



EFFECT OF DIFFERENT FERTILIZER DOSES ON YIELD AND ITS ATTRIBUTES IN POTATO

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ABSTRACT

Potato is one of the world's fourth most important food crops after rice, wheat and corn. 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 effects of different fertilizer doses on yield and its attributes 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 revealed that potato treated with T2= 100% RDF i.e. 150 kg N, 60 kg P₂O₅ and 120 kg K₂O recorded a yield of 15.33 t/ha which was at par with that recorded by T3 i.e. 150% RDF (13.74 t/ha). The fertilizer dose of 100% RDF was found beneficial for improving yield, quality and storability of potato tubers. The gross monetary return (Rs. 1,83,397/ha) and net monetary return (Rs. 98,401/ ha) were found to be maximum in treatment T2. B:C ratio was found to be maximum in T2.

Key word: Potato, inorganic fertilizers, nutritional analysis.

INTRODUCTION

Potato is one of the world's fourth most important food crops. India has taken a leap in terms of area and production of potato since independence. The average production of potato crop was 41.32 million tons from 1.89 million hectares in 2015-16. Gujarat is one of the leading states in production of potato with 29.6 t/ha followed by 28.92 t/ha in West Bengal. The national average productivity of potato is 22.07 t/ha (Brown, 2005).

Potato is grown in India in almost all the states and very diverse conditions. Nearly 80% 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% area where potatoes are grown as a rainfed 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 application of inorganic fertilizers is not based on soil fertility tests. Fertilizer requirement varies with the soil and previous crop. Inorganic fertilizers are being used only as a readily available potato mixture. Farmers are not aware of the benefits of applying straight fertilizers. They feel it more convenient to apply readymade mixture as there is no need to mix individual fertilizers as per the recommended dose. Few farmers are using fertilizers like diammonium phosphate and complex fertilizers both as basal as well as at the time of earthing up.

Farmers normally use more than the recommended doses. Besides 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. Indiscriminate use of fertilizers leads to undesirable nutrient infiltration.

OBJECTIVES

The present investigation was undertaken with the objective to prevent the indiscriminate use of fertilizers by the farmers and find out the optimum fertilizer dose for potato.

MATERIAL AND METHODS

A field experiment was conducted at All India Co-ordinated Research Project on Potato, NARP, Ganeshkhind Pune on Potato cultivar Surya during rabi season of 2012-13, 13-14 and 14-15 (Table 1) in randomized block design with three replications (Table 1 and Fig. 1).

Table 1: Treatments with varying fertilizer doses.

T1 = 50% RDF of NPK	T2 = 100% RDF of NPK
T3 = 150% RDF of NPK	T4 = Without N fertilizer (PK)
T5 = Without P fertilizer (NK)	T6 = Without K (NP)
T7 = Without NPK (absolute control)	RDF = 150 : 60 : 120

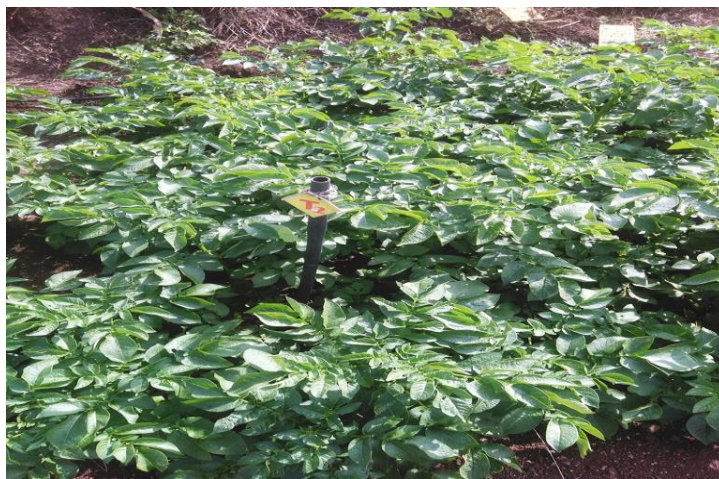


Figure 1: Plant growth and vigor observed in T2.

The treatments consisted of; Basal application of 50% N and 100% P₂O₅ and K₂O were made in all treatments. Soil of the experimental plot consists of coarse sand (2.20%), fine sand (44.4%), silt (26.3%) and clay (22.5%) with loam texture in class bulk density 1.10 mg m⁻³. The pH (1.25) was 7.5, electrical conductivity (0.25 ds m⁻¹), organic carbon (0.77%), available nitrogen (185 kg/ha), available phosphorus (32 kg ha⁻¹) and available potassium (360 kg ha⁻¹). Nitrogen, Phosphorus and Potash were applied through straight fertilizers viz. Urea, Single Super Phosphate and Muriate of Potash respectively. Fertilizers were applied as for the treatments. All agronomic practices were adopted to raise a good and healthy crop. The crop was harvested after a period of 90 days. Representative soil, plant and tuber samples were collected for nutritional analysis. The observations on growth and yield characters were recorded and statistically analyzed

by using methods given by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Growth and biomass production were strongly affected by the indigenous nutrient supply and the nutrients supplied through fertilizers. Nutrient omissions significantly influenced the yield of potato (ICAR, 2015). The reduction in tuber yield was strongly related to the N supply, omission of which resulted in 31% reduction in tuber yield. The reduction in the tuber yield was 23.35% and 26.41 % 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 presented in Table 2 revealed that higher total tuber yield (15.33 t/ha) was observed in treatment T2 (100 % RDF of NPK) which was significantly superior over the remaining treatment except T3 (150% RDF of NPK) (Table 3).

Table 2 : 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 uber yield (t/ha)	50-75g tuber yield (t/ha)	>75 g tuber yield (t/ha)	Total tuber yield (t/ha)
1	T ₁ -50% RDF of NPK	90.28	0.28	1.23	7.66	1.66	10.80
2	T ₂ -100% RDF of NPK	92.13	0.43	1.68	9.45	3.85	15.33
3	T ₃ -150% RDF of NPK	89.66	0.33	1.83	9.47	2.11	13.74
4.	T ₄ -Without N fertilizer (PK)	88.43	0.21	0.88	7.96	1.54	10.58
5	T ₅ -Without P (NK)	90.43	0.20	1.70	8.22	1.62	11.75
6	T ₆ -Without K (NP)	88.04	0.27	1.67	7.97	1.37	11.28
7	T ₇ -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 3: Available nutrient status of soil, tuber and plant after harvesting .

Sr. No.	Treatment	Av.soil N (kg ha ⁻¹)	Av.soil P ₂ O ₅ (kg ha ⁻¹)	Av.soil K ₂ O (kg ha ⁻¹)	Av tuber N%	Av tuber P ₂ O ₅ %	Av tuber K ₂ O %	Av Plant N%	Av Plant P ₂ O ₅ %	Av Plant K ₂ O %
1	T ₁ -50% RDF of NPK	159	21	302	2.83	1.76	1.97	2.86	1.78	2.36
2	T ₂ -100% RDF of NPK	164	26	315	3.23	1.90	1.64	2.78	1.82	2.79
3	T ₃ -150% RDF of NPK	159	32	345	2.90	2.06	1.78	2.79	2.02	3.03
4.	T ₄ -Without N fertilizer (PK)	153	30	327	2.96	1.98	2.06	2.62	1.83	2.58
5	T ₅ -Without P (NK)	159	20	327	2.82	1.73	1.86	3.48	1.07	2.07
6	T ₆ -Without K (NP)	157	24	302	2.92	1.73	2.01	3.50	1.64	1.94
7	T ₇ -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

Treatment T2 recorded higher monetary returns of Rs. 9840/- and B:C ratio 2.60. These results are in agreement with those reported by Olanya *et al.* (2009). N update in tuber

and haulm as well as the total N uptake were significantly affected by N omission treatment as presented in Table 4 and 5. Total N uptake ranged from 53.24 kg/ha in the control

plots, 77.24 kg/ha in the N omission plot to 91.47 kg/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.

Table 4: Nutrient uptake in tuber, plant and total uptake

Sr. No.	Treatments	Tuber NPK (Kg/ha)			Plant NPK (Kg/ha)			Total uptake (Kg/ha)		
		N	P	K	N	P	K	N	P	K
1	T ₁ -50% RDF of NPK	50.62	31.50	35.32	30.10	18.68	24.84	80.72	50.18	60.17
2	T ₂ -100% RDF of NPK	63.25	37.20	32.10	28.22	18.47	28.32	91.47	55.67	60.42
3	T ₃ -150% RDF of NPK	56.35	40.02	34.58	31.52	22.83	34.32	87.87	62.85	68.90
4.	T ₄ -Without N fertilizer (PK)	52.31	35.04	36.43	24.92	17.41	24.63	77.24	52.45	61.06
5	T ₅ -Without P (NK)	49.41	30.26	32.59	32.02	9.81	19.03	81.43	40.07	51.62
6	T ₆ -Without K (NP)	50.02	29.73	34.44	30.30	14.16	16.77	80.32	43.89	51.21
7	T ₇ -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 5: Yield and economics.

Sr. No	Treatments	Yield (q ha ⁻¹)	Gross monetary returns (Rs ha ⁻¹)	Cost of cultivation (Rs ha ⁻¹)	Net monetary returns (Rs ha ⁻¹)	B:C ratio
1.	T ₁ -50% RDF of NPK	10.80	129152	83466	45686	1.80
2.	T ₂ -100% RDF of NPK	15.33	183397	84996	98401	2.60
3.	T ₃ -150% RDF of NPK	13.74	164344	86474	77870	2.15
4.	T ₄ -Without N fertilizer (PK)	10.58	126589	82318	44271	1.85
5.	T ₅ -Without P (NK)	11.75	140506	83748	56758	1.91
6.	T ₆ -Without K (NP)	11.28	134902	83511	51391	1.89
7.	T ₇ -Without NPK (Absolute control)	9.73	116360	81264	35096	1.64
	SE±	0.58	6963.07		6963.07	
	CD at 5%	1.79	21455.35		21455.35	
	CV	8.48	8.48		20.62	

CONCLUSION

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

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REFERENCES

- Brown, C. R., 2005. Antioxidants in potato. *American journal of potato research*, 82(2): 163-172.
- ICAR, 2015. All india co-ordinated research project. *Potato annual report*: 15.
- Kadian, M. S., S. Ilangantileke, M. Arif, M. Hossain, A. Roder, B.M. Sakha, S.V. Singh, K. Farooq and A.C.M. Mazeen, 2013. *Status of potato seed systems in South West Asia (swa)*.
- Olanya, O. M., C.W. Honeycutt, R.P. Larkin, T.S. Griffin, Z. He and J. M. Halloran, 2009. The effect of cropping systems and irrigation management on development of potato early blight. *Journal of general plant pathology*, 75(4): 267-275.
- Panse, V. G. and P. V. Sukhatme, 1985. *Statistical methods for agricultural workers (2nd edn.)*, Indian council of agricultural research, New Delhi.