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RESEARCH PAPER

Evaluation of selected varieties of processing potato under Chhattisgarh plains

■ BHUWNESHWARI*, SATISH K. VERMA, KAMAL NARAYAN, M.S. PAIKRA AND SATRAM S. PAIKRA[1]

Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, RAIPUR (C.G.) INDIA (Email : bhuwneshwari_07@yahoo.com)

[1]C.G. State Seed Certification Agency, Indira Gandhi Krishi Vishwavidyalaya, Campus, Krishaknagar, RAIPUR (C.G.) INDIA

*Author for Correspondence

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SUMMARY :

An experiment was conducted to evaluate the selected varieties of processing potato (*Solanum tuberosum* L.) under Chhattisgarh plains. The experiment was laid out in a randomized block design with three replications and nine treatments/genotypes during *Rabi* 2009-10. The results revealed that the highest per cent emergence was recorded in Kufri Chipsona-1 (93.26%), the maximum number of leaves plant^{-1} was counted in Kufri Surya (326.30), significantly the maximum number of shoots plant^{-1} (5.36) and tallest plant (62.66) was found in Kufri Chipsona-1 at 60 DAP, no mark differences was observed among all the treatments as regard number of stolen plant^{-1} but relatively higher number of stolen plant^{-1} was noted in Kufri Surya (31.52) at 60 DAP and Kufri Chipsona-1 (33.02) at 75 DAP, tuberization efficiency was found relatively higher in Kufri Chipsona-1 (3.75 g), the highest number of marketable (11.56) and unmarketable (4.11) tubers as well as tuber yield plant^{-1} of marketable (440 g) and unmarketable (57.7 g) was counted in Kufri Chipsona-1. The highest total yield (280 q/ha) was recorded in Kufri Chipsona-1.

KEY WORDS : Potato, Varietal evaluation, Growth, Yield, Yield attributes

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Potato (*Solanum tuberosum* L.) belongs to family Solanaceae is a most important crop among the vegetables. The crop finds prime position in the economy of poor and marginal farmers and plays a significant role in nutritional security producing more food per unit area and time as compared to wheat, rice and maize in short period of time. Potato contains substantial energy of edible protein 2.8 g, starch 16.3 g, total sugar 0.6 g, crude fiber 0.5 g, carbohydrate 22.6 g, and vitamin C 25 mg per 100 g fresh weight of tubers. It also provides more calories per unit area per unit time than any other major food crop which has many industrial uses. Thus it is the most suitable non-traditional crop to address the issues of hunger and malnutrition. According to Swaminathan *et al.* (1999), beside its significance to human food security potato is also a crop with fascinating genetic traits and cultural history.

In India the potato is grown in almost all states except Kerala under diversified agro climatic conditions. About 90% of the total potato area is located in the subtropical plains, 6% in the hills and 4% in the plateau region of peninsular India (Chadda, 2005).

Potato in India is grown under diverse agro-climatic conditions where planting and harvesting periods are different. In the hills, it is grown during March-April to August-

September, while in the Indo-gangetic plains; it is grown during October-November to January-February. In certain states, like Karnataka, Maharastra, Jharkand and hills of Chhattisgarh it is grown during *Kharif* season from June-July to September-October. The general climatic requirements for potato cultivation are similar to that of temperate to sub tropical regions. About 18-20^{0}C temperature is favourable for tuberization. Tuberization is adversely affected when temperature rises about 30^{0}C. Thus, finally open sunny days coupled with cooler nights are favourable for high bulking of tubers. In Chhattisgarh plains it is being cultivated from mid of October to mid of November and during *Kharif* in Mainpath hills of Surguja district. However, when it is harvested, the temperature rises and its storage become difficult. It either should be used for consumption or stored in cold storage for further consumption and cultivation. The sufficient information regarding use of suitable variety under Chhattisgarh condition is not available. Keeping in view the above fact, the present study was undertaken.

EXPERIMENTAL METHODS

The present investigation was conducted at the Horticultural Research farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during the *Rabi* 2009-2010. The experiment was laid out in Randomized Complete Block Design (RBD) with three replications and nine genotypes/treatments (T_1- Kufri Surya, T_2- Atlantic, T_3- Kufri Chipsona-1, T_4- Kufri Chipsona-2, T_5- Kufri Chipsona-3, T_6- MP/99-403, T_7- MP/99-322, T_8- MP/98-71 and T_9- MP/98-172). The treatments were allocated to different plots by using random method (Gomez and Gomez, 1984). The experimental plots were 3×3 m and each plot consisted of 5 rows keeping spacing of 60 cm in between and 20 cm between plant to plant. The soils of experimental field were clay loam in texture with pH 7.10 (Neutral), available N 218 kg per hectare (low), available P 172 kg per hectare (Medium), available K 311 kg per hectare (High) and organic matter 0.5 %.

Field was prepared for planting by ploughing with mould bold plough followed by two cross harrowing and it was leveled with the help of '*pata*'. Well rotten farm yard manure was spread in all plots in equal quantity (22.5 kg plot^{-1}) so that it may be applied @ 250q ha^{-1}. It was well mixed with the soil and ridges were prepared at 60 cm apart in each plot. The height of ridges was kept 20 cm. Tuber of various cultivars/hybrids included in this study were taken out from cold storage and kept in store room of AICRP- Potato. Sprouting occurred after the removal of tubers from cold storage and the planting was done immediately after sufficient sprouts had emerged on tuber. Before planting, sprouted tubers were treated with dithane M-45 @ 2.5 g lit^{-1} for 15 minute in a tray to avoid any external and internal fungal infection. The treated tubers were planted on ridges with a spacing of 20 cm in the month of November. Full dose of phosphorus and potassium @ 100 kg ha^{-1} each was applied through single super phosphate and murate of potash, respectively at the time of planting, whereas, nitrogen was applied in each plot into two split doses. Basal dose of nitrogen @ 75 kg ha^{-1} was applied through urea and remaining dose of nitrogen *i.e.* 75 kg ha^{-1} through urea (30 DAP). Weeding and earthing up were practiced with the top dressing of nitrogen fertilizer at 30 days after planting.

The observations of different growth parameters and yield parameters were recorded on three randomly selected competitive plants of each plot in each replication. Per cent emergence was observed by counting the emerged plant up to 30 days after planting. The observations on growth attributes namely plant height, number of shoot plant^{-1}, number of leaves plant^{-1}, and yield attribute namely number of tuber plant^{-1} were recorded on three randomly selected competitive plants from each plot and per replication. Total marketable, unmarketable and processing grade tuber yield were recorded after digging of tuber on net plot basis in each replication at the time of harvest. The data collected for different characters were processed and were analyzed by the method of analysis of variance given by Gomez and Gomez (1984) for Randomized Block Design.

EXPERIMENTAL FINDINGS AND ANALYSIS

The findings of the present study as well as relevant discussion have been presented under following heads :

Growth parameters :

Plant emergence (%) :

Plant emergence varied from 83.48% (Kufri Chipsona-2) to 93.26% (Kufri Chipsona-1) with mean 88.25% (Table 1). Significantly highest percentage of plant emergence was recorded in Kufri Chipsona-1 (93.26%) which was found at par with MP/98-172 (92.44%), MP/99-322 (91.76%), MP/-403 (88.88%) and found significantly better than Kufri Chipsona-3 (87.66%), Kufri Surya (87.44%), Atlantic (85.66%), MP/98-71 (83.66%) whereas, minimum per cent of plant emergence in potato was reported in Kufri Chipsona-2 (83.48%).

Plant emergence was noted significantly maximum in Kufri Chipsona-1 at 60 days after planting may be due to their inherent genetic character of that cultivars/ hybrids to more emergences. The above result is in close proximity with the finding of Anonymous (2005) who reported that, the highest plant emergence was reported on Kufri Chipsona-1 (68%) at Raipur, Chhattisgarh.

Number of leaves plant^{-1} **:**

The average number of leaves per plant counted at different stages of crop growth is presented in Table 1. It

revealed from the data recorded on 60 days after planting that, the number of leaves plant^{-1} ranged from 249.35 to 326.30 with an overall mean of 300.25. It was seen that the maximum number of leaves plant^{-1} were counted in Kufri Surya (326.30). The minimum number of leaves plant^{-1} was counted in Kufri Chipsona-3 (249.35), which was found at par with MP/99-403 (277.50).

At 75 days after planting, number of leaves plant^{-1} ranged from 277.02 to 343.35 with mean of 320.33. The maximum number of leaves was counted in Kufri Surya (343.35) but no significant differences were observed for this character among all the treatments including in this study.

It is revealed from the data recorded on number of leaves plant^{-1} at 90 days after planting that, it ranged from 279.02 to 335.35 with mean of 311.62. The maximum number of leaves plant^{-1} were counted in Kufri Surya (335.53), which was found at par with Kufri Chipsona-1 (328.35), Atlantic (326.23), MP/98-71 (323.02), Kufri Chipsona-2 (321.33), MP/98-172 (315.23). The minimum number of leaves plant^{-1} was found in MP/99-403 (279.02).

Significantly higher number of leaves plant^{-1} was noted in Kufri Surya than rest of the treatments and it may be due to its inherent genetic nature and supply of more food material from source to sink.

Number of shoots per plant at 60 DAP **:**

Number of shoots plant^{-1} at 60 days after planting ranged from 2.47 to 5.36 with mean of 3.85 (Table 1). The maximum number of shoot plant^{-1} were found in Kufri Chipsona-1 (5.36), which was found at par with Kufri Surya (5.27), Kufri Chipsona-2 (4.60), MP/98-172 (4.83). The minimum numbers of shoots plant^{-1} were found in Atlantic (2.47). The maximum number of shoots recorded in Kufri Chipsona-1 for trait at 60 days after planting 5.36 shoots plant^{-1} recorded in this investigation are in close proximity with the finding of Rana *et al.* (1996) who reported maximum number of shoots (5-6) in Kufri Sutlej. Similar result were also reported by Kushwaha *et al.* (1993) who noted 4-6 shoots per plant for mid maturing

Table 1: Growth characteristics of different potato genotypes under Chhattisgarh condition

Treatments/Genotypes	Plant emergence at 60 DAP (%)	No. of leaves plant^{-1}			No. of shoots plant^{-1} (60 DAP)	Plant height (cm) at 60 DAP
		60 DAP	75 DAP	90 DAP		
T_1- Kufri Surya	87.44	326.30	343.35	335.35	5.27	61.76
T_2- Atlantic	85.66	311.34	321.67	326.23	2.47	52.56
T_3- Kufri Chipsona-1	93.26	313.50	333.90	328.35	5.36	62.66
T_4- Kufri Chipsona-2	83.48	299.34	315.03	321.33	4.90	48.50
T_5- Kufri Chipsona-3	87.66	249.35	277.02	279.34	3.60	49.76
T_6- MP/99-403	88.88	277.50	297.68	279.02	2.76	62.66
T_7- MP/99-322	91.76	318.67	339.03	297.33	4.14	61.93
T_8- MP/98-71	83.66	299.01	319.93	323.02	3.20	56.90
T_9- MP/98-172	92.44	308.02	336.00	315.23	4.83	61.83
Mean	88.25	300.25	320.33	311.62	3.85	56.84
C.D. (P=0.05)	4.76	38.33	NS	31.01	1.05	8.88

NS=Non-significant

Table 2 : Yield and yield attributing characteristics of different potato genotypes under Chhattisgarh condition

Treatments/ Genotypes	No. of stolen plant^{-1}		Tuberization efficiency at Harvest (g)	No. of tubers plant^{-1}		Tuber yield (g plant^{-1})		Total yield (q/ha)
	60 DAP	75 DAP		Marketable	Unmarketable	Marketable	Unmarketable	
T_1 Kufri Surya	31.52	32.36	3.67	9.56	2.93	423.67	40.13	263.737
T_2 Atlantic	28.73	30.84	3.27	8.23	3.23	318.02	44.76	249.773
T_3 Kufri Chipsona-1	31.11	33.02	3.75	11.56	4.11	440.00	57.50	280.993
T_4 Kufri Chipsona-2	30.16	31.44	3.23	10.46	3.66	305.00	47.96	244.33
T_5 Kufri Chipsona-3	30.73	32.07	2.60	9.16	2.20	252.66	31.60	195.257
T_6 MP/99-403	28.36	29.03	2.77	8.93	3.46	265.65	31.86	218.03
T_7 MP/99-322	29.01	30.68	3.52	10.46	3.43	395.00	34.40	255.81
T_8 MP/98-71	29.67	33.01	2.52	9.09	3.73	233.66	52.16	212.29
T_9 MP/98-172	29.33	31.34	3.69	10.6	2.43	403.34	34.73	258.107
Mean	29.85	31.53	3.33	9.78	3.24	333.74	41.68	242.03
C.D. (P=0.05)	NS	NS	0.50	1.79	1.12	59.33	7.17	35.64

NS=Non-significant

cultivars and Mehta (1987) also reported 4.20 shoots per plant in medium maturing cultivars.

Plant height (cm) at 60 DAP **:**

The average plant heights at 60 DAP (Table 1) ranged from 48.50 cm to 62.66 cm, with the mean of 56.84 cm. The tallest plant was measured in Kufri Chipsona-1 (62.66 cm) and MP/99-403 (62.66 cm) which were found at par with MP/99-322 (61.93 cm), MP/98-172 (61.83 cm), Kufri Surya (61.76 cm) and MP/98-71 (56.90 cm). On the other hand the minimum plant height was measured in Kufri Chipsona-2 (48.50 cm) which was found at par with Kufri Chipsona-3 and Atlantic.

Plant height was significantly maximum in Kufri Chipsona-1 and MP/99-322 cultivars at 60 DAP. The variation in plant height among the different potato cultivars may be due to genetic and inherent character of cultivars/ hybrids of potato which is in accordance with the finding of Kumar *et al.* (2008).

Yield and its attributing characters :

Number of stolen plant^{-1} **:**

It was noticed from the Table 2 that at 60 days after planting, the number of stolen plant^{-1} ranged from 28.36 (MP/99-403) to 31.52 (Kufri Surya) with an overall mean of 29.85 and at 75 days after planting the number of stolen plant^{-1} ranged from 29.03 (MP/99-403) to 33.02 (Kufri Chipsona-1) with an overall mean of 31.53.

No significant difference was observed among all the treatments as regards number of stolen plant^{-1}. However, remarkably higher number of stolen per plant was noted in Kufri Surya at 60 DAP and at 75 DAP higher number of stolen per plant was noted in Kufri Chipsona-1 and these result are close to the finding of Sharma (1999).

Tuberization efficiency **:**

Data regarding tuberization efficiency of different cultivars/hybrids shown in Table 2. The highest tuberization efficiency was observed in Kufri Chipsona-1 (3.75 g) at 105 days after planting, which was found significantly better than all the other treatments included under this study and was found at par with MP/98- 172 (3.69 g), Kufri surya (3.67) and MP/99-322 (3.52 g). However, the lowest tuberization efficiency was found in MP/98–71 (2.52 g). Higher tuberization efficiency noted in Kufri Chipsona-1 (3.75 g) at 105 days after planting may be due to relatively lower fresh weight of shoots as well as slightly higher fresh weight of tubers noted in this cultivar/ hybrid.

Number of marketable and unmarketable tubers plant^{-1} **:**

A perusal of data (Table 2) exhibited that the number of marketable tubers plant^{-1} varied from 8.23 to 11.56 with mean of 9.78. The highest number of marketable tubers was noted in Kufri Chipsona-1 (11.56), which was found at par with MP/98-172 (10.60), Kufri Chipsona-2 (10.46) and MP/99-322 (10.46). The least number of marketable tubers was recorded in Atlantic (8.23) which was found at par with Kufri Surya (9.56), Kufri Chipsona-3 (9.16), MP/98-71 (9.09) and MP/99-403 (8.93). However, the least number of unmarketable tubers was recorded in Kufri Chipsona-3 (2.20), which was found at par with Atlantic (3.23), Kufri Surya (2.93) and MP/98-172 (2.43). The highest number of unmarketable tubers was noticed in Kufri Chipsona-1 (4.11), which was found at par with MP/98-71(3.73), Kufri Chipsona-2 (3.66), MP/99-403 (3.46), MP/99-322(3.43) and Atlantic (3.23).

The highest number of marketable and unmarketable tubers per plant was recorded in Kufri Chipsona-1, which might be due to higher tuberization efficiency of this cultivar.

Marketable and unmarketable tuber yield (g plant^{-1}) **:**

Data presented in Table 2 revealed the maximum marketable yield plant^{-1} was recorded in Kufri Chipsona-1 (440.00 g plant^{-1}), which was found at par with MP/98-172 (403.34 g plant^{-1}), MP/99-322 (395.00 g plant^{-1}) and Kufri Surya (423.67 g plant^{-1}). The lowest yield was recorded in MP/98-71 (233.66 g plant^{-1}), which was found at par with MP/99-403(265.45 g plant^{-1}) and Kufri Chipsona-3 (252.66 g plant^{-1}). The highest tuber yield was found in Kufri Chipsona-1, which might be due to higher tuberization efficiency and more number of marketable tubers per plant.

Data regarding the unmarketable tuber yield plant^{-1} ranged from 31.60 to 57.50 (g plant^{-1}). The least unmarketable yield was recorded in Kufri Chipsona-3 which was found at par with all the treatment except Kufri Chipsona-1 (57.50 g plant^{-1}) and MP/98-71 (52.16 g plant^{-1}), The highest unmarketable yield (57.50 g plant^{-1}) were noted on Kufri Chipsona-1, which was at par with MP/98-71 (52.16 g plant^{-1}), Kufri Chipsona-2 (47.96 g plant^{-1}) and Atlantic (44.76 g plant^{-1}). It might be due to more number of unmarketable tubers per plant.

Total yield (q/ha) **:**

Data regarding total yield per hectare ranged from 195.25 to 280.99 q ha^{-1}. The highest total tuber yield was recorded in Kufri Chipsona-1 (280.99 q ha^{-1}) and the lowest yield was recorded in Kufri Chipsona-3 (195.25 q ha^{-1}). However, significant difference was not observed among Kufri Surya (263.73 q ha^{-1}), MP/98-172 (258.10 q ha^{-1}), MP/99-403 (255.81 q ha^{-1}) and Atlantic (249.77 q ha^{-1}). The above results in close proximity with the finding of Joseph *et al.* (2004) who reported the maximum yield in Kufri Chipsona-1 (426 q ha^{-1}) for processing cultivar. The above results are also confirmed with the finding of Kumar *et al.* (2007) who reported the maximum yield at 100 days of crops in Kufri Chipsona-1 (322.9 q ha^{-1}).

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