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Response of different date of planting on growth, yield and economics of potato (*Solanum tuberosum* L) genotypes under Northern hill region of Chhattisgarh

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Abstract

Field experiment was conducted in *kharif* season of 2018 at Instructional Farm of Potato Research Station, Mainpat, Chhattisgarh to study the effect of different date of planting on productivity and economics of potato (*Solanum tuberosum* L) genotypes under rainfed conditions. The experiment was laid out in a split plot design with three date of planting *viz.*, 10th July (D₁), 20th July (D₂) and 30th July (D₃) in the main-plot treatments with three genotypes *viz.*, Kufri Pukhraj (V₁), Kufri Khyati (V₂), Kufri Jyoti (V₃), in the sub-plot treatments. The result showed that the potato planting on 10th July were recorded significantly higher plant height (75.00 cm), number of shoots plant⁻¹(8.63), compound leaves plant⁻¹(42.25), leaf area index (3.71), dry matter accumulation plant⁻¹(43.84), number of tuber plant⁻¹(13.84), total yield (16.21 t ha⁻¹), net return (179294) and B:C ratio (3.07) as compared to other dates of planting. Among the genotypes Kufri Pukhraj (V₁) was recorded significantly superior performance in all growth parameters, yield attributes, total yield, net return and B:C ratio followed by Kufri Jyoti and Kufri Khyati. The interaction effect of dates of planting and genotypes was showed significant variation and Kufri Pukhraj yielded more total tuber (15.68 t ha⁻¹) with 10th July (D₁) date of planting.

Keywords: Response, economics, *Solanum tuberosum* L.

Introduction

Potato (*Solanum tuberosum* L.) is one of the most important vegetable crops and ranks 4th in terms of production in the world after rice, wheat and maize. It is a unique and important food crops of the world's, which can be grown under a wide range of climatic conditions and has wide flexibility in planting and can be harvested early or late depending upon market price and requirement of field for subsequent crop. In Chhattisgarh potato occupies about 0.04 m ha with a total production of 0.58 million tonnes and productivity is 14.26 t ha⁻¹. (Anonymous, 2018) [1]. In Chhattisgarh, hilly region of Surguja and Jashpur are suitable for potato cultivation during rainy season. It covered about 1500 ha with productivity of 15 to 20 t ha⁻¹. Cultivation of potato is a new agricultural enterprise during monsoon season on slopy uplands of hilly areas in Chhattisgarh on a limited area. The common tendency of the farmers is to go for rice and small millets crop in lowlands and uplands which occupy the major area under cultivation. Since the rains are heavy during monsoon period, the farmers cannot Options for other crops with the fear that they may fail due to excess soil moisture conditions. After harvest of the rice and small millets crop, the land remains fallow. The farmers cannot think of a better crop after the harvest of rice and small millets with good production potential which can fetch them a good market price. In this situation, if *kharif* potato cultivation is found to be remunerative, it will solve the financial problems of the poor farming community, in addition to a dramatic change in the cash crop scenario in the hilly areas. Among the various agronomical factors influencing the growth and yield of potato, use of suitable varieties and it's sowing in appropriate time are two most important non-monetary inputs particularly for rainfed conditions. The present study was undertaken to investigate the response of different date of planting and genotypes with respect to growth performance, yield attributing characters, yield and net profit of potato (*Solanum tuberosum* L) under northern hill region of Chhattisgarh.

Materials and Methods

An experiment was conducted during 2018 at Instructional Farm of Potato and Temperate fruit Research, Mainpat, Chhattisgarh. The soil of the experimental field was sandy clay loam with acidic nature pH (6.3) and soil texture with low organic carbon (0.42) and nitrogen (214.22 kg

ha⁻¹), medium in phosphorus (15.04) and high potassium (274.65). Treatments included combinations of three dates of planting *viz.*, D₁- 10th July, D₂- 20th July and D₃- 30th July as main-plot treatments and three genotypes of potato *viz.*, V₁ – Kufri Pukhraj, V₂- Kufri Khyati and V₃ – Kufri Jyoti, in sub-plot treatments, replicated three times with split plot design. Surface soil samples taken before planting of potato crop were analysed for their physico-chemical properties employing standard procedure. Well sprouted seed tubers were planted in the 10th July, 20th July and 30th July. Half of the N was applied as urea and full dose of P and K was applied as single super phosphate and murite of potash with a uniform dose of 180 kg ha⁻¹ N, 100 kg P₂O₅ ha⁻¹ and 100 kg K₂O ha⁻¹ inside the ridge band at planting while the remaining N was applied through urea at 30 days after planting *i.e.* at the time of earthing up.

Result

Growth attributes

The data on Table 1 reveals that early planting at 10th July gave significantly higher plant height (75.00 cm), number of shoots plant⁻¹(8.63), compound leaves plant⁻¹ (42.25), leaf area index (3.71), dry matter accumulation plant⁻¹ (43.84) as compared to 20th July and 30th July date of planting. The lowest growth attributing characters was recorded with potato planting on 30th July. It might due to favorable temperature and suitable soil moisture as compared to low temperature and higher soil moisture during late planting of potato. Among various potato genotypes, Kufri Pukhraj produced significantly plant height (77.33 cm), number of shoots plant⁻¹(7.81), compound leaves plant⁻¹(42.49), leaf area index (3.67), dry matter accumulation plant⁻¹ (43.21) as compared to Kufri Jyoti and Kufri Khyati. On the other hand, the lowest growth attributing characters was noted with Kufri Khyati. The varietal differences in plant height, number of shoot and compound leaves, LAI and dry matter accumulation might be due to genetic composition of the variety (Singh, 2005) [9]. Ezekiel and Bhargava (2010) [7] reported that the plant height of Kufri Pukhraj and Kufri Jyoti decreased with delayed planting. Nandekar and Sharma (2007) [8] who also found that number of shoots plant⁻¹ and number of compound leaves plant⁻¹ decreased with delay in planting. Higher interception of solar radiation in earlier sowing may be responsible for more dry matter accumulation plant⁻¹ when soil moisture and light are non limiting, higher temperatures accelerate growth process.

Yield attributes and yield

The data presented on Table 2 reveals that yield attributing characters and yield were significantly influenced by date of planting and genotypes of potato. The early planting of potato on 10th July was recorded significantly higher number of tuber plant⁻¹ (13.84), fresh weight of tubers plant⁻¹ (264.50 g), marketable yield (15.17 t ha⁻¹) and total yield (16.21 t ha⁻¹), as compared to other date of planting 20 July and 30 July and minimum yield attributes and yield was recorded during planting of potato on 30 July. This might be due to adequate moisture and better utilization of solar radiation for proper growth and development of crops which turn in more number of tuber plant⁻¹ which ultimately showed higher yield. Among the variety of potato, Kufri Pukhraj recorded maximum number of tuber plant⁻¹ (13.89), fresh weight of tubers plant⁻¹ (276.48 g), marketable yield (15.61 t ha⁻¹) and total yield (16.68 t ha⁻¹) as compared to Kufri Jyoti and Kufri Khyati. It might be due to inherent capacity of the variety to contribute differently in tuber productivity (Baishya *et al.* 2010) [2]. The increase in yield may be attributed to better crop growth *i.e.* plant height, the number of shoots and number and size of tubers (Kumar *et al.*, 2001) [3]. The interaction of date of planting and genotypes on total yield was showed significant variation and potato variety Kufri Pukhraj recorded more yield when it was planted on 10th July than other varieties with planting dates. High tuber yield of Kufri Pukhraj was mainly due to high tuber bulking resulting in greater tuber weight in comparison to other varieties. Similar result was observed by Kumar *et al.* (2009) [5] and reported that the graded and total tubers yield of Kufri Pukhraj was significantly higher than Kufri Giriraj and Kufri Jyoti.

Economics

Higher cost of cultivation (Rs 86922 ha⁻¹) was recorded when potato were planting on 30th July but maximum net return (Rs179294 ha⁻¹) and B:C ratio (3.07) was observed in 10th July. Among the potato genotypes Kufri Pukhraj was recorded significantly higher net return (Rs 175076 ha⁻¹) and B:C ratio (3.02) but similar cost of cultivation (Rs 86628 ha⁻¹) was noticed in all genotypes. This was mainly due to higher production potential of potato Kufri Pukhraj accompanied with good monetary return. Kumar and Trehan (2012) [4] also recorded higher net return and B:C ratio at optimum yield levels for Kufri Pukhraj than Kufri Jyoti. Minimum net return and B:C ratio was observed in variety Kufri Khyati.

Table 1: Growth parameters of potato as effect by different date of planting and genotypes

Treatments	Plant height (cm)	Number of shoots plant ⁻¹	Number of compound leaves plant ⁻¹	Leaf area index (60 DAP)	Dry matter accumulation plant ⁻¹ (g)
Date of planting					
D ₁ -10 July	75.00	8.63	42.25	3.71	43.84
D ₂ -20 July	73.11	7.42	41.25	3.56	41.67
D ₃ -30 July	71.44	5.59	40.38	2.97	38.34
SEm±	0.56	0.11	0.20	0.03	0.24
CD (P= 0.05%)	1.79	0.36	0.63	0.10	0.83
Varieties					
V ₁ -Kufri Pukhraj	77.33	7.81	42.49	3.67	43.21
V ₂ -Kufri Khyati	71.44	6.52	40.01	2.81	39.27
V ₃ -Kufri Jyoti	73.78	7.11	41.18	3.24	41.57
SEm±	0.60	0.08	0.31	0.04	0.26
CD (P= 0.05%)	1.87	0.33	1.02	0.16	0.91

Table 2: Yield attributes, yield and total tuber yield ($t\ ha^{-1}$) of potato as effect by different date of planting and genotypes

Treatments	Number of tuber plant ⁻¹	Fresh weight of tubers plant ⁻¹ (g)	Marketable yield ($t\ ha^{-1}$)	Total yield ($t\ ha^{-1}$)
Date of planting				
D ₁ -10 July	13.84	264.50	15.17	16.21
D ₂ -20 July	12.09	255.18	14.02	14.99
D ₃ -30 July	11.13	246.88	13.05	13.95
SEm±	0.10	1.53	0.23	0.25
CD (P= 0.05%)	0.40	6.02	0.93	0.99
Varieties				
V ₁ -Kufri Pukhraj	13.89	276.48	15.61	16.68
V ₂ -Kufri Khyati	10.96	230.82	12.26	13.11
V ₃ -Kufri Jyoti	12.22	259.26	14.36	15.35
SEm±	0.17	2.19	0.23	0.25
CD (P= 0.05%)	0.54	6.76	0.72	0.77

Table 3: Interaction effect of total yield ($t\ ha^{-1}$) influenced by date of planting and genotypes

Varieties	Date of planting			
	D ₁ -10 July	D ₂ -20 July	D ₃ -30 July	Mean
V ₁ -Kufri Pukhraj	17.14	16.89	16.03	16.69
V ₂ -Kufri Khyati	15.17	13.13	14.97	13.12
V ₃ -Kufri Jyoti	16.32	14.97	14.78	15.36
Mean	16.21	14.97	13.95	
SEm±	0.25	0.25	0.43	
CD (P= 0.05)	0.99	0.77	1.34	

Table 4: Economics of potato as effect by different date of planting and genotypes

Treatment	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B: C Ratio
Date of planting				
D ₁ -10 July	86482	266528	179294	3.07
D ₂ -20 July	86482	255413	168930	2.95
D ₃ -30 July	86922	241375	154453	2.78
SEm±	-	739	655	0.01
CD (P= 0.05%)	-	2903	2571	0.03
Varieties				
V ₁ -Kufri Pukhraj	86628	261705	175076	3.02
V ₂ -Kufri Khyati	86628	248297	160917	2.86
V ₃ -Kufri Jyoti	86628	253314	166685	2.92
SEm±	-	481	730	0.01
CD (P= 0.05%)	-	1483	2250	0.03

Conclusion

The potato were planting on 10th July with variety Kufri Pukhraj gave significantly superior performance than other date of planting (20th July, 30th July) and genotypes (Kufri Jyoti, Kufri Khyati) in all growth parameters, yield attributes, marketable and total yield, net return and B:C ratio.

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