



RESEARCH ARTICLE

TO STUDY THE RESPONSE OF NITROGEN AND PHOSPHORUS ON GROWTH AND YIELD OF ONION

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ABSTRACT

The field trials of the present experiment were conducted to study the response of nitrogen and phosphorus fertilization on the onion growth and yield during the Rabi season 2021-22 at the Vegetable Farm of College of Agriculture of Guru Kashi University at Bathinda. The plant material comprised onion (*Allium cepa* L.) variety "N-53" which has been recommended by PAU, Ludhiana for cultivation in the state during *rabi* season. The field experiments were laid out in split plot design. The treatments comprised three levels of nitrogen and three levels of phosphorus i.e. N = 100(N1), 150 (N2) and 200 (N3) kg/ha and P = 50 (P1), 75 (P2) and 100 (P3) kg/ha of chemical fertilizers and its combination. Each treatment was replicated thrice. The observations were recorded for ten randomly selected plants and leaving two border rows from each plot. The data were recorded with respect to the plant height (cm) at 60, 90, 120 and at last harvest, number of leaf length (cm) at 60, 90 and 120 days, bulb weight (gm) and bulb yield (t/ha). Nitrogen 200 kg/ha and phosphorus 100 kg/ha showed the maximum height of 33.70cm, 39.46cm, 54.48cm and 56.17 cm and leaf length 32.99cm, 50.50cm, 45.19cm and 47.00cm at 60 DAP, 90 DAP, 120DAP and at the time of harvest respectively. The dose of 200 kg/ha N and 100 kg/ha P increased the bulb weight 89.60 gm at maturity and marketable bulb yield 22.32 t ha⁻¹. The current study revealed that the highest bulb yield of onion cv. N-53 can be achieved with the incorporation of 200 kg nitrogen and 100 kg phosphorus per ha.

INTRODUCTION

Onion (*Allium cepa* L., 2n=16) which is an important bulb crop, belongs to the family Alliaceae and is considered as a crucial commercial vegetable crop grown throughout the world. It is relatively a short duration vegetable. It is a native of Western and Eastern Asia, but its domestication took place in South West or Central Asia (Fritsch *et al* 2002). Onions are considerably sensitive as compared to most of the crops in absorbing nutrients, mainly the immobile type of nutrients due to unbranched, shallow rooting. Therefore, they need and provide favorable response on addition of fertilizers. Primary macronutrients, Nitrogen (N) and phosphorus (P) are mostly deficient and also the large quantities are taken up from the soil relative to other essential nutrients (Birhanu Messele 2016). Cultivation of onion require various nutrients such as nitrogen, as nitrogen is essential for carbohydrate used within plants. It plays an essential role in synthesizing amino acid to increase vegetative growth of onion which ultimately helps in increasing bulb size and total yield (Geisseler *et al* 2022). Nitrogen has a great impact on the development, flavor and quality of onion bulbs (Randle 2000). Nitrogen enhances the vegetative growth, produces good quality foliage and promotes carbohydrate synthesis.

The increased level of N, increase the growth trend of the number of leaves, leaf length and ultimately the yield (Misganaw *et al* 2021). Application of manures and phosphorus enhanced vegetative growth and yield in onion (Emmanuel *et al* 2021). There is no comprehensive recommendation for N and P fertilizers in the cultivated regions hence, there is dearth of information on the optimal usage of nitrogen and phosphorus fertilizer. Bearing these aspects in mind, this research is going to shed some light on the effect of different level of nitrogen and phosphorus fertilizer on productivity and associated parameters such as growth, bulb yield and associated yield attributes of onion. Without knowing the fertility status of the soil and the type of crop cultivar, state wide recommendation is being used in the selected region. Henceforth, direct investigation of the response of onion crop to applied doses of N and P fertilizers under the particular agro-ecology is essential so as to come up with an ideal fertilizer dose recommendations which will be beneficial for the growers to increase yield of onion in their particular region. In view of this, the present research study was conducted with the sole objective to assess the impact of nitrogen and phosphorus fertilizers and their interaction on growth, yield and yield components of onion.

MATERIALS AND METHODS

The field trials of the experiment were conducted during the Rabi season 2021-22 at the Vegetable Farm of College of

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Agriculture of Guru Kashi University at Bathinda. The plant material comprised onion (*Allium cepa L.*) variety "N-53" which has been recommended by PAU, Ludhiana for cultivation in the state during *rabi* season. The trial was laid out in split plot design. The treatments comprised three levels of nitrogen and three levels of phosphorus chemical fertilizers and its combination. Each treatment was replicated thrice. The details are described as follows:

Table 1.1 Treatment: details

Treatment level	P1	P2	P3
	(N:P kg/ha)		
N1	100:50	100:75	100:100
N2	150:50	150:75	150:100
N3	200:50	200:75	200:100

The observations were recorded for ten randomly selected plants and leaving two border rows from each plot. The data was recorded with respect to the plant height (cm) at 60, 90, 120 days and at last harvest, leaf length (cm) per plant at 60, 90 and 120 days, bulb weight (gm) and bulb yield (t/ha). The data recorded during the experimentation was statistically analyzed as per split plot design using SAS 9.4 software. The comparison of the mean values of different treatments was kept at 5% level of significance.

RESULTS AND DISCUSSION

The data for plant height was recorded at 60, 90, 120 days after planting (DAP) and finally at harvesting.

The data analysis revealed that with the increase in the days after planting a gradual increase in plant height was observed. Present data revealed that supplementation of nitrogen and phosphorus resulted in an increased plant height at different DAP where nitrogen and phosphorus supplementation at rate of 200 kg/ha N and 100 kg/ha P showed the maximum height of 33.70cm, 39.46cm, 54.48cm and 56.17 cm at 60 DAP, 90 DAP, 120DAP and at the time of harvest. Increased height at increased dosage of N could be due to its role as a building block during the synthesis of amino acids, these acids combine to form proteins and make up metabolic processes required for plant growth. Similar findings have been stated by Khan *et al.* (2002), El-Shaikh (2005), Shaheen *et al.* (2007) and Abdissa *et al.* (2011). The effect of supplementation of nitrogen and phosphorus was evident and supplementation at rate of 200 kg/ha N and 100 kg/ha P increased the leaf length 32.99cm, 50.50cm, 45.19cm and 47.7cm at 60 DAP, 90 DAP, 120DAP and at last harvest significantly. The N fertilization at 200 kg/ha resulted in significant increase in leaf length with increasing levels of phosphorus fertilization (Jilani 2004). Similarly, (Morsy *et al.* 2012) it was indicated that 120 kg N ha⁻¹ resulted in higher values of plant height, number of leaves per plant, bulb diameter and days to maturity as compared to adding of 90 kg ha⁻¹. The nitrogen and phosphorus supplementation at rate of 200 kg/ha N and 100 kg/ha P increased the bulb weight 89.60 gm at maturity significantly. Similarly, Negash *et al.* (2009) also reported that increasing the rate of N fertilization from 0 to 138 kg ha⁻¹ increased total bulb yield from 19.26 t ha⁻¹ to 32.24 t ha⁻¹.

Table 1.2: Effect of N and P fertilizers on plant height of onion

Treatment level	60 DAP				90 DAP			
	P1	P2	P3	Mean	P1	P2	P3	Mean
N1	22.87	25.10	26.67	24.8	31.92	32.58	34.98	33.1
N2	24.43	26.03	21.39	23.9	33.79	33.71	35.31	34.2
N3	30.07	32.87	33.70	32.2	35.72	37.84	39.46	37.6
Mean	25.7	28.0	28.2	27.0	33.8	34.7	36.5	35.0
CD (at 5%) N	2.22				2.08			
CD (at 5%) P	2.08				1.82			

Table 1.3. Effect of N and P fertilizers on plant height of onion

Treatment level	120 DAP				Harvest			
	P1	P2	P3	Mean	P1	P2	P3	Mean
N1	45.44	44.56	46.78	45.5	47.34	47.49	48.82	47.8
N2	47.70	48.74	52.31	49.5	48.94	49.88	55.62	51.4
N3	52.19	53.69	54.48	53.4	54.29	55.66	56.17	55.3
Mean	48.4	48.9	51.1	49.5	50.1	51	53.5	51.5
CD (at 5%) for N	0.77				0.80			
CD (at 5%) for P	1.04				0.35			

Table 1.4 Effect of N and P fertilizers on leaf length (cm) of onion

Treatment level	60 DAP				90 DAP			
	P1	P2	P3	Mean	P1	P2	P3	Mean
N1	21.42	23.90	26.50	23.9	38.17	40.70	43.20	40.6
N2	25.95	29.02	29.53	28.1	44.30	45.77	46.83	45.6
N3	30.06	31.73	32.99	31.5	48.30	49.17	50.50	49.3
Mean	25.8	28.2	29.6	27.9	43.5	45.2	46.8	45.2
CD (at 5%) for N	0.91				1.65			
CD (at 5%) for P	1.06				1.22			

Table 1.5 Effect of N and P fertilizers on leaf length (cm) of onion

Treatment level	120 DAP				HARVEST			
	P1	P2	P3	Mean	P1	P2	P3	Mean
N1	38.52	40.22	40.89	39.8	40.32	42.10	42.80	41.7
N2	39.46	41.46	42.80	41.2	41.30	43.40	44.80	43.1
N3	42.23	43.47	45.19	43.6	44.20	45.50	47.30	45.6
Mean	40	41.7	42.9	41.5	41.9	43.6	44.9	43.5
CD (at 5%) N	0.23				0.33			
CD (at 5%) P	0.14				0.24			

Table 1.6 Effect of N and P fertilizer on bulb weight (gm) of onion

Treatment level	P1	P2	P3	Mean
N1	70.58	71.30	72.93	71.6
N2	73.03	84.25	85.21	80.8
N3	86.64	89.55	89.60	88.5
Mean	76.7	81.7	82.5	80.3
CD (at 5%) for N	1.49			
CD (at 5%) for P	1.41			
CD (at 5%) for N×P	0.40			

Table 1.7. Effect of N and P fertilizer on bulb yield (t/ha) of onion

Treatment level	P1	P2	P3	Mean
N1	17.49	17.98	18.48	17.9
N2	19.04	20.60	21.18	20.2
N3	20.08	22.19	22.32	21.5
Mean	18.8	20.2	20.6	19.9
CD (at 5%) N	0.72			
CD (at 5%) P	0.73			
CD (at 5%) for N×P	0.36			

Similarly, 200 kg/ha nitrogen and 100 kg/ha Phosphorus predominantly enhanced marketable bulb yield 22.32 t ha⁻¹. (Soleymani and Shahrajabian 2012) The study showed that the highest and the lowest marketable yield was obtained by applying 300 kg N ha⁻¹ and 0 kg N ha⁻¹, respectively. Overall, the findings of the current study revealed that the highest bulb yield of onion cv. N-53 can be accomplished with the application of 200 kg nitrogen and 100kg phosphorus per ha in the sandy loam soils of south western Punjab conditions.

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