

Original Research Article

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Effect of Different Levels of Nitrogen on Growth and Yield in Potato (*Solanum tuberosum* L.) CV. Kufri Khyati

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ABSTRACT

The present investigation was carried out at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.), during the year 2014-15 and 2015-16. The seven treatments were evaluated on the CV. Kufri Khyati in Randomized Block Design with three replications. The study revealed that almost growth characters are influenced and found significantly higher by the increasing of the levels of nitrogen. The growth characters viz., Plant height, number of haulms per hill, number of leaves per plant, fresh weight and dry weight of plant recorded maximum with the application of treatment (T₅) 200 kg N/ha during both the years (2014-15 and 2015-16). The study further revealed that the treatment T₅ also had obtained maximum per plot yield and yield per hectare during both the years of investigation.

Keywords

Growth attributes,
Potato,
Yield and nitrogen
levels.

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Introduction

Potato (*Solanum tuberosum* L.) is wholesome food and belongs to the family Solanaceae. It has originated in South America and now commercially grown in all over the world. In India, it has been introduced in the early 17th century by Portuguese traders and gradually become a commercial crop of all over India. Potato is grown in almost all states of India. The leading states in terms of area, production and productivity are Gujarat, Uttar Pradesh, Bihar, West Bengal and Punjab. The other major potato growing states are Assam, M.P., Haryana, Meghalaya, Karnataka, Tamil Nadu,

Himachal Pradesh and Maharashtra. Potato is a relatively stable part of the diet of European and North American people. Potato contains practically all essential dietary constituents like carbohydrates, essential nutrients, protein, vitamins and minerals. Normally some potato tubers of Indian cultivars contain less than 20 mg glycoalkaloids per 100 g fresh weight and cause no harmful effects. Nitrogen is the most limiting factor in Indian soils. It is known that about 4000 Mt of nitrogen is presented in an atmosphere which about seventy seven thousand tonnes over an

area of one hectare land. In fact, this vast reserve of nitrogen could remain utilizable by the crops until it converted into available from either through industrial synthesis or through bio-fixation.

Materials and Methods

The experiment was conducted during the winter season of 2014-15 and 2015-2016 at Main Experiment Station Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.). Faizabad region receives a mean annual precipitation of about 1200 mm.

Maximum rainfall in this area is received from mid-June to end of September. However, occasional showers are very common in the month of January and February.

The experiment was conducted in Randomized Block Design (RBD) with four replications. The seven treatments were allocated randomly into the plots in such a way that each and every treatment was received only once in each block.

Details of treatments

Nitrogen levels: 7

T ₁	: 0 kg N/ha
T ₂	: 50 kg N/ha
T ₃	: 100 kg N/ha
T ₄	: 150 kg N/ha
T ₅	: 200 kg N/ha
T ₆	: 250 kg N/ha
T ₇	: 300 kg N/ha

Results and Discussion

The emergence per cent at (Table 1) 30 days after planting did not influence significantly due to various treatments. As another factor

such as tuber size and post-cold storage period, influencing emergence were common to all treatments.

It may be due to the food material already stored in the seed tubers, which gave an initial boost to the emerging plants. Satyanarayan (1983) and Dandekar *et al.*, (1991) had also not observed any significant effect of increasing levels of nitrogen on plant emergence.

Nitrogen being an essential constituent of protoplasm is vitally associated with the activity of every living cell. In the present investigation nitrogen application has a profound effect on different biomedical attributes of potato.

Increasing levels of nitrogen significantly increased (Table 1) the height of the plant. Maximum height of the plant in 60 and 75 DAP was recorded under 200 kg N/ha, while minimum under control plots.

The supply of nitrogen is related to carbohydrate utilization. When nitrogen supply is adequate and conditions are favorable for growth, proteins are formed from the manufactured carbohydrates.

This extra protein allows the plants to grow faster. Thus, height of plant was significantly increased by increasing levels of nitrogen.

These results were also supported by Gupta (1992), Anabousi *et al.*, (1997) and Ramirez *et al.*, (2004).

The dose of 200 kg N/ha produced more number of haulms per hill than control plots. Though, the number of haulms per hill depends on the number of buds present on seed tubers, their survival with plant growth will depend on the nutrition available in the soil.

Table.1 Response of different levels of nitrogen on growth and quality traits

Treatments	Emergence percentage				Number of haulms per hill				Plant height (cm)				Number of leaves per plant			
	2014-15		2015-16		2014-15		2015-16		2014-15		2014-15		2014-15		2014-15	
	15 DAP	30 DAP	15 DAP	30 DAP	60 DAP	60 DAP	60 DAP	60 DAP	60 DAP	75 DAP	60 DAP	75 DAP	60 DAP	75 DAP	60 DAP	75 DAP
T1: 0 kg N/ha	61.32	93.35	56.41	93.00	186.63	186.63	186.63	186.63	47.02	56.90	48.30	49.75	30.81	31.31	31.40	32.10
T2: 50 kg N/ha	60.75	85.55	56.41	94.53	233.81	233.81	233.81	233.81	55.59	57.12	55.65	57.30	37.91	37.73	38.50	39.30
T3: 100 kg N/ha	61.30	93.50	56.56	94.06	293.22	293.22	293.22	293.22	55.95	67.26	67.70	69.70	46.01	47.08	47.40	48.50
T4: 150 kg N/ha	61.75	78.85	56.72	94.10	297.60	297.60	297.60	297.60	57.46	72.69	72.55	74.75	48.28	49.03	49.50	50.50
T5: 200 kg N/ha	61.35	93.65	56.72	94.53	306.95	306.95	306.95	306.95	70.50	75.69	74.65	76.90	50.95	51.20	51.80	52.80
T6 : 250 kg N/ha	61.25	93.20	56.72	94.06	307.58	307.58	307.58	307.58	70.64	76.15	74.80	78.00	51.17	51.26	51.90	53.00
T7 : 300 kg N/ha	60.50	93.60	56.41	93.91	308.85	308.85	308.85	308.85	70.80	76.25	74.90	79.00	51.90	51.46	52.00	53.20
S.Em. ±	0.60	1.05	0.75	0.75	3.36	3.36	3.36	3.36	2.55	2.35	2.47	251	1.99	1.89	2.53	2.27
C.D. (p=0.05)	NS	NS	NS	NS	31.64	31.64	31.64	31.64	6.99	5.99	6.53	6.73	3.65	3.15	5.49	3.99

Treatments	Fresh weight of plant (g)				Dry weight of plant (g)				Total yield of tubers perplot (kg)		Total yield of tubers per hectare (q)	
	2014-15		2015-16		2014-15		2015-16		2014-15	2015-16	2014-15	2015-16
	60 DAP	75 DAP	60 DAP	75 DAP	60 DAP	75 DAP	60 DAP	75 DAP				
T1: 0 kg N/ha	13.91	16.96	14.15	17.45	13.91	16.96	14.15	17.45	28.85	29.17	150.05	155.01
T2: 50 kg N/ha	16.73	20.91	17.60	21.70	16.73	20.91	17.60	21.70	33.67	34.19	175.25	177.62
T3: 100 kg N/ha	21.51	26.62	22.20	27.40	21.51	26.62	22.20	27.40	35.20	36.44	183.50	191.64
T4: 150 kg N/ha	22.10	27.12	22.55	27.90	22.10	27.12	22.55	27.90	46.17	44.52	240.25	231.80
T5: 200 kg N/ha	23.19	28.42	23.10	28.50	23.19	28.42	23.10	28.50	48.02	48.48	250.8	253.05
T6: 250 kg N/ha	23.01	27.74	22.90	28.00	23.01	27.74	22.90	28.00	47.78	48.28	248.52	252.13
T7: 300 kg N/ha	22.90	27.20	22.70	27.70	22.90	27.20	22.70	27.70	47.59	48.42	247.50	251.82
S.Em. ±	3.22	2.99	2.99	2.89	3.22	2.99	2.99	2.89	1.07	1.89	0.99	0.907
C.D. (p=0.05)	2.34	2.90	2.94	2.89	2.34	2.90	2.94	2.89	1.99	3.57	7.89	6.92

Table 2 Physico-chemical properties of soil

S.No.	Physico-chemical properties of soil	Values	Method employed
		2015-16	
A.	Mechanical analysis:		
1.	Sand (%)	53.35	(Jackson, 1969)
2.	Silt (%)	24.95	
3.	Clay (%)	21.70	
4.	Soil texture	Sandy loam	
B.	Chemical analysis:		
1.	Soil reaction (pH)	7.80	1:2.5 soil : water using glass electrode pH meter (Jackson, 1969)
2.	Organic carbon (%)	0.27	Walkley and Black's rapid titration method (Walkely, 1947)
3.	Available nitrogen(kg/ha)	112.10	Alkaline potassium permanganate method (Subbiah and Asija, 1956)
4.	Available phosphorus (kg/ha)	17.20	Olsen's method (Olsen et al., 1954)
5.	Available potassium(kg/ha)	218.10	Flame emission spectrophotometer (Jackson, 1969)

Availability of nitrogen with increasing rates therefore seems the main cause of increased number of haulms per hill. Positive significant effect of increased nitrogen doses on number of haulms per hill has also been reported by Gupta and Pal (1989), Singh and Singh (1994), Shirin-e-janagrad *et al.*, (2009) and Udom *et al.*, (2012).

Nitrogen application up to 200 kg N/ha produced taller plant which ultimately resulted in the production of more number of leaves per plant. Successive increase in nitrogen levels produce significantly more number of leaves per plant (51.207 at 75 DAP) over its lower levels. Nitrogen affects the rate and extent of protein synthesis. Therefore, it increases the plant height and number of leaves per plant. This finding was close conformity with results of Bekhit *et al.*, (2005), Kumar *et al.*, (2007) and Bose *et al.*, (2008).

Yield is the (Table 2) result of the vegetative growth of the plant. Increasing nitrogen levels increased the tuber yield to a great extent. The yield increased continuously up to 200 kg N/ha. However, highest nitrogen level (300 kg N/ha) produced at par higher tuber yield with 200, 250

kg/ha nitrogen. This increase in tuber yield was due to increase in photosynthetic activity of the plant which enhance with the supply of nitrogen.

The manufactured photosynthesis help in increasing height of plants, number of leaves, number and weight of tubers per plot. Therefore, increasing nitrogen levels boosted the tuber yield tremendously. This is mainly due to more tuberization. Similar results have been reported by Castro (1988), Lakshmi *et al.*, (2010), Dubey *et al.*, (2012) and Jing *et al.*, (2012).

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