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Effect of NPK on growth, yield and quality of potato (*Solanum tuberosum* L.) under Chhattisgarh plain

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Abstract
Potato (*Solanum tuberosum* L.) is herbaceous annual plant belongs to the family *Solanaceae* and genus *Solanum.* It is one of the most important vegetable cum starch supplying crop having high production per unit area per unit time. Potato being an underground tuber occupies key position among the cash crops in India. A research trial was conducted during *Rabi* season of 2021-22 at the Research cum Demonstrational Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The experiment was laid out under Randomized Block Design with 3 replications and 12 nutrient treatments and one absolute control. Result regarding growth and yield of potato were significantly influenced by varying doses of NPK fertilizers. Results showed NPK dose of T_5; 300:80:150 NPK kg/ha recorded highest plant height (58.18 cm), number of shoots per plant (6.07), marketable tuber yield (32.70), tuber yield (39.78 t/ha). Quality parameter such as dry matter content (%) in tuber and haulm were found non - significant differ under different NPK doses.

Keywords: Potato, growth parameters, yield and quality

Introduction
Potato (*Solanum tuberosum* L.) is herbaceous annual plant belongs to the family *Solanaceae* and genus *Solanum.* It is one of the most important vegetable cum starch supplying crop having high production per unit area per unit time. Potato being an underground tuber occupies key position among the cash crops in India. Potato crop has higher yield potential and good nutritive value. The 100 gm of fresh tuber contains 70-80% water, 20.6% carbohydrates, 2.1% protein, 0.3% fat, 1.1% crude fibre and 0.9% ash. Potatoes are rich source of vitamin C, minerals and essential amino acids like leucine, tryptophan and isoleucine (Bist and Sharma, 1997) [3]. Potato is one of the staple food crops and it is third most important crop after rice and wheat (Andre *et al*., 2014) [14]. India is one of the second largest potato producers contributing almost 12% of global production subsequent to China (Anonymous, 2019) [2]. In India, it is cultivated in about the 21.42 lakh hectares area with a production of 513.27 lakh MT and average productivity of 23.68 tonnes per hectare (Anonymous, 2018) [1]. In Chhattisgarh, it is cultivated in an area of 43,541 hectares with annual production of 5,98,315 tonnes and productivity 15.02 tonnes per hectare (Anonymous, 2019) [2]. In Chhattisgarh state, potato is mainly cultivated in Sarguja, Raigarh, Jashpur, Balrampur, Raipur, Bilaspur and Baster as *Rabi* crop and in Mainpat and Samripat hills of Sarguja district as kharif crop. Potato can be grown in all the agro-climatic zones of Chhattisgarh under irrigated conditions. The potato plant can be grown well under ample availability of all macronutrients (Nitrogen, Phosphorus, Potassium, Calcium, Magnesium and Sulphur). A mature crop of potato yielding 25 – 30 t ha^{-1} uptake 110 kg per ha N, 50 kg P_2O_5 and 225 kg K_2O per ha, (Choudhary, 1990) [5]. Thus, potato is heavy feeder crop which uptake large amount of nutrients. The potato crops need adequate amount of nutrients for sustaining the optimum yield potential. If nutrients are not applied in a adequate as well as balanced manner resulting improper growth, development and yield. Nitrogen, Phosphorus and Potassium are considered as the most significant macronutrients for potato crop in Indian soils. Nitrogen is the 1st limiting nutrient in potato production that greatly influence crop growth and tuber yield. Nitrogen (N) is a component of protoplasm and it is helpful for chlorophyll synthesis. It has play predominant role for growth and development in potato. Nitrogen applications can increase dry matter content, protein content of tubers and total tuber yield (Belanger *et al*., 2002) [4]. Phosphorus (P) is the 2nd most important macronutrient limiting plant growth after nitrogen.

It is a plant nutrient that restricts the cellular energy transfer, photosynthesis, and respiration and is a component of phospholipids, phosphorylated sugars, nucleic acid and nucleotides (Marschner, 1996; Plaxton & Carswell, 1999) [10, 11]. Whereas, Potassium (K) influences production and tuber quality as well as increases plant tolerance to drought and frost stress. It is a mobile element found in plant tissues and it plays an important role in photosynthesis through carbohydrate metabolism, osmotic regulation, translocation of assimilates and nitrogen uptake. It also plays a vital role in physiological processes such as plant respiration, transformation of transpiration enzymes and the movement of sugars and carbohydrates. (Kelling *et al*., 1998) [8].

Methods and Materials

A field experiment was conducted during *Rabi* season of 2021-2022 at the Research cum Demonstrational farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G). The soil of experimental site was clay loam (Dorsa) having pH 7.12. The experiment was conducted under Randomized Block Design with three replications. It consists of 12 nutrient (NPK) treatments included absolute control *viz.*,(T_0) 0:0:0 NPK kg/ha (T_0) 0:0:0 NPK kg/ha, (T_1) 0:80:150 NPK kg/ha, (T_2) 120:80:150 NPK kg/ha, (T_3) 180:80:150; NPK kg/ha, (T_4) 240:80:150 NPK kg/ha, (T_5) 300:80:150 NPK kg/ha, (T_6) 240:0:150 NPK kg/ha, (T_7) 240:40:150 NPK, (T_8) 240:120:150 NPK kg/ha, (T_9) 240:80:0 NPK kg/ha,, (T_{10}) 240:80:50 NPK kg/ha, (T_{11}) 240:80:100 NPK kg/ha, (T_{12}) 150:100:100 NPK kg/ha. Five plants were randomly selected and tagged for the observations on growth and yield parameters. The Observations to be recorded: growth parameters like: Per cent plant emergence (%), Plant height (cm), Number of shoots per plant recorded in 50 DAP. Yield Parameter such as Marketable yield and total tuber yield (t/ha). Quality parameter: Dry matter content in tuber and haulm (%). All the experimental plants were provided same cultural practices *i.e.* fertilizer application, irrigation, earthing- up, weed management, haulm cutting and plant protection measures during the whole period of investigation. Healthy sprouted potato tubers were treated with fungicide Dithane M-45 0.25% and planted on a well - prepared field at 60 X 20 cm spacing with application of different dose of NPK fertilizers and uniformity maintained all the cultural practices in potato cultivation.

Result and Discussion

1. Per cent plant emergence (%)

The percent plant emergence at 30 days was differ significantly due to different doses of nutrients. However, mean performance of per cent emergence ranged from per cent (88.33 to 93.67%). The highest percentage of emergence was found in T_1; 0:80:150 NPK kg/ha (93.67 per cent) which was followed by T_{12}; 150:100:100 NPK kg/ha (93.33%), T_2; 120:80:150 NPK kg/ha (92.67%) and T_7; 240:40:150 NPK kg/ha (91%). Whereas, the minimum per cent emergence was recorded in T_{11}; 240:80:100 NPK kg/ha (88.33%). The emergence of seed tubers in potato varied from 90 to 98%.

2. Plant height (cm)

The Plant height under different treatments was recorded at 50 DAP which is significantly. Highest plant height of 58.18 cm was recorded with treatment T_5; 300:80:150 NPK kg/ha. However, it was found statistically *at par* with treatment T_8; 240:120:150 NPK kg/ha (57.16 cm), T_{10}; 240:80:50 NPK kg/ha (55.71 cm) and T_{11}; 240:80:100 NPK kg/ha (55.67 cm). Whereas, the lowest plant height was recorded in T_0; absolute control (38.4 cm).This indicates that higher NPK doses stimulated the potato plants to grow taller than those fertilized lower doses rates or absolute control Solangi *et al*. (2015) [13].

3. Number of shoots per plant

Numbers of shoots per plant were recorded at 50 DAP which is significantly highest number of shoots plant^{-1} was recorded in the T_5; 300:80:100 NPK kg/ha (6.07) which was found to be statistically at par withT_{10}; 240:80:50 NPK kg/ha (5.67) and T_{11}; 240:80:100 NPK kg/ha (5.47). The lowest number of shoots per plant was observed in absolute control T_0; (3.73).

Yield parameters

1. Marketable tuber yield (kg/plot)

Marketable tuber yield (kg/plot) of different treatment are presented in Table 1. Significantly higher marketable tuber yield was found in T_5; 300:80:150 NPK kg/ha (32.70 kg/plot) which was statistically *at par* with T_8; 240:120:150 NPK (31.72 kg/plot) followed by T_{11}; 240:80:100 NPK kg/ha (28.37 kg/plot) and T_4; 240:80:150 NPK kg/ha (26.62 kg/plot). However, the lower marketable tuber yield was found in absolute control T_0; (10.49 kg/plot).The increment in marketable tuber yield was due to the increase in doses of N, P and K at each successive levels. The nitrogen (N) applied at higher doses was found to be beneficial. This might be due to the accumulation of suffiecient quantity of photosynthate transfer from source to sink part. This finding is in confirmation with Kumar *et al*., 2008.

2. Total tuber yield (t/ha)

The total tuber yield ranged from 13.73 t/ha (absolute control) to 39.78 t/ha (300:80:150 NPK kg/ha) with an overall mean of 29.620 t/ha. The significantly higher total tuber yield kg/plot was recorded in 300:80:150 NPK kg/ha (39.78 t/ha) which was statistically *at par* with T_8; 240:120:150 NPK kg/ha (38.72 t/ha). The lowest total tuber yield t/ha was recorded in absolute control T_0; (13.73 t/ha). The results is close refers with the findings of Jatav *et al.* (2013) [7] reported that nitrogen was one of the most limiting nutrients for both total and marketable tuber yield of potato. Due to the highest yield reduction was observed without nitrogen, among other nutrients like phosphorus and potassium in this experiment. The second most limiting nutrient was phosphorus followed by potassium.

Quality parameters

Dry matter content in tuber and haulm (%)

The Dry matter content in tuber (%) ranged from 16.67% (absolute **c**ontrol) to 21.33% (300:80:150 NPK kg/ha) with an overall mean of 19.41% (Table 2).The dry matter content of tuber was differ non-significantly due to different doses of NPK. The higher dry matter content of tuber (kg/plot) was found in T5; 300:80:150 NPK kg/ha (21.33%) and the lower was found in absolute **c**ontrol (16.67%). The dry matter content in haulm (%) ranged from 16.89% (absolute control) to 21.67% (300:80:150 NPK kg/ha) with an overall mean of 19.33%. The dry matter content of tuber was differ non-significantly due to different doses of NPK. The higher dry matter content of haulm (kg/plot) was found in T5; 300:80:150 NPK kg/ha (21.67%) and the lower was found in absolute control (19.32%).

Table 1: Percent emergence, plant height, number of shoots per plant, Marketable tuber yield (kg/plot) and Total tuber yield (t/ha)

Treatment N:P:K (kg/ha)	Per cent emergence	Plant height (cm)	Number of shoots per plant	Marketable tuber yield (kg/plot)	Total tuber yield (t/ha)
0:0:0 (Absolute control)	90.00	38.4	3.73	10.49	13.73
0:80:150	93.67	42.10	4.80	12.79	18.36
120:80:150	92.67	53.84	4.87	18.77	26.05
180:80:150	91.33	55.02	4.40	23.30	29.55
240:80:150	90.67	53.73	4.93	26.62	34.03
300:80:150	89.33	58.18	6.07	32.70	39.78
240:0:150	91.00	54.47	4.13	22.18	27.85
240:40:150	91.33	55.24	5.07	22.82	29.48
240:120:150	90.00	57.16	5.47	31.72	38.72
240:80:0	91.00	55.05	5.07	24.27	30.45
240:80:50	89.00	55.71	5.67	27.68	33.27
240:80:100	88.33	55.67	5.47	28.37	33.60
150:100:100	93.33	44.7	4.07	21.23	30.21
S.Em±	0.92	1.07	0.32	2.61	3.12
CD (P = 0.05)	2.68	3.14	0.95	7.62	9.11

Table 2: Tuber dry matter content (%) and Haulm dry matter content (%) affected by different doses of nutrients.

Treatment N:P:K (kg/ha)	Tuber dry matter content (%)	Haulm dry matter content (%)
0:0:0 (Absolute control)	16.67	16.89
0:80:150	18.00	18.33
120:80:150	17.67	18.67
180:80:150	19.33	19.67
240:80:150	20.67	20.67
300:80:150	21.33	21.67
240:0:150	19.00	19.00
240:40:150	19.33	19.67
240:120:150	21.00	21.33
240:80:0	20.00	19.67
240:80:50	20.67	21.00
240:80:100	20.67	20.67
150:100:100	18.00	18.33
S.Em±	1.04	0.95
CD (P = 0.05)	NS	NS

Conclusion

Based on the present investigation, reveal that the growth parameters were highly significant in $T_{5;}$ 300:80:150 NPK kg/ha, it was good performers. The average highest tuber yield was recorded in T_5; 300:80:150 NPK kg/ha (39.78 t/ha) followed by T_8; 240:120:150 NPK kg/ha (38.72 t/ha)). The result revealed that $T_{5;}$ 300:80:150 NPK kg/ha were promising for obtaining higher productivity.

References

1. Anonymous. Horticultural Statistics at a Glance. Horticulture Statistics Division, Department of Agriculture, Co-operation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Govt. of India; c2018, 458.
2. Anonymous. Horticulture Statistics Division, Department of Agriculture, Co-operation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Govt. of India; c2019.
3. Bist BS, Sharma HC. Potato statistics India and the World Technical Bulletin, CPRI, Shimla. 1997;40:124.
4. Belanger G, Walsh JR, Richards JE, Milburn PH, Ziadi N. Nitrogen fertilization and irrigation affects tuber characteristics of two potato cultivars. Am. J Pot. Res. 2002;79:269-279.
5. Choudhary B. Potato Handbook of Agriculture. ICAR, New Delhi. Grewal, J.S. Fertilizer use in potato crop in north-western hills of India- Present status and future strategies. J Indian Potato Assoc. 1990;17(1 &2):102-112.
6. Grewal JS. Fertilizer use in potato crop in north-western hills of India-Present status and future strategies. J Indian Potato Assoc. 1990;17(1 &2):102-112.
7. Jatav MK, Kumar M, Trehan SP, Dua VK, Kumar S. Effect of nitrogen and varieties of potato on yield and agronomic use efficiency in north western plains of India. Potato Journal. 2013;40(1):55-59.
8. Kelling KA, Bundy LG, Combs SM, Peters JB. Soil test recommendation for field, Vegetable and fruit crops. UWEX Bull. A. 1998;2809:54.
9. Kumar P, Trehan SP, Singh BP, Rawal S, Khan MA. Precision nitrogen requirement of table potato (*Solanum tuberosum* L.) cultivars for different growth periods. Indian Journal of Potato Association. 2008;28(1):60-61.
10. Marschner H. Mineral nutrition of higher plants. Academic press, London, England, 1996.
11. Plaxton WC, Carswell MC. Metabolic aspects of phosphate starvation response in plants. In Lerner, H.R. (Ed); c1996. p. 350-372.
12. Singh SK, Lal SS. Effect of potassium nutrition on potato yield, quality and nutrient use efficiency under varied levels of nitrogen application. Potato Journal. 2012;39(2):155-165.
13. Solangi M, Jogi Q, Shah AR, Suthar V, Wagan B, Soothar RK. Response of potato (*Solanum tuberosum* L.)

in terms of growth and tuber yield to varying NPK doses, 2015; 28(1):385-389.
14. Lefaucheur JP, André-Obadia N, Antal A, Ayache SS, Baeken C, Benninger DH, *et al*. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS). Clinical Neurophysiology. 2014 Nov 1;125(11):2150-206.
15. Raj S, Verma S, Bisen RK, Sharma G, Agrawal HP. Effect of growth parameters as influenced by nutrient sources of Potato (*Solanum tuberosum* L.).