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Evaluation of potato (*Solanum tuberosum* L.) varieties for growth and yield attributes under Southern Telangana Agroclimatic conditions

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Abstract

A field experiment was carried out with an aim to evaluate the performance of six potato varieties and identify suitable varieties for Southern Telangana Zone. The experiment was laid out in a Randomized Block Design with six treatments replicated four times during the Rabi season of 2020-2021 at Sri Konda Laxman Telangana State Horticultural University, College of Horticulture, Hyderabad. Results indicated that there was a significant variation among the varieties in the growth and yield parameters. Highest sprouting per cent (84.56%) and low mortality (4.25%) was observed in Kufri Pukhraj. Kufri Chipsona-3 recorded highest values for plant height (59.68 cm), number of compound leaves (17.4) at 90 DAP, number of tubers plant⁻¹ (18.6) and tuber yield (26.646 kg plot⁻¹ and 28.875 t ha⁻¹). However maximum (0.809 kg) fresh weight of tuber plant⁻¹ and highest percent of grade B tubers (69.56%) were recorded in Kufri Pukhraj. Among the varieties, Kufri Chipsona-3 and Kufri Pukhraj have potential to contribute to National potato production and could be recommended for commercial cultivation in Telangana state.

Keywords: Potato, Telangana, varieties, growth, tuber yield, grades

Introduction

Potato crop is basically grown under temperate climatic conditions. The crop grows best in cool and frost free areas where the tuber development is favoured at 200 C. In the volume of world crops production, potato ranks fifth following sugarcane, maize, rice and wheat (FAOSTAT data 2014) [4]. Indian vegetable basket is incomplete without potato. Potato is highly nutritious, easily digestible, wholesome food containing carbohydrates, proteins, minerals, vitamins and high quality dietary fibre. It produces more quantity of dry matter, edible energy and edible protein within short period of time than cereals like rice and wheat which makes it nutritionally superior vegetable as well as staple food in our country and also throughout the world.

Hence, potato has potential to achieve the nutritional security of the nation. Average 100 g fresh tuber contains substantial quantity of energy with 2.8g edible protein, 16.3 g starch, 0.6 g total sugar, 0.5 g crude fibre, 22.6 g of carbohydrate and vitamin-C at the rate of 25 mg (Bhuwleshwari *et al.*, 2013) [2]. Potato also contains considerable quantities of niacin, thiamine, pyridoxine and its derivatives (Yadav *et al.*, 2015) [20].

India ranks second in potato production in the world after China (FAOSTAT data 2015) [5] with an area of 21.8 lakh ha with production around 52.9 MT (NHB Database, 2018-19). The main potato producing states in India are Uttar Pradesh, Punjab, Haryana, Bihar, West Bengal, Gujarat and Madhya Pradesh. In south India, Potatoes are not a common crop, however it is cultivated in short winters from November to January in some parts of Karnataka, Tamilnadu and Telangana. Year-round production takes place in relatively high altitude areas in Nilgiri hills of Tamil Nadu.

Material and Methods

A field experiment was laid at PG Research block, Department of Vegetable Science, College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University during Rabi, 2020-2021. Geographically, it is situated at a latitude of 17.019° N, longitude of 79.23° E and altitude of 542.3 m above mean sea level. It has semi-arid tropical zone with average rainfall of 615.6 mm. The soil is sandy loam in texture. Six elite varieties Kufri Chipsona-1, Kufri Chipsona-3, Kufri Jyoti,

Kufri Chandramukhi, Kufri Lauvkar and Kufri Pukhraj were procured from ICAR- CPRS, Gwalior, Madhya Pradesh. The experiment was laid in randomized block design with four replications. Healthy, uniform sized tubers were planted at a spacing of 60x30 cm during first week of November, 2021 and the crop was harvested during last week of January, 2021. 125:100:125 kg ha⁻¹ nitrogen, phosphorous and potassium with urea, di ammonium phosphate and muriate of potash. Full quantity of phosphorous, potassium and half dose of nitrogen were applied at the time of planting, while the remaining quantity of nitrogen was applied in two split doses. 1st at first earthen-up and 2nd at second earthen-up (20 and 40 days after planting respectively). Plant protection measures were taken up by spraying of Imidacloprid 30% @ 0.3 ml per liter of water and Acephate @ 2 g l⁻¹ of water to control sucking pests (aphids and thrips).

Five hills from each plot were randomly selected for data collection of sprouting percentage, plant height, number of compound leaves per plant, number of branches per plant, mortality rate, berry set percentage, number of tubers per plant, fresh tuber weight, tuber diameter and tuber yield. Plant height was measured from base of the plant to the growing tip at 30, 60 and 90 DAP. Mortality rate was obtained by dividing the number of plants died in each plot divided by the total number of plants germinated and then multiplied by 100 and their averages were expressed in percentage. Berry set percentage was calculated by dividing the total number of berries in each plot divided by total number of flowers and then multiplied by 100 and their averages were expressed in percentage. Tubers collected from each plot were weighed in kg for yield determination. The weight obtained was then converted to kg per hectare. Tubers collected from each plot were sorted and classified into three grades: Grade-C potatoes with a diameter less than 28 mm, Grade-B potatoes with a diameter between 28 and 55 mm and Grade-A potatoes with a diameter greater than 55 mm. Potatoes from each grade and plot were weighed (Wg). Wt is the weight of all tubers from the same plot. To determine the percentage of potatoes of each grade with in a plot the following formula was used: % of potatoes of grade M = (Wg M/ Wt) x 100. M= Grade A, B or C. For each plot, the sum of the percentages of all grades equals to 100. The data recorded under the study were subjected to statistical analysis as per standard procedure as suggested by Panse and Sukhatme (1985) [16].

Results and Discussion

Growth parameters

Significant variation was observed for the growth parameters among all the varieties. Sprout growth pattern ranged from 64.83% (Kufri Lauvkar) to 84.56% (Kufri Pukhraj). It is evident that there was greater increase in the plant height (21.93% to 46.70%) from 30 to 60 DAP than from 60-90 DAP (1.70% to 5.57%). This indicates that during initial stage, (upto 60 days) most of the resources are utilized by the plants for its vegetative growth and in the later stages, (from 60 days) on the tuber development. Kufri Chipsona-3 (47.18 cm) recorded highest plant height which was superior to all except Kufri Jyoti (46.05 cm) being at par and the lowest plant height was recorded in Kufri Chandramukhi (32.48 cm) at 30 DAP reported significant higher plant height (58.68 cm) at 60 DAP and reported maximum plant height (59.68 cm) at 90 DAP. The variation in the plant height may be due to food reserve for early growth of seed tubers and varietal characters and interactions of planting materials and environment

(Sadawarti *et al.*, 2016, Sandhu *et al.*, 2014, Kumar *et al.*, 2008) [18, 11].

At all the stages *i.e.*, at 30, 60 and 90 DAP maximum number of compound leaves plant-1 was attained in Kufri Chipsona-3 (9.9,16.05 and 17.4 cm) which was statistically at par with Kufri Jyoti (9.45,15.2,16.95 cm) while the minimum number of leaves was recorded in Kufri Chandramukhi (7.05, 12.45, 15 cm). Number of branches plant-1 was counted maximum in variety Kufri Chipsona-1 (5.8,7.35 and 8.8) and Kufri Chipsona-3 (3.65,6.75,8.3) was noticed to be at par, while the minimum was reported in Kufri Pukhraj (2.65,3.525,5.0).

The variation in number of compound leaves per plant and number of branches among different potato varieties may be due to different genetic make-up and better adaptability to prevailing environment conditions. (Mehta, 1987; Kumar *et al.*, 2008 and Bhuneshwari *et al.*, 2013) [14, 2, 11].

Kufri Pukhraj-V6 recorded the lowest mortality rate (4.25%) and the highest mortality rate was observed in the Kufri Lauvkar-V5 (23.18%) while other varieties Kufri Chipsona-3, Kufri Jyoti, Kufri Chipsona-1, Kufri Chandramukhi having mortality rates of 5.29%, 6.54%, 6.835%, 14.215% respectively. This may be due to presence of different resistance genes in different genotypes. Earlier researchers also reported presence of different genes and different degree of resistance in potato germplasm/accession/genotypes (Kaushik *et al.*, 2007; Sharma *et al.*, 2013; Kankwasta *et al.*, 2003; Fontem, 2001) [9, 19, 8, 6].

Significant difference was observed in berry set percentage due to effect of varieties. Kufri Chipsona-1-V1 had maximum berry set percentage (75.605%) followed by Kufri Chipsona-3-V2 (64.62%) while the minimum berry set percentage was recorded in Kufri Lauvkar -V5 (17.475%).

Yield attributes

Significant differences in the yield attributes and yield were noticed among the varieties. Kufri Chipsona-3 recorded more number of tubers per plant (18.6) which was statistically at par with Kufri Chipsona (17.75) and the lowest number of tubers per plant recorded in Kufri Lauvkar (12.9). Kumar *et al.* (2017) [10] revealed that Kufri Surya produced significantly higher number of tubers per plant. Mehara *et al.* (2018) [13] observed maximum number of tubers (12.67) in Kufri Lauvkar.

Kufri Pukhraj recorded the maximum fresh weight of tuber per plant (0.809 kg) which was statistically at par with Kufri Chandramukhi (0.704 kg) and the minimum fresh weight observed in Kufri Lauvkar (0.404 kg). The variations in fresh weight of the tuber may be due to genetic differences or agro ecological conditions and attributed to inheritability of genotypes. Maximum tuber diameter reported in Kufri Chandramukhi (6.9 cm) followed by Kufri Jyoti (6.23 cm) and the minimum tuber diameter reported in Kufri Chipsona-1 (5.63 cm). The variation in size of tubers might be due to genetic and environmental factors.

Yield

Kufri Chipsona-3 reported significantly maximum tuber yield per plot (26.646 kg) and tuber yield per hectare (28.875 kg) which was statistically at par with Kufri Pukhraj (25.059 kg plot-1 and 26.675 t ha⁻¹) and the minimum tuber yield reported in Kufri Lauvkar (16.654 kg plot-1 and 17.675 t ha⁻¹). The tuber yield varies significantly with variety, location and genotypes x environmental interaction. (Elfinesh, 2008, Gebreselassie *et al.*, 2016, Pandey *et al.*, 2004 and Kumar *et*

al., 2007) [3, 7, 15, 12].

Grades of Tubers

The highest percentage of Grade-A and Grade-C tubers was produced by Kufri Lauvkar (19.32 and 31.11%) and the lowest percentage of Grade-A and Grade-C tubers was found in Kufri Pukhraj (12.12% and 18.32%). Data pertaining to

Grades of tubers revealed that variety Kufri Pukhraj (69.56%) had highest percentage of Grade-B tubers and lowest percentage was found in Kufri Lauvkar (49.57%). The differences in the percentage of different grades among the varieties might be due to genetic variations or adoptability of the variety to the climatic conditions of the experimental site.

Table 1: Performance of potato varieties on different growth parameters- sprouting percent, plant height, number of compound leaves

Variety	Sprouting percentage		Plant height (cm)			Number of compound leaves		
	10 DAP	15 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
Kufri Chipsona-1	25.55d	75.55d	37.85cd	50.05cd	52.84cd	8.1cd	13.2cd	15.3cd
Kufri Chipsona-3	24.05de	74.31de	47.18a	58.68a	59.68a	9.9a	16.05a	17.4a
Kufri Jyoti	29.48c	75.98c	46.05ab	56.15ab	57.11ab	9.45ab	15.2ab	16.95ab
Kufri Chandramukhi	34.98ab	83.98ab	32.48f	47.65def	49.15ef	7.05def	12.45def	15cdf
Kufri Lauvkar	15.58f	64.83f	40.25c	52.53c	55.12 bc	7.3de	12.9de	15.1cde
Kufri Pukhraj	35.06a	84.56a	36.55de	49.25 cde	51.15e	8.75abc	14.35bc	15.9bc
Sem (\pm)	0.39	0.46	1.15	1.18	1.22	0.38	0.44	0.46
CD (0.05)	1.19	1.41	3.48	3.58	3.68	1.17	1.34	1.39

Table 2: Performance of potato varieties on different growth parameters- number of branches, mortality rate, berry set percent, grades of tubers

Variety	Number of branches			Mortality rate	Berry set percentage	Grades of tuber (%)		
	30 DAP	60 DAP	90 DAP			Grade-A	Grade-B	Grade-C
Kufri Chipsona-1	5.8a	7.35a	8.8a	6.835c	75.605a	15.17	57.81	27.02
Kufri Chipsona-3	3.65b	6.75ab	8.3ab	5.29ed	64.62b	14.21	60.40	25.39
Kufri Jyoti	3.45bc	5.55bc	7.05abc	6.54ce	42.84d	17.31	54.60	28.09
Kufri Chandramukhi	3.15bcd	4.9cd	6.45cd	14.215b	36.245e	14.48	64.32	21.2
Kufri Lauvkar	2.95bcde	4.2cde	5.95cde	23.18a	17.475f	19.32	49.57	31.11
Kufri Pukhraj	2.65bcdef	3.525def	5def	4.25df	49.57c	12.12	69.56	18.32
Sem (\pm)	0.41	0.46	0.58	0.43	1.93	-	-	-
CD (0.05)	1.25	1.40	1.77	1.30	5.83	-	-	-

Table 3: Performance of potato varieties on yield and yield attributes- Number of tubers, tuber weight, tuber diameter, tuber yield per plot, yield per hectare

Variety/Treatments (V)	No. of tubers Plant-1	Fresh weight of tuber Plant-1 (kg)	Tuber diameter (cm)	Tuber yield (kg Plot-1)	Tuber yield (t ha-1)
Kufri Chipsona-1 (V1)	17.75ab	0.563cd	5.63cdef	21.813d	22.559d
Kufri Chipsona-3 (V2)	18.6a	0.646bc	6.01bcde	26.646a	28.875a
Kufri Jyoti (V3)	14.8cd	0.497de	6.23b	17.365e	18.906e
Kufri Chandramukhi (V4)	15.55bc	0.704ab	6.9a	24.204bc	26.063abc
Kufri Lauvkar (V5)	12.9cdef	0.404ef	6.05bcd	16.654ef	17.675ef
Kufri Pukhraj (V6)	13.25cde	0.809a	6.11bc	25.059ab	26.675ab
Sem (\pm)	0.91	0.04	0.19	0.58	1.15
CD(0.05)	2.76	0.14	0.58	1.76	3.48

Conclusion

The present study revealed the existence of significant variability among the different potato varieties in their growth, yield and quality attributes. Among all cultivars, Kufri Chipsona-3 (V2) and Kufri Pukhraj (V6) performed better in terms of growth and yield parameters. Also they have tuber size which has direct relationship with market acceptance for consumption purpose and are comparably good in all other studied traits. The variety Kufri Chipsona-3 (V2) recorded maximum profitability due to its higher farm gate price.

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