

## Research Article

# Effect of Different Levels of NPK Fertilizer on Potato Tuber Yield In South Eastern Rajasthan

B. L. Nagar\* and D. L. Yadav

AICRP on Potato, Agricultural Research Station, Kota-324001 (Rajasthan)

**Abstract**

Present study was conducted at Agricultural Research Station, Agriculture University, Kota with popular variety of Kufri Pushkar during 2016-17 and 2017-18 in *Rabi* season to investigate the site specific nutrient management on potato to attain higher levels of potato productivity along with maintaining the fertility of the soil. Application 281.25, 187.5 and 187.5 kg/ha of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O gave the highest potato tuber yield (23.91t/ha) which was at par with 187.5, 125 and 125 kg/ha of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O (23.25t/ha). However, maximum plant height was recorded in application of 281.25, 187.5 and 187.5 kg/ha of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O while 187.5, 125 and 125 kg/ha of N, P<sub>2</sub>O<sub>5</sub> at par in no of shoot per plant. Result revealed that the maximum B:C ratio was obtained with the application of 187.5, 125 and 125 kg/ha of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied.

**Keywords:** NPK, Potato, Tuber yield, B:C ratio and KufriPushkar

**\*Correspondence**

Author: B. L. Nagar

Email: banwarilalnagar510@gmail.com

**Introduction**

Potato (*Solanum tuberosum* L.) popularly known as 'The king of vegetables'. Potato plays a vital role in food security for ever increasing world population [1, 2]). It is highly capital and labour intensive crop [3]. It is a high quality vegetable cum food crop and used in preparing more than 100 types of recipes in India. India ranks as the world's second largest potato producing nation after China. Freshly harvested potatoes contain about 75-80% water, 16-20% carbohydrates, 2.5-3.2% crude protein, 0.8-1.2% minerals, 0.1-0.2% crude fats, 0.6% crude fiber and some vitamins. Although potato contain only relatively little protein, their nutritional quality is better than cereals. Potatoes contains fair amount of essential amino acids such as isoleucine, leucine and tryptophan [4]. The major potato producing states are Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Haryana, Assam, Jharkhand and Chhattisgarh. In Rajasthan total area of vegetables 166235.8 ha and production of 1699584 MT. In Rajasthan, total area in potato 13819 ha and production 278519 MT and productivity 201.6 q/ha. The major potato producing districts are Dholpur, Bharatpur, Hanumangarh, Kota, Sirohi, Sriganganagar and Jalore.

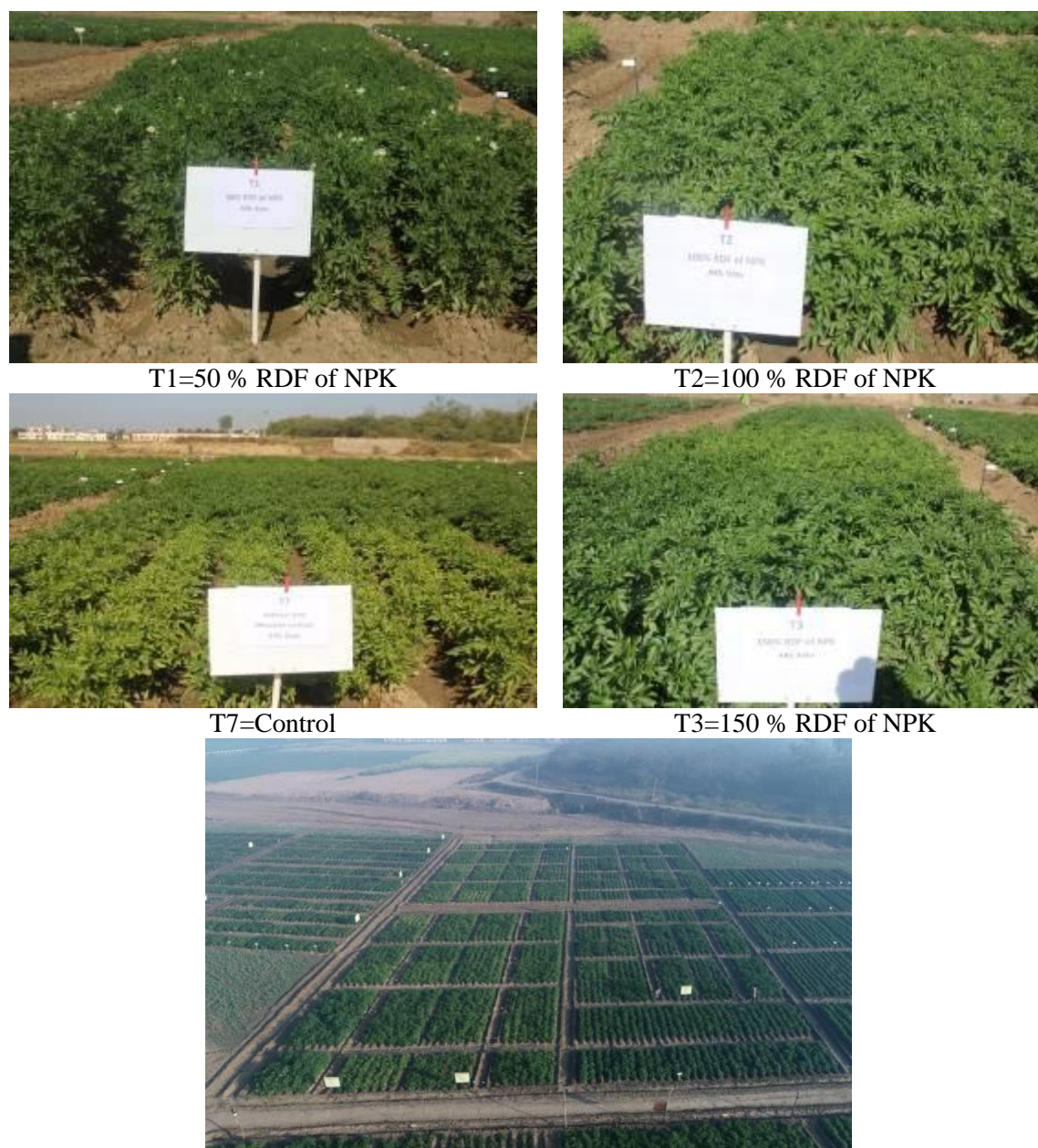
The production of vegetables is estimated to be 187.5 mt, (potato share 27.4 % of total vegetable production) about 3.5 per cent more than that in 2016-17. Potato is one of the most valuable food crops of the world and produces more dry matter and protein per day per unit area compared to major cereals. The importance of potato as a vegetable in the state is because about 75% area of Rajasthan is desert where availability of green vegetables is inadequate. The annual consumption of potato is more than its production in the state and hence needs special attention to improve its production. Fertilizer application is one of the best means of increasing yield per unit area. It is believed that NPK fertilizers improve both yield and quality of potato tubers. Potato requires high amounts of potassium fertilizer for optimum growth, production and tuber quality [5], but its recovery of K is often quite low. The efficiency of NPK fertilizers can be further enhanced by the use of micronutrients. However response of these fertilizers varies depending upon the variety and location. Site-specific nutrient management (SSNM) strategies that include site and season-specific knowledge of crop nutrient requirements and indigenous nutrient supplies are required to increase productivity, yields, and nutrient use efficiency. The aim of present study is to determine the effect of different doses of fertilizers on nutritional composition of prominent local variety of potato i.e. Kufri Pushkar. Results of this study would be worthwhile to improve the nutritional quality of potato by the use of suitable combination of NPK fertilizers. Therefore, a field experiments was conducted at Agriculture Research Station Umedganj, Kota, research farm with popular Potato cultivars KufriPushkar to investigate the site specific nutrient management on Potato performance.

## Materials and Methods

A field experiments was conducted at Agriculture Research Station Umedganj, Kota, Research Farm (Figure 1) with popular Potato cultivars KufriPuskar to investigate the site specific nutrient management on Potato performance. The Potato crop received differential doses of NPK through inorganic fertilizers as per schedule of treatments. The seven treatments involving NPK through inorganic fertilizer viz., 93.75, 62.5 and 62.5 kg/ha of NPK, 187.5,125 and 125kg/ha of NPK, 281.25, 187.5 and 187.5 kg/ha of NPK, 125 and 125 kg/ha of PK, 187.5 and 125 kg/ha of NK, 187.5 and 125 kg/ha of NP and without NPK (Absolute control) were replicated 4 times in a randomized block design. Nitrogen dose was applied in two splits *i.e.* 1/2at planting and half at 30-35 days after sowing. Phosphorus and potassium fertilizers were applied in furrows at the planting time as per treatment. For working out net return from Potato, price of Potato was taken as Rs. 5/kg.

Percent yield response was computed as follows.

$$\text{Yield Response} = \frac{\text{Yield in fertilized plot} - \text{Yield in unfertilized plot}}{\text{Yield in unfertilized plot}}$$



**Figure 1.** Aerial view of Experiment at AICRP on Potato, ARS, Kota

## Results and Discussion

Application of different combinations of NPK doses significantly increased yield of Potato as compared to Control. Application of 281.25, 187.5 and 187.5 kg/ha of NPK gave the highest Potato yield (23.91t/ha) which was significantly higher than all other treatments, but at par (23.25t/ha) with 187.5,125 and 125 kg/ha of NPK. The increase in total yield was 2.83% higher over recommended NPK through fertilizers. Application of 100% NPK increased yield significantly by 61.01% compared to control. However, 93.75, 62.5 and 62.5 kg/ha of NPK gave tuber yield 21.34t/ha while, without Nitrogen 125& 125kg/ha P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O without phosphorus 187.5 & 125kg/ha of N& K<sub>2</sub>O and without potash 187.5 &125kg/ha NP gave 19.19/ha, 19.14t/ha and 17.8t/ha, respectively result presented in **Table 1 and Figure 2**. [6] reported similar type of results that significant increase in yield from 100 to 150% of all grades was recorded with increase in recommended dose of NPK (160-60-120 kg NPK ha<sup>-1</sup>). [7] reported the increase in the yield of potato tubers due to NPK application. Among the different nitrogen doses (80, 160 and 240 kg/ ha), maximum N response in terms of yield was observed at 160 kg/ ha.[8 ] and [9 ] have also reported that different cultivars behave differently in terms of yield and bulking rate, to the applied nitrogen.

**Table 1** Effect of various treatments on plant height, no. of shoot and total tuber yield (Pooled Data)

Treatments	Plant height (cm.) at 50 DAP	No. of shoot/plant	Tuber yield (t/ha.)				Total tuber yield
			0-25 g	25-50 g	50-75 g	>75g	
T1=50 % RDF (93.75, 62.5 and 62.5 kg/ha of NPK)	37.59	3.00	5.76	5.78	5.83	3.97	21.34
T2=100% RDF (187.5,125 and 125 kg/ha of NPK)	45.58	5.10	6.07	6.26	6.34	4.58	23.25
T3=150% RDF (281.25, 187.5 and 187.5 kg/ha of NPK)	53.45	5.38	6.30	6.45	6.57	4.58	23.91
T4=Without N (125 and 125 kg/ha of PK)	30.75	3.48	5.38	5.53	5.41	2.87	19.19
T5=Without P (187.5 and 125 kg/ha of NK)	34.30	4.40	5.45	5.57	5.47	2.92	19.40
T6=Without K (187.5 and 125 kg/ha of NP)	33.53	4.13	4.98	5.14	5.05	2.64	17.80
T7= without NPK (Absolute control)	29.93	3.13	4.03	4.16	4.23	2.15	14.44
F-Test	SIG	SIG	SIG	SIG	SIG	SIG	SIG
CD 5%	3.15	0.66	0.42	0.38	0.38	0.52	1.58
SE	1.49	0.31	0.20	0.18	0.18	0.24	0.75
CV%	5.56	10.84	5.20	4.53	4.59	10.20	5.30

### *Net return and benefit cost ratio of the Potato*

Net return from Potato followed similar trend (**Table 2**) as that of fruit yield with highest values of Rs51485.53/ha was observed in 281.25, 187.5 and 187.5 kg/ha of NPK treatment. This was closely followed by 187.5,125 and 125 kg/ha of NPK (Rs51204/ha) as compared to control (Rs 16356/ha). However, 93.75, 62.5 and 62.5 kg/ha of NPK (Rs45209/ha) and 187.5 and 125 kg/ha of N and K application gave net return of Rs36085/ha. The benefit: cost ratio (1.93) was highest in the treatment receiving 187.5,125 and 125 kg/ha of NPK. Whereas, control gave the lowest B:C ratio (1.33). Similarly, [10] reported that the interaction of nitrogen and phosphorus was significantly affected the marketable tuber yield per hectare. [11] showed that the increasing rate of phosphorus increases the marketable and total tuber yield of potato. Nitrogen supply plays a major role in the growth and development of plants as well as yield because it is an essential constituent of protein and chlorophyll. Among fertilizers, nitrogen is first the most important nutrient. Nitrogen is essential for maintaining higher haulm growth, increased bulking rate, quality of tuber and more dry matter production [12].

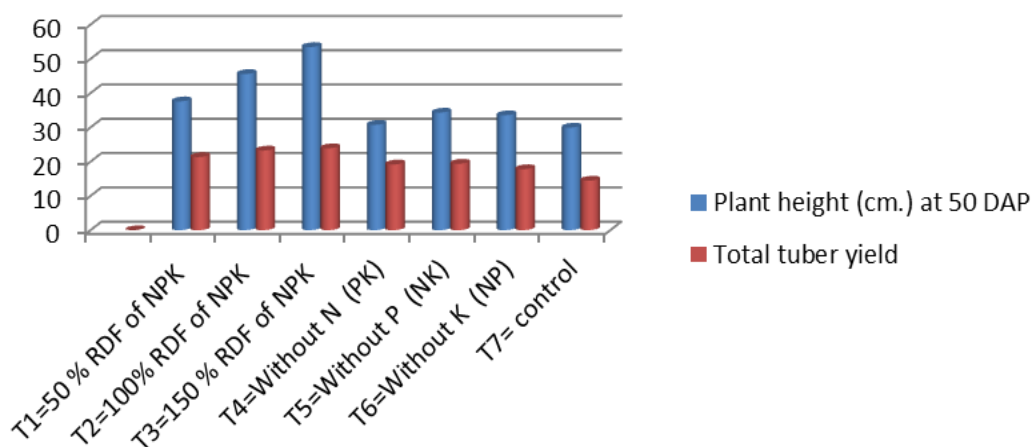


**Table 2** Net return and B:C ratio (Pooled data)

Treatments	Cost of cultivation	Yield t/ha	Price /kg (Rs.)	Gross returns	Net return	B:C ratio
T1=50 % RDF (93.75, 62.5 and 62.5 kg/ha of NPK)	52409.86	21.34	5	97619.05	45209.19	1.86
T2=100% RDF (187.5,125 and 125 kg/ha of NPK)	55144.69	23.25	5	106349.21	51204.52	1.93
T3=150% RDF (281.25, 187.5 and 187.5 kg/ha of NPK)	57879.55	23.91	5	109365.08	51485.53	1.89
T4=Without N (125 and 125 kg/ha of PK)	53133.29	19.19	5	87777.78	34644.49	1.65
T5=Without P (187.5 and 125 kg/ha of NK)	52644.72	19.40	5	88730.16	36085.44	1.69
T6=Without K (187.5 and 125 kg/ha of NP)	54186.37	17.80	5	81428.57	27242.20	1.50
T7= without NPK (Absolute control)	49675.00	14.44	5	66031.75	16356.75	1.33

## Conclusion

The study revealed that application of organic and inorganic sources of nutrient to potato crop increased the nutrients uptake by plants which were strongly correlated with tuber yield and other quality parameters. It may conclude that 281.25, 187.5 and 187.5kg/ha of NPK gave higher yield followed by 187.5,125 and 125 kg/ha of NPK which were significantly at par. While, The benefit: cost ratio (1.93) was highest in the treatment with 100 %RDF i.e. 187.5,125 and 125 kg/ha of NPK. Therefore, it is suggested to the growers of this area to use the balance doses of NPK 187.5,125 and 125kg ha<sup>-1</sup> for better yields.



**Figure 2.** Effect of various treatments on plant height, no. of shoot and total tuber yield

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