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Evaluation of growth and yield attributes of potato (*Solanum tuberosum* L.) under agro-climatic conditions of Chhattisgarh plains

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Abstract

An experiment was conducted at Research cum Demonstration Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during *rabi* season of 2019-20 to study the yield and yield attributing characters. Results indicated that K. Mohan (98.48%) was recorded for higher plant emergence per cent which was followed by K. Surya (96.36%), K. Jyoti (96.17%) and K. Ch-1 (96.07%). The plant height at 45 DAP (cm) ranged from 43.78 cm (K. Himalini) to K. Mohan (20.65 cm). The number of stem plant-1 ranged from 2.39 (IGP-2012-4) to 4.30 (IGP-2012-6). K. Sindhuri was recorded for significantly maximum number of leaves plant-1, plant vigour and fresh weight of haulm (423.62, 4.90 and 13.87 respectively kg/plot). K. Pukhraj was recorded for significantly maximum foliage senescence per cent (5.60) and it was statistically similar with K. Surya (5.50) and K. Ch-1 (5.40). Plant vigour was recorded maximum for K. Nilkanth and K. Sindhuri (4.90, 4.90 respectively) and minimum for IGP-2012-4 (4.1) and K. Jyoti (4.3). Average tuber weight varied from (IGP-2012-7) 41.78 g to K. Nilkanth (77.10 g). No. of total tuber (number per plot) ranged from IGP-2012-3 (149.37) (number per plot) to K. Surya (298.08) (number per plot). K. Surya recorded maximum no. of total tuber 298.08 (number per plot), harvest index (68.75%) and total tuber yield (36.68 t/ha).

Keywords: Potato, yield, growth and variety

Introduction

Potato (*Solanum tuberosum* L.) is one of the most important herbaceous tuber producing vegetable and is supposed to be the native of Andes in South America. In 17th century, Portuguese traders or British monks introduced potato to India, and the British expanded its cultivation to North India (Nath *et al.*, 2008; Pandey and Sarkar, 2005) [4, 6]. Out of 900 species belongs to the solanaceae family, only 235 species form tubers (Hawkes, 1990). It has various ploidy levels varies from hexa-ploid ($2n=6x=72$) to di-ploid ($2n=2x=24$). The cultivated forms of *S. tuberosum* are tetraploids ($2n=4x=48$) and vegetative propagated only four solanum species are cultivated *i.e.* *Solanum curtilobum*, *Solanum tuberosum*, *Solanum ajanhuiri*, and *Solanum juzepczukii* (Spooner *et al* 2007) [8]. The two *Solanum tuberosum* sub species *tuberosum* (long day adapted) which is cultivated in temperate and subtropical climate and other is andigena limited cultivation at Central and South America (Hawkes, 1990).

The potato is a highly nutritious wholesome food containing carbohydrates, proteins, minerals, vitamins. The 100 g of fresh potato tuber contains edible protein 2.8 g, starch 16.3 g, total sugar 0.6 g, crude fibre 0.5 g, carbohydrate 22.6 g, vitamin C 25.0 mg (Bhuwneshwari *et al* 2013) [2].

In India, the potato is grown in almost all states except Kerela. Approx. (90%) of the potato growing area in the subtropical plains, (6%) in the hills and 4% in the plateau region of peninsular India (Kumar *et al*, 2022) [3]. In Chhattisgarh potato is mainly cultivated in Sarguja, Raigarh, Jashpur, Balrampur, Raipur, Bilaspur and Bastar during *rabi* season and in Mainpat and Samripat cultivated during *kharif* crop. In Chhattisgarh potato is grown in 45033 hectare area with production of 697280 MT and productivity of 15.48 tonnes per hectare (Anon., 2019) [1].

Materials and Methods

An experiment was conducted at Research cum Demonstration Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during *rabi* season of 2019-20. The experimental site is situated in between 21°16' N latitude and 81°36' E longitude and an altitude of 289.56 m above the mean sea level (MSL). Raipur is located under the tropical zone which is dry, slightly moist-hot and sub-humid region. The main source of rainfall is south-west monsoon with an average annual rainfall of 1200-1400 mm. The most of rainfall near about 85% is received from third week of June to mid September and light during October and February. The potato tuber seed of all sixteen genotypes were taken from different part of Chhattisgarh and other released genotypes were taken from the All India Coordinated Research Project, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G). IGP-2012-1, IGP-2012-2, IGP-2012-3, IGP-2012-4, IGP-2012-5, IGP-2012-6, K. Nilkanth, K. Jyoti, K. Pukhraj, K. Chipsona-1, K. Mohan, K. Himalini, K. Bahar and K. Sindhuri were used for planting in experiment. The experiment was laid out in a randomized block design with three replications. Tubers were planted at a spacing of 60 X 20 cm. Well-rotted Farm Yard Manure (FYM) was apply in the field @ 20 tha⁻¹ and fertilized with 150:100:100 kg nitrogen, phosphorus and potassium. The whole amount of phosphorus and potassium was applied at the time of planting. The rest amount of nitrogen was applied in each plot in two equal split doses. The first split of nitrogen applied as a basal dose @ 75 kg ha⁻¹, remaining dose of nitrogen *i.e.* 75 kg ha⁻¹ after 30 days of planting. The data of different growth and yield parameters was recorded on five randomly selected competitive plants from each plot. The observations on growth parameters (at 30 DAP) and yield parameters (at the time of harvesting) were recorded. After 30 days after planting plant emergence per cent was noted by counting the emerged plants. Plant height at maturity, plant vigour, foliage senescence number of shoots/plant at maturity, number of leaves/plant at maturity, number of compound leaves/plant at maturity, fresh weight of haulm/plant, dry weight of haulm/plant, average tuber weight, number of total tubers 000'ha, harvest Index, dry matter of tuber and total tuber yield t/ha were taken. Foliage senescence was recorded when plant obtained 75% foliage maturity.

Results and Discussion

The significant differences were observed with respect to growth characters (Table 1). The plant emergence differed significantly ranged from 98.48% (K. Mohan) to 90.43% (IGP-2012-2). K. Mohan recorded significantly higher plant emergence per cent which was followed by K. Surya

(96.36%), K. Pukhraj (95.52%) and K. Jyoti (96.17%). The plant height of potato at maturity (cm) ranged from 43.78 cm (K. Himalini) to 22.57 cm (IGP-2012-4) for the year 2019-20. K. Himalini was significantly at par with K. Nilkanth (43.57 cm), IGP-2012-6 (43.04 cm) and IGP-2012-7 (37.50 cm). The numbers of shoots plant⁻¹ at 45 DAP ranged from 4.30 (IGP-2012-6) to 2.39 (IGP-2012-4). IGP-2012-6 recorded significantly maximum number of shoots/plant at 45 DAP followed by K. Nilkanth (4.27) and K. Ch-1 (3.73). K. Sindhuri (423.62) recorded significantly maximum number of leaves plant⁻¹ at 45 DAP followed by K. Pukhraj (415.37) and IGP-2012-6 (383.84) and K. Ch-1 (363.85). K. Pukhraj was recorded higher foliage senescence (5.60%) followed by K. Surya (5.50%) and K. Ch-1 (5.40%). K. Sindhuri and K. Nilkanth exhibited better plant vigour (4.90) followed by K. Ch-1 (4.80) and IGP-2012-5 (4.70). Fresh weight of haulm varied from K. Sindhuri (13.87 kg/plot) to IGP-2012-6 (4.79 kg/plot). K. Sindhuri significantly recorded higher with K. Ch-1 (12.38 kg/plot), K. Pukhraj (9.65 kg/plot) and K. Nilkanth (8.93 kg/plot). K. Pukhraj recorded significantly maximum dry weight of haulm (1.18 kg/plot) which was statistically at par with genotype *viz.* K. Mohan (1.11 kg/plot) and K. Sindhuri (1.01 kg/plot). Average tuber weight (g) was ranged from 77.10 g (K. Nilkanth) to 41.78 g (IGP-2012-7). K. Nilkanth recorded significantly higher average tuber weight (g) and statistically at par with K. Surya (71.16 g) and K. Pukhraj (68.42 g).

Total number of tubers ranged from K. Surya 298.08 (number per plot) followed by K. Jyoti 228.38 (number per plot) and K. Pukhraj 259.26 (number per plot). With respect to harvest index% ranged from 68.75% (K. Surya) to 48.34% (K. Sindhuri). K. Surya noted significantly higher harvest index% which was statistically at par with genotype *viz.* K. Bahar (67.72%), IGP-2012-4 (66.20%) and IGP-2012-6 (64.62%). Total tuber yield (t/ha) ranged from K. Surya (36.68 t/ha) to IGP-2012-3 (14.81 t/ha). K. Surya recorded significantly higher total tuber yield (t/ha) which was statistically at par with genotype *viz.* K. Pukhraj (30.08 t/ha) and K. Nilkanth (29.78 t/ha).

The number of shoots relates to numbers of branches and numbers of leaves which contribute to photosynthesis process. An increase in the absorption of solar radiation can ensure a higher photosynthesis potential and promote the synthesis and accumulation of reserve carbohydrates in the potato tuber, which has a positive effect on the tuber yield (White *et al.*, 2007) [9]. The varietal differences amongst these parameters are attributed to the variability in the genetic inheritance among the varieties. Similar to the present, findings were also recorded by Raj *et al.* (2016) [7], Preetham *et al.* (2018) [5] and Kumar *et al.* (2022) [3].

Table 1: Mean performance of potato landraces/genotypes for tuber yield and yield attributing characters.

		Plant emergence	Plant height	No. of shoots plant	No. of leaves plant	Foliage senescence (%)	Plant vigour (1-5 Scale)	Fresh haulm wt. (Kg/plot)	Dry haulm wt. (Kg/plot)	Avg. tuber wt. (g)	No. of total tuber (number per plot)	Harvest index (%)	Total tuber yield (t/ha)
1.	IGP- 2012 - 1	91.71	32.72	3.04	283.04	4.70	4.65	6.56	0.79	57.66	144.03	53.16	15.66
2.	IGP - 2012 - 2	90.43	27.61	2.68	334.58	4.50	4.40	6.37	0.76	47.72	169.15	55.49	17.05
3.	IGP - 2012 - 3	92.04	28.62	2.42	266.22	4.60	4.35	5.66	0.68	59.76	149.87	55.6	14.81
4.	IGP - 2012 - 4	91.23	22.57	2.39	266.36	4.70	4.10	5.29	0.62	47.31	227.09	66.2	21.73
5.	IGP - 2012 - 5	91.32	28.71	2.93	259.86	4.10	4.70	6.24	0.56	47.9	227.32	58.01	19.21
6.	IGP - 2012 - 6	93.06	43.04	4.30	383.84	4.30	4.50	4.79	0.56	63.85	203.7	64.62	18.12
7.	IGP - 2012 - 7	93.38	37.50	2.84	250.34	4.10	4.40	6.28	0.73	41.78	243.36	63.25	22.75
8.	K. Nilkanth	94.33	43.57	4.27	282.94	4.00	4.90	8.93	1.00	77.1	248.7	61.24	29.78
9.	K. Surya	96.36	31.98	2.42	338.92	5.50	4.45	7.96	0.90	71.16	298.08	68.75	36.68
10.	K. Pukhraj	95.52	34.29	3.43	415.37	5.60	4.40	9.65	1.18	68.42	259.26	59.86	30.08
11.	K. Jyoti	96.17	30.60	2.56	338.75	4.60	4.30	6.93	0.84	47.85	228.38	66.88	29.33
12.	K. Ch 1	96.07	29.40	3.73	363.85	5.40	4.80	12.38	0.83	62.44	188.12	48.48	24.74
13.	K. Mohan	98.48	20.65	3.06	234.89	4.50	4.60	7.67	1.11	55.57	227.5	63.6	28.23
14.	K. Himalini	96.66	43.78	3.40	353.99	4.15	4.50	7.21	0.86	56.77	202.22	59.38	22.03
15.	K. Bahar	97.67	42.87	2.83	293.18	4.10	4.60	6.24	0.90	64.67	233.44	67.72	27.34
16.	K. Sindhuri	95.01	35.02	3.11	423.62	4.00	4.90	13.87	1.01	59.82	204.95	48.34	26.86
	General Mean	94.34	33.31	3.09	318.11	4.55	4.53	7.63	0.83	58.11	258.35	60.04	24.03
	SEm±	1.25	2.34	0.25	23.40	0.15	0.07	0.59	0.07	3.12	27.67	2.51	2.42
	CD(0.05)	3.61	6.75	0.72	67.58	0.43	0.20	1.72	0.20	9.01	79.90	7.24	6.99
	CV	2.3	12.15	14.00	12.74	5.69	2.59	13.51	14.31	9.3	18.55	7.23	17.44

Conclusion

In conclusion, significant variations in growth and yield characteristics were observed among the potato varieties. Notably, K. Mohan demonstrated the highest plant emergence, while K. Surya excelled in tuber yield and harvest index. K. Sindhuri showed superior fresh weight of haulm and plant vigour, whereas K. Nilkanth had the highest average tuber weight. The disparities in these parameters reflect genetic variability among the varieties, impacting their overall performance. These findings align with previous research, highlighting the importance of genetic factors in optimizing potato growth and yield.

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