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Growth and yield of potato (*Solanum tuberosum* L.) as influenced by dates of planting and genotypes

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Abstract
The present experiment was conducted during *rabi* season of 2020-21 at College of Horticulture, Dr. Y.S.R Horticultural University, Venkataramannagudem, West Godavari district, Andhra Pradesh, to study the interaction effect of dates of planting and genotypes on growth and yield of potato. Eight potato genotypes (HT/14-95, HT/14-109, HT/12-834, HT/16-113, HT/12-116, HT/10-1554, HT/12-830, HT/15-240) with Kufri Surya as check were evaluated for their growth and yield performance at two planting dates i.e. 10th November and 17th November. Experiment was laid out in factorial RBD design replicated four times. Results revealed that plant height, plant spread, leaf area, average growth rate, number of tubers per plant, diameter of tubers, and length of tubers of potato were significantly influenced by interaction effect of planting dates and genotypes while the interaction effect was found non- significant on average tuber weight, marketable and total tuber yield per plant and marketable and total tuber yield per plot.

Keywords: Potato, dates of planting, genotypes, growth, yield

Introduction
Potato (*Solanum tuberosum* L.) is the fourth most important food crop in the world after rice, wheat and maize. It belongs to the family Solanaceae and it is widely regarded as King of Vegetables. It is one of the most efficient plant sources for starch and yields highest amount of protein and carbohydrate per unit area per unit time compared to all other food crops. India is the second leading producer of potato with an area of 2.164 million hectares. The production is about 53.027 million tonnes with productivity of 23.07 t ha-1(Anon, 2019) [2].
The cultivation of potato is limited to relatively low temperature areas and seasons throughout the world due to photo and thermo-sensitivity of the crop (Minhas *et al.* 2011) [5]. It requires long day conditions for flowering but short day conditions for tuberization. Night temperature is more important than day temperature for potato tuber development. Bushnell (1925) defined 17 ºC as optimum mean temperature for good In high altitude areas of the tropics where the temperature is comparatively low potato can be successfully cultivated in winter season. However in plain areas of southern tropical states like Andhra Pradesh, where average day temperature is about 30 ºC and night temperature is about 20-25 ºC, its cultivation is almost negligible. In order to expand potato cultivation in non-traditional warmer areas, it is necessary to optimize the planting date and to evolve varieties that could germinate, grow and tuberize well under prevailing temperatures. Hence, the present study was carried out with the objective of finding out suitable planting date and potato genotypes for cultivation in coastal plains of Andhra Pradesh.

Material and Methods
The present experiment was conducted at College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari district, Andhra Pradesh during *rabi* season of 2020-21 to study the interaction effect of planting dates and genotypes on growth and yield of potato. The experimental site is located in Krishna-Godavari agro-climatic zone of Andhra Pradesh at 17.4 ºN latitude and 78.48 ºE longitude with an altitude of 18 m above mean sea level. Annual rainfall of this region is about 880-1100 mm. The maximum temperature of this zone ranges from 29 to 42 ºC and the minimum temperature ranges from 16 to 24 ºC. Experiment was conducted on red sandy loam soil having a pH of 6.8. Eight potato genotypes *viz.* HT/14-95, HT/14-109, HT/12-834, HT/16-113, HT/12-116, HT/10-1554, HT/12-830, HT/15-240 and Kufri Surya as check were planted at two dates i.e.

10th November and 17th November and laid out in factorial randomized block design replicated four times. Recommended package of practices was followed for planting potato during the experiment. Five plants from each treatment were selected randomly and data on growth parameters like plant height, plant spread, leaf area and average growth rate and yield parameters including number of tubers per plant, diameter of tubers, length of tubers and average tuber weight were recorded from these five plants and the average was computed. Data on marketable yield and total yield of tubers was collected from individual plants as well as whole plots. Tubers weighing more than 20 grams were considered for calculating marketable yield. The daily temperatures (minimum and maximum) recorded during the crop period were averaged and presented in Figure-1.

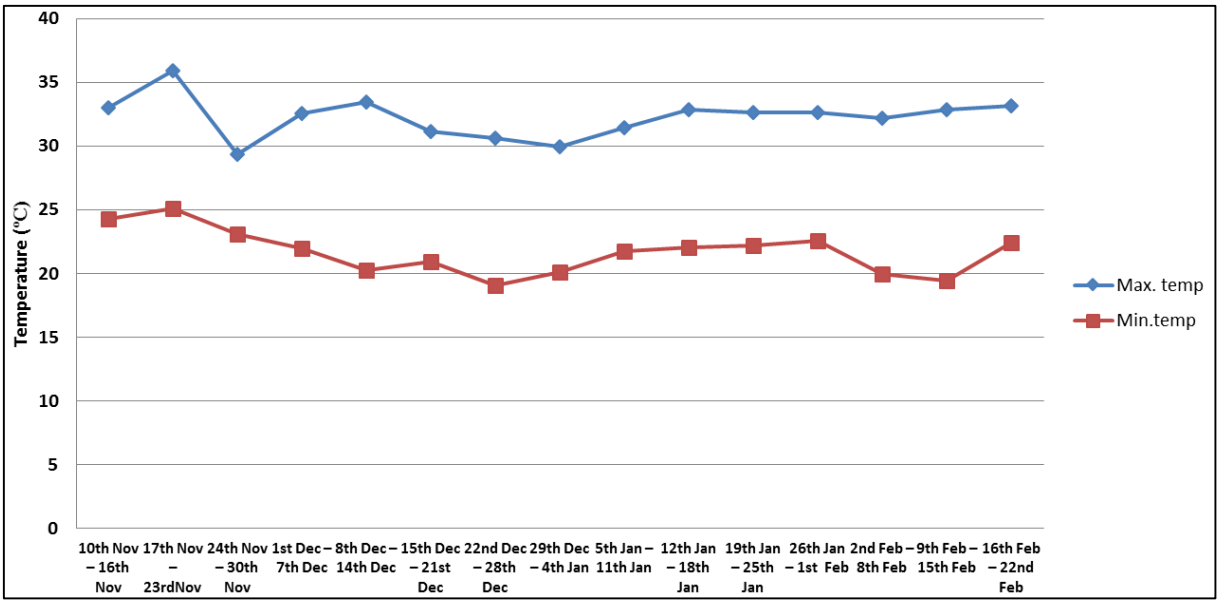

Fig 1: Average weekly temperature (minimum and maximum) recorded during the crop season (2020-21)

Results and Discussion

Growth attributes

Data revealed that, interaction effect of dates of planting and genotypes significantly influenced the growth parameters of potato (Table 1).

The highest plant height was recorded in genotype HT/15-240 of 10th November planting (55.35 cm) which was found statistically at par with genotype HT/12-834 of 10th November planting (52.80 cm) while minimum plant height was recorded in genotype HT/16-113 of 17th November planting (33.25 cm). Maximum plant spread was recorded in genotype HT/12-834 of 10th November planting (56.95 cm) and the minimum plant spread was recorded in genotype HT/16-113 of 10th November (39.68 cm).

The interaction of date of sowing and genotypes exhibited a significant effect on leaf area. The maximum leaf area was recorded in the genotype HT/12-834 of 10th November planting (459.58 cm^2) whereas the minimum leaf area was recorded in genotype HT/12-116 of 17th November planting (203.88 cm^2). Average growth rate of plants was recorded highest in genotype HT/15-240 of 10th November planting (0.91) which was on par with Kufri Surya of 10th November (0.88) and the minimum average growth rate was recorded in the genotype HT/16-113 of 17th November planting (0.21).

Genetic constitution of genotypes and their interaction with suitable temperature and moisture conditions of growing environment might have resulted in their better performance on 10th November planting. Comparatively retarded growth attributes recorded at 17th November planting might be due to the lower temperature experienced by the plants at these growth stages which lead to reduced allocation of assimilates. Similar observations have been reported by Sadawarti *et al.* (2016) [6], Agrawal *et al.* (2016) [1] and Das *et al.* (2021) [3] in potato.

Table 1: Growth attributes of potato as influenced by interaction effects of dates of planting and genotypes

Genotypes	Plant height (cm)		Plant spread (cm)		Leaf area (cm^2)		Average growth rate (AGR)	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
HT/14-95	38.75	43.75	43.05	41.33	296.87	205.31	0.59	0.42
HT/14-109	47.48	42.00	49.98	45.15	377.78	393.90	0.83	0.72
HT/12-834	52.80	47.45	56.95	47.20	459.58	284.49	0.83	0.33
HT/16-113	35.00	33.25	39.68	43.35	271.25	339.11	0.41	0.21
HT/12-116	39.65	40.50	49.67	46.00	292.38	203.88	0.52	0.34
HT/10-1554	38.30	37.50	47.51	44.25	223.05	213.09	0.79	0.36
HT/12-830	45.90	42.15	48.60	43.85	381.85	306.13	0.60	0.30
HT/15-240	55.35	47.35	46.23	49.30	302.18	308.02	0.91	0.44
Kufri Surya	48.45	41.70	46.88	46.60	241.61	184.88	0.88	0.46
S.Em±	1.88		1.87		3.78		0.01	
CD (P = 0.05)	5.33		5.31		10.74		0.03	

Dates of planting (D): D_1 - 10th November D_2 - 17th November

Yield attributes

Data collected on yield and yield attributing parameters are presented in table 2. Yield attributes *viz.* number of tubers per plant and diameter of tubers were found significantly influenced by the interaction effect of dates of planting and genotypes. However, the interaction effect was found non-significant on marketable and total tuber yield per plant and marketable and total tuber yield per plot.

Maximum number of tubers per plant was obtained in genotype HT/12-834 of 10th November planting (9.52) which was found statistically on par with genotype HT/12-116 of 10th November (8.80) and HT/12-834 of 17th November planting (8.69). This might be due to the better plant growth in terms of plant height and number of leaves, coupled with favorable temperature and soil moisture conditions. It might have helped in formation of more photosynthetic area which resulted in accumulation of photosynthates and their translocation to tubers. Also, the stolon initiation and tuber development might have coincided with suitable temperature might have resulted in more number of tubers per plant. The minimum number of tubers per plant was recorded in genotype HT/10-1554 of 17th November planting (2.54). These results are in agreement with findings of Jamro *et al.* (2015) [4] and Thongam *et al.* (2017) [7] in potato.

Diameter of tubers was recorded the maximum in genotype HT/10-1554 of 10th November planting (6.05 cm) which was found on par with HT/12-116 of 10th November (5.85 cm), whereas the minimum diameter of tubers was recorded in the genotype HT/16-113 of 17th November planting (4.34 cm).

Genotype HT/10-1554 was found to have minimum number of tubers with maximum diameter. The maximum length of tubers was recorded in genotype HT/12-116 of 10th November (8.80 cm) which was found on par with Kufri Surya of 10th November (8.38 cm), whereas, the minimum length of tubers was recorded in genotype HT/16-113 of 10th November (5.72 cm).

Average tuber weight, marketable and total tuber yield per plant and marketable and total tuber yield per plot were not significantly influenced by interaction effect of planting dates and genotypes (Table 3). Among planting dates, more yield was recorded in 10th November planting and genotypes HT/12- 830, HT/15-240, HT/12-834, HT/14-109 and HT/12-116 were found better performing with respect to total and marketable yield per plant and per plot.

Table 2: Yield attributes of potato as influenced by interaction effects of dates of planting and genotypes

Genotypes	Number of tubers per plant		Diameter of tubers (cm)		Length of tubers (cm)		Average tuber weight (g)	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
HT/14-95	4.75	3.79	5.17	4.42	7.41	7.50	41.52	42.75
HT/14-109	6.99	6.76	5.57	5.52	7.44	7.25	47.95	44.73
HT/12-834	9.52	8.69	4.85	5.66	6.83	6.81	39.43	35.75
HT/16-113	3.69	4.45	4.45	4.34	5.72	5.85	32.02	24.84
HT/12-116	8.80	4.70	5.85	4.55	8.80	7.87	40.18	55.67
HT/10-1554	3.26	2.54	6.05	5.13	6.41	6.63	72.66	66.45
HT/12-830	7.21	6.44	4.69	4.77	8.07	7.79	59.18	57.86
HT/15-240	5.47	5.20	5.58	5.36	6.57	7.17	73.57	61.94
Kufri Surya	3.92	3.37	5.51	5.59	8.38	7.48	68.29	66.01
S.Em±	0.46		0.12		0.18		6.22	
CD (P = 0.05)	1.30		0.35		0.50		NS	

Dates of planting (D): D_1 - 10th November D_2 - 17th November NS – Non-significant

Table 3: Marketable yield and total yield of potato as influenced by interaction effects of dates of planting and genotypes

Genotypes	Marketable yield per plant (g)		Total yield per plant (g)		Marketable yield per plot (kg)		Total yield per plot (kg)	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
HT/14-95	179.13	151.64	201.89	157.42	2.94	3.48	3.13	3.61
HT/14-109	328.53	294.84	335.71	303.81	7.19	7.06	7.35	7.28
HT/12-834	356.16	297.05	373.91	309.85	8.69	8.13	9.13	8.47
HT/16-113	110.55	101.88	118.07	109.05	2.20	2.71	2.35	2.90
HT/12-116	328.81	251.26	341.89	258.40	7.13	6.03	7.41	6.19
HT/10-1554	216.62	159.45	232.44	165.32	3.85	3.85	4.14	3.99
HT/12-830	398.09	357.90	422.31	370.25	9.46	8.88	10.03	9.19
HT/15-240	389.60	312.95	397.66	318.95	8.88	7.06	9.07	7.20
Kufri Surya	257.00	218.58	262.52	222.10	6.15	5.90	6.27	5.99
S.Em±	27.28		27.77		0.68		0.69	
CD (P = 0.05)	NS		NS		NS		NS	

Dates of planting (D): D_1 - 10th November D_2 - 17th November NS – Non-significant

Conclusion

Based on the present experimental results it was concluded that, interaction of dates of planting and genotypes significantly influenced growth and yield promoting parameters.

However it had no significant influence on total yield. The genotypes, HT/15-240, HT/12-834, HT/10-1554 and HT/12-116 performed well at 10th November planting and can suggested to cultivate in coastal plains of Andhra Pradesh after further evaluation.

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