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Effect of Different Fertilizer Doses on Yield and its Attributes in Potato

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ABSTRACT

The potato is one of the most important food crops after rice, wheat and maize. More than one billion people consume potatoes worldwide and it is the part of the diet of half a billion people in developing countries. In terms of area, India ranks third in the world after China and Russia and second in production after China. A field experiment on potato was conducted during rabi season for three consecutive years with an objective to prevent the indiscriminate use of fertilizers by the potato growers. The experiment was laid out in randomized block design with seven treatments and 3 replications. The results showed that the potato crop applied 100 per cent recommended dose of fertilizers (RDF) i.e. 150kg N, 60kg P2O5 and 120kg K2O recorded a yield of 15.33 t/ha which was at par with that of 150 per cent of RDF (13.74 t/ha). Therefore, the recommended dose of fertilizers was found to be beneficial for improving yield, quality and storage of potato tubers.

Key Words: Nutritional analysis, Potato, Tuber, Inorganic fertilizers, Economics.

INTRODUCTION

Potato is grown in India in almost all the states under very diverse conditions. Nearly 80 per cent potatoes are grown in vast Indo- Gangetic plains of North India during short winter days from October to March. Plateau regions of South- eastern, Central and peninsular India, constitute about 6 per cent area where potatoes are grown as a rain fed kharif crop during rainy season (July to October) or as irrigated rabi crop during winter (October to March) (Kadian *et al,* 2013). In most of the potato growing areas, farmers are not applying fertilizers on the soil test basis whereas the fertilizers requirement varies with the type of soil and the residual effect of the previous crop. However, inorganic fertilizers are being used as a readily available mixture by the farmers and not aware of the benefits of applying straight fertilizers. The farmers feel more convenient to apply readymade mixture as there is no need to mix individual fertilizers as per the recommended dose. In general, farmers normally use more quantity of fertilizers than the recommendations made by the research institutes. Likewise, they use most of the nitrogenous fertilizers at the time of planting which leads to rotting of tubers, loss of nutrients and ultimately yield loss. Hence, the present investigation was undertaken to study the effects of different fertilizer doses on yield and its attributes in Potato.

MATERIALS AND METHODS

A field experiment was conducted at Ganeshkhind, Pune on Potato cultivar Surya during rabi seasons of 2012-13 to 2014-15 in randomized block design with three replications. The treatments consisted of

T1 = 50% RDF of NPK	T2 = 100% RDF of NPK
T3 = 150% RDF of NPK	T4 = Without N fertilizer (PK)

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T5 = Without P fertilizer (NK) T6 = Without K (NP)

T7 = Without NPK (absolute control) RDF = 150kg N: 60 kg P2 O5: 120K_2O

The basal application of 50% N and 100% P_2O_5 and K_2O was used in all treatments. The soil of the experimental plot consisted of coarse sand (2.20%), fine sand (44.4%), silt (26.3%), clay (22.5%) with loam texture in class bulk density 1.10mg/m3. The pH was 7.5, electrical conductivity (0.25ds/m), organic carbon (0.77%), available nitrogen (185kg/ha), available phosphorus (32 kg/ha) and available potassium (360 kg/ha). Nitrogen, phosphorus and potash were applied through urea, single super phosphate and muriate of potash, respectively. All the recommended agronomic practices were adopted to raise a good and healthy crop. The crop was harvested after a period of 90 days and the representative soil, plant and tuber samples were collected for nutritional analysis. The observations on growth and yield characters were recorded and statistically analyzed (Panse and Sukhatame,1985).

RESULTS AND DISCUSSION

The growth and biomass production were strongly affected by the nutrient supply. The reduction in tuber yield was strongly related to the nitrogen supply, omission of which resulted in 31 per cent reduction in tuber yield and it was 23.35 and 26.41 per cent due to P and K omission, respectively. The N is the most limiting nutrient and P is becoming progressively limiting in potato. The reduction in tuber due to P omission was higher than k omission plots.

The data (Table 1) revealed that higher total tuber yield (15.33t/ha) was observed in treatment T2 (100% RDF of NPK) which was significantly superior over the remaining treatment except T3 (150% RDF of NPK). Treatment T2 recorded higher monetary returns of Rs. 9840/- and B: C ratio 2.60.

Table 1. Effect of different fertilizers doses on growth and yield parameters of Potato (Pooled data 2012-2015))

Sr. No.	Treatment	Emergence %	0-25 g tuber yield (t/ha)	25-50g tuber yield (t/ha)	50-75g tuber yield (t/ha)	>75 g tuber yield (t/ha)	Total tuber yield (t/ha)
1	T1-50% RDF of NPK	90.28	0.28	1.23	7.66	1.66	10.80
2	T2-100% RDF of NPK	92.13	0.43	1.68	9.45	3.85	15.33
3	T3-150% RDF of NPK	89.66	0.33	1.83	9.47	2.11	13.74
4.	T4-Without N fertilizer (PK)	88.43	0.21	0.88	7.96	1.54	10.58
5	T5-Without P (NK)	90.43	0.20	1.70	8.22	1.62	11.75
6	T6-Without K (NP)	88.04	0.27	1.67	7.97	1.37	11.28
7	T7-Without NPK (Absolute control)	89.27	0.16	0.43	7.21	1.92	9.73
	SE+	0.93	0.02	0.10	0.26	0.34	0.58
	CD at 5%	2.86	0.07	0.30	0.79	1.04	1.79
	CV	1.79	15.65	13.47	5.87	29.98	8.48

Table 2. Available nutrient status of soil, tuber and plant after harvesting.

Sr. No.	Treatment	Av.soil N (kg/ ha)	Av.soil P_2O_5 (kg/ha)	Av.soil K_2O (kg/ ha)	Av. tuber N%	Av. tuber P_2O_5 %	Av. tuber K_2O %	Av. Plant N%	Av. Plant P_2O_5 %	Av. Plant K_2O %
1	T1-50% RDF of NPK	159	21	302	2.83	1.76	1.97	2.86	1.78	2.36
2	T2-100% RDF of NPK	164	26	315	3.23	1.90	1.64	2.78	1.82	2.79
3	T3-150% RDF of NPK	159	32	345	2.90	2.06	1.78	2.79	2.02	3.03
4.	T4-Without N fertilizer (PK)	153	30	327	2.96	1.98	2.06	2.62	1.83	2.58
5	T5-Without P (NK)	159	20	327	2.82	1.73	1.86	3.48	1.07	2.07
6	T6-Without K (NP)	157	24	302	2.92	1.73	2.01	3.50	1.64	1.94
7	T7-Without NPK (Absolute control)	125	23	292	2.43	1.28	1.68	2.08	0.82	1.39
	SE+	3.16	0.64	4.01	0.01	0.03	0.01	0.02	0.02	0.01
	CD at 5%	9.65	1.97	12.36	0.04	0.09	0.04	0.05	0.05	0.02
	CV	4.94	4.40	2.20	0.86	2.83	1.19	0.91	1.87	0.53

Table 3. Nutrient uptake in Tuber, Plant and total uptake.

Sr. No.	Treatment	Tuber NPK (kg/ha)			Plant NPK (kg/ha)			Total uptake (kg/ha)		
		N	P	K	N	P	K	N	P	K
1	T1-50% RDF of NPK	50.62	31.50	35.32	30.10	18.68	24.84	80.72	50.18	60.17
2	T2-100% RDF of NPK	63.25	37.20	32.10	28.22	18.47	28.32	91.47	55.67	60.42
3	T3-150% RDF of NPK	56.35	40.02	34.58	31.52	22.83	34.32	87.87	62.85	68.90
4.	T4-Without N fertilizer (PK)	52.31	35.04	36.43	24.92	17.41	24.63	77.24	52.45	61.06
5	T5-Without P (NK)	49.41	30.26	32.59	32.02	9.81	19.03	81.43	40.07	51.62
6	T6-Without K (NP)	50.02	29.73	34.44	30.30	14.16	16.77	80.32	43.89	51.21
7	T7-Without NPK (Absolute control)	37.04	19.54	25.61	16.20	6.38	10.83	53.24	25.91	36.44
	SEM	0.79	0.75	0.47	1.68	1.14	1.64	1.86	1.52	1.69
	CD	2.44	2.32	1.44	5.18	3.52	5.04	5.73	4.68	5.19
	CV	2.67	4.09	2.45	10.54	12.84	12.50	4.08	5.56	5.24

Table 4. Yield and economics of potato.

Sr. No	Treatment	Yield (q/ha)	Gross returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	B:C ratio
1.	T1-50% RDF of NPK	10.80	129152	83466	45686	1.80
2.	T2-100% RDF of NPK	15.33	183397	84996	98401	2.60
3.	T3-150% RDF of NPK	13.74	164344	86474	77870	2.15
4.	T4-Without N fertilizer (PK)	10.58	126589	82318	44271	1.85
5.	T5-Without P (NK)	11.75	140506	83748	56758	1.91
6.	T6-Without K (NP)	11.28	134902	83511	51391	1.89
7.	T7-Without NPK (Absolute control)	9.73	116360	81264	35096	1.64
	SE+	0.58	6963		6963	
	CD at 5%	1.79	21455		21455	
	CV	8.48	8.48		20.62	

These results were in agreement with those reported by Olanya *et al* (2009). The nitrogen update in tuber and haulm as well as the total N update were significantly affected by N omission treatment (Table 3). Total N uptake ranged from 53.24kg/ha in the control plots, 77.24kg/ha in the N omission plot to 91.47kg/ ha in optimally fertilized plots. Lowest N uptake was recorded in absolute control plots. Total P uptake was significantly reduced due to P omission. However the lowest P uptake (25.91 kg/ha) was noticed in control plots. Similarly, Potassium uptake was significantly reduced due to K omission. However the lowest K uptake (36.44 kg/ha) was noticed in absolute control.

CONCLUSION

In potato, compared to the full application of all macro elements, the omission of N significantly decreased the tuber yields, whereas the omission of P and K had relatively lesser effect. The results showed that different rates of fertilize application were required for different soils with different soil nutrient supplying capacities. The co-efficient used to quantify soil nutrient supply and parameterization of nutrients requirement of potato would help to recommended different NPK combination for different soils with different values of soil nutrients supply for targeted potato yields instead of applying blanket fertilizers recommendation.

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