,

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1997. During the following year experiment was repeated with Kufri Sindhuri (late maturing cultivar) replacing Kufri Chandramukhi. Seed tubers of Kufri Bahar and Kufri Sindhuri were planted during third week of October 1997 and harvested during the second week of February, 1998. Recommended package and practices were followed.

**Production of little tubers:** Tubers (referred to as mother tubers hereafter) of Kufri Bahar and Kufri Chandramukhi weighing 75-120g were selected and shifted to cold store (2 - 4°C, 90-95% RH) on 22-3-1997. They were removed from cold store on 7-10-1997 (after 200 days) and stored in a walk-in-chamber (18±2°C; 80-85% RH). During storage the mother tubers were desprouted twice *i.e.* on 10-11-1997 and 10-12-1997. Little tubers produced on mother tubers were harvested twice *i.e.*, on 15-2-1998 and 15-3-1998. Most of the little tubers produced

weighed between 0.5 and 1.0 g (Fig. 1 A and D). They were stored in cold store from 23-3-1998 to 16-10-1998 (for 208 days). Normal seed tubers weighing 40-60 g harvested during the second week of February, 1998 from a seed crop of Kufri Bahar and Kufri Chandramukhi were also stored in cold store for the same period and used as control.

Selected tubers (mother tubers) of Kufri Bahar and Kufri Sindhuri were also stored in cold store on 17-3-1998. They were removed from cold store on 15-10-1998 (after 203 days) and stored in a walk-in-chamber. During storage the tubers were desprouted thrice *i.e.*, on 25-10-1998, 27-11-1998 and 29-12-1998. Little tubers produced on mother tubers were harvested twice *i.e.*, on 5-2-1999 and 10-3-1999. Most of the little tubers produced weighted between 0.3 and 0.5g (Fig. 1 B and C). They were stored in cold

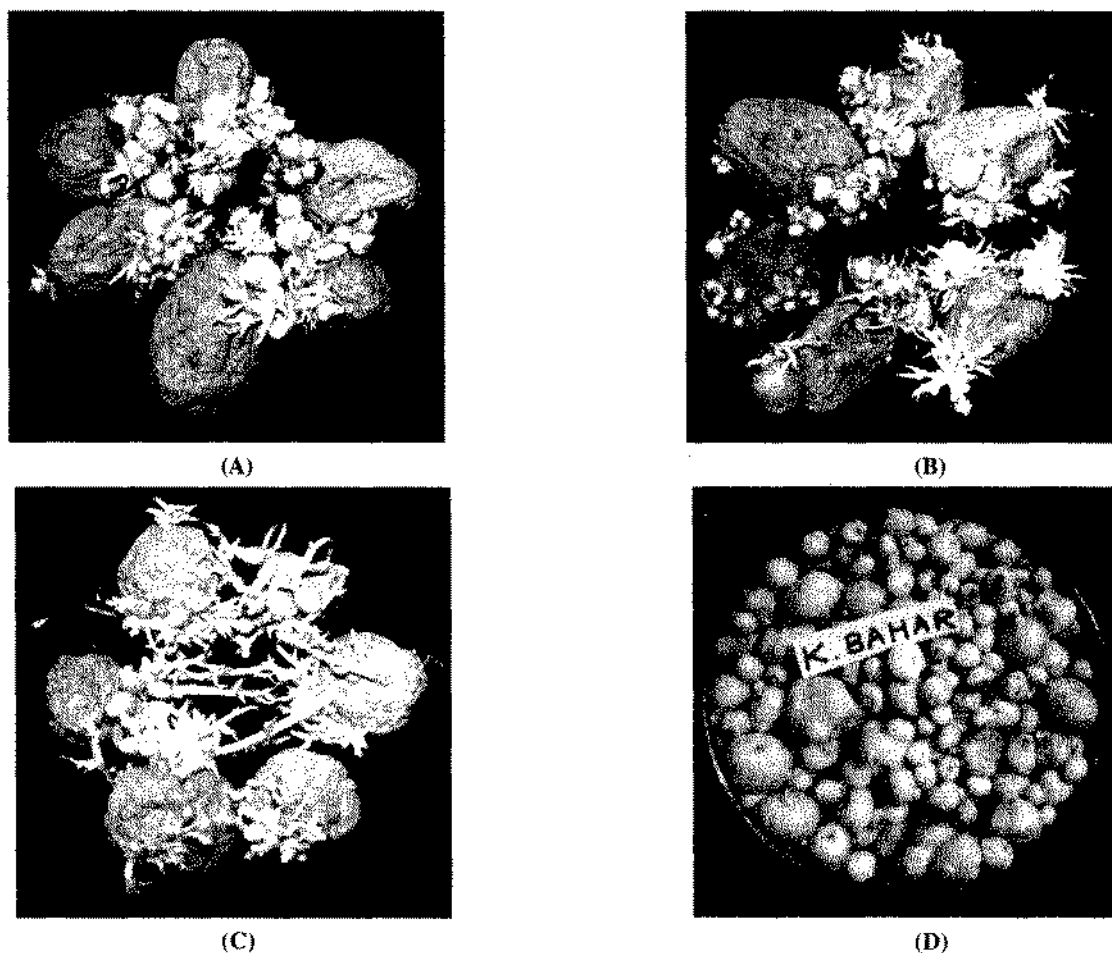


Fig. 1. Production of little tubers on physiologically old mother tubers of Kufri Chandramukhi (A), Kufri Bahar (B) and Kufri Sindhuri (C). Harvested little tubers of Kufri Bahar (D).

store from 17-3-1999 to 5-10-1999 (for 203 days). Normal seed tubers weighing 40-60g, harvested during the second week of February, 1999 from a seed crop of Kufri Bahar and Kufri Sindhuri were also stored in cold store for the same period and used as control.

**Field evaluation:** The little tubers and normal seed tubers of Kufri Bahar and Kufri Chandramukhi were removed from cold store on 16-10-1998 and pre-sprouted for 10 days at room temperature (Max. 28°C and Min. 16.2°C) and planted in the field on 26-10-1998. Normal seed tubers weighing 40-60g were planted at the recommended spacing of 60x20 cm while little tubers weighing 0.5-1.0 g were planted at 60x10 cm. Recommended package of practices were followed and they were common to both normal and little tubers. Observations were recorded on number of stem per plant and length, girth and number of leaves on the main stem at 60 days after planting in Kufri Bahar and Kufri Chandramukhi. Harvesting was done on 3-2-1999. The harvested tubers were graded into three grades *i.e.* <25 g, 25-75 g and >75 g and their number and weight were determined.

Similarly the little tubers and normal seed tubers of Kufri Bahar and Kufri Sindhuri of second year experiment were removed from cold store on 5-10-1999 and pre-sprouted for 10 days at room temperature (Max. 30.1°C, Min. 17.4°C) and planted in the field on 15-10-1999. Normal seed tubers weighing 40-60 g were planted at the recommended spacing of 60x20 cm while little tubers weighing 0.3-0.5 g were planted at 60x10 cm. Recommended package of practices were followed and they were common to both normal and little tubers. Harvesting was done on 25-1-2000. The harvested tubers were graded into three grades *i.e.* <25 g, 25-75 g and >75 g and their number and weight were determined. The experiments were laid out in Randomized Block Design with three replications. The data were analysed statistically following the procedure given by Gomez and Gomez (1984).

## RESULTS AND DISCUSSION

The characteristics of plants produced from little tubers were compared with that of plants from normal seed tubers. Stem number per plant was significantly higher with normal seed tubers in both the cultivars

(Table 1). Stem length and stem girth were higher in plants from normal seed tubers than from little tubers in Kufri Chandramukhi but there was no significant difference in Kufri Bahar. The difference in the number of leaves on the main stem of plants from normal and little tubers was non-significant in both the cultivars. The higher number of stem per plant was due to the multiple sprouts present in a normal seed tuber weighing 40-60 g but little tubers, weighing less than one g, cannot support the growth of more than one sprout due to limited food material available in them (Paul and Ezekiel 2002). While the plants produced by little tubers were similar to those produced by normal seed tubers in Kufri Bahar, they were shorter with thinner stem in Kufri Chandramukhi.

In Kufri Bahar the number of tubers were more in the crop raised from little tubers due to larger number of tubers weighing less than 25 g (Table 2). On the other hand, Kufri Chandramukhi, although produced more number of tubers weighing less than 25 g in the crop raised from little tubers but there was no significant difference in the total number of tubers. (Table 2). In Kufri Chandramukhi, the yield was significantly lower in the crop raised from little tubers as compared to the crop raised from normal seed tubers. However, there was no significant difference in yield in case of Kufri Bahar (Table 2). The little tubers produced by a short duration cultivar (Kufri Chandramukhi) and a medium duration cultivar (Kufri Bahar) were examined in 1998-99, whereas, little tubers produced by a medium duration cultivar (Kufri Bahar) and a long duration cultivar (Kufri Sindhuri) were determined in 1999-2000. Although there was significantly higher tuber yield for the grade 25-75 g from little tuber raised crop of Kufri Bahar but there was no significant difference in the yield between little tubers and normal seed tubers raised crop either of Kufri Bahar or Kufri Sindhuri (Table 3). Number of tubers produced was higher in crop from little tubers in both the cultivars and it was mainly due to larger number of tubers weighing less than 25 g in comparison with the crop raised from normal tubers (Table 3). For all the three cultivars little tuber raised crop always produced more number of total tubers in comparison with control. Amongst the cultivars, Kufri Sindhuri produced the maximum number of tubers.

The number of stems per plant is proportional to the number of sprouts at planting (Goodwin *et al.* 1992). Little tubers produce single sprout and there is no increase in the

**Table 1.** Characteristics of plants produced from little tubers (tuber weight : 0.5-1.0 g; spacing : 60 x 10cm) and normal seed tubers (tuber weight : 40-60 g; spacing : 60 x 20cm) 60 days after planting during 1998-1999 season.

Plant characteristics	Kufri Bahar			Kufri Chandramukhi		
	Normal tubers	Little tubers	C.D. (P = 0.05)	Normal tubers	Little tubers	C.D. (P = 0.05)
Stems per plant	4.0	1.0	1.4	4.0	1.0	1.6
Length of the main stem (cm)	23.0	18.0	NS	29.0	11.0	5.8
Girth of the main stem (cm)	2.9	2.6	NS	3.0	2.3	0.4
Leaves on the main stem	13.0	15.0	NS	14.0	14.0	NS

**Table 2.** Yield performance of little tubers as compared to normal seed tubers in two potato cultivars during 1998-99 season (tuber weight and spacing as in Table 1)

Grade	Kufri Bahar			Kufri Chandramukhi		
	Normal tubers	Little tubers	C.D. (P = 0.05)	Normal tubers	Little tubers	C.D. (P = 0.05)
<b>Tuber number/m<sup>2</sup></b>						
<25g	22.0	53.0	9.3	28.0	47.0	11.8
25-75g	34.0	25.0	NS	32.0	17.0	13.3
>75g	5.0	4.0	NS	2.0	1.0	NS
Total	61.0	82.0	15.0	62.0	65.0	NS
<b>Tuber yield (kg/m<sup>2</sup>)</b>						
<25g	0.350	0.705	0.170	0.472	0.540	NS
25-75g	1.710	1.215	NS	1.531	0.716	0.680
>75g	0.530	0.410	NS	0.246	0.160	NS
Total	2.590	2.330	NS	2.249	1.416	0.702

**Table 3.** Yield performance of little tubers (tuber weight : 0.3-0.5 g; spacing : 60 x 10cm) as compared to normal seed tubers (tuber weight : 40-60 g; spacing: 60 x 20cm) in two potato cultivars during 1999-2000 season.

Grade	Kufri Bahar			Kufri Sindhuri		
	Normal tubers	Little tubers	C.D. (P = 0.05)	Normal tubers	Little tubers	C.D. (P = 0.05)
<b>Tuber number/m<sup>2</sup></b>						
<25g	31.0	74.0	20.6	71.0	143.0	35.7
25-75g	62.0	91.0	17.1	48.0	61.0	NS
>75g	10.0	4.0	3.0	2.0	1.0	NS
Total	103.0	169.0	21.0	121.0	205.0	45.2
<b>Tuber yield (kg/m<sup>2</sup>)</b>						
<25g	0.555	0.687	NS	1.000	1.505	NS
25-75g	3.490	4.054	0.495	2.403	2.077	NS
>75g	1.056	0.536	NS	0.211	0.110	NS
Total	5.100	5.277	NS	3.614	3.692	NS

number of sprouts per tuber even two months after the release of dormancy (Paul and Ezekiel 2002). The size of tuber has a strong influence on the number of sprouts per tuber (Allen *et al.* 1992). Although the number of plants per unit area was double in the case of little tubers, the number of stems per unit area was only half to that of normal seed tubers.

The vegetative growth and yield performance of the crop raised from little tubers was cultivar dependent. In Kufri Bahar and Kufri Sindhuri, the crop produced by little tubers was comparable to that produced by normal seed tubers but the same was not true for Kufri Chandramukhi. When little tubers weighing 2-10 g were compared with normal seed tubers of similar weight, there was no significant difference in the morphological characters of the plants produced (Paul and Ezekiel 2003). The plants produced by little tubers of Kufri Chandramukhi were shorter with thinner stems when compared to normal seed tubers. This was also reflected in the lower yield obtained in the crop produced by little tubers of Kufri Chandramukhi. The study indicates that little tubers of Kufri Bahar and Kufri Sindhuri can be used to raise reasonably good crop comparable to crop raised from normal seed tubers but this does not hold true for little tubers of Kufri Chandramukhi.

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