

Effect of Nitrogen and Sulfur on Yield and Yield Attributing Characters of Onion (*Allium cepa* L.)

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Abstract

An experiment was conducted on onion cv Nasik Red with the levels of N 80 and 120 kg/ha and S 30, 45 and 60 kg/ha. The maximum plant height, length of leaves, number of leaves and diameter of bulb were recorded with the level of both N and S (N₁₂₀ S₄₅). The same combination of nutrient also showed pronounced effect on yield of bulb/plot. Maximum diameter of bulb and fresh weight of bulb were observed in S₃ N₂ and S₃ N₁ treatments respectively. Thus, application of 120 kg N and 45 kg sulfur/ha may be adopted for obtaining higher yield of onion.

Key words : *Allium cepa*, N, S, Growth, Yield.

Onion (*Allium cepa* L.) is considered the poor man's staple, now flying out of reach of even the middle-class families. Among the bulb crops, onion is the most important vegetable crops grown throughout the world and it is grown from ancient times. It is extensively used in human diet and having medicinal properties. Among various production factor nitrogen and sulfur are important to attain uniform plant stand and better growth, which ultimately affect the yield of crop. An adequate supply of nitrogen is associated with vigorous growth and more efficient use of available inputs finally leading to higher productivity (1, 2). Application of different doses of sulfur increased plant growth, yield and yield attributing characters of onion. Therefore, the present investigation was undertaken with a view to find out the optimum doses of nitrogen and sulfur for obtaining maximum and good quality of onion bulb.

Methods

The experiment was conducted during 2006-07 at Babasaheb Bhimrao Ambedkar University, Lucknow to evaluate the suitable dose of N and S on onion cv Nasik Red. Experimental soil was sandy loam and slightly alkaline in nature (pH 8.9) with low in organic carbon (0.13%). It was low in available nitrogen (92.0 kg/ha) and available phosphorus (72.5 kg/ha) and high in potassium (17.5 kg/ha). The experi-

ment was laid out in randomized block design with three levels of N (0, 80 and 120 kg/ha) combined with four levels of S (0, 30, 45 and 60 kg/ha), comprising 12 treatments with three replications. Entire P, one third of N and half of S with well-rotten FYM at 25 t/ha were given as basal application before planting, one-third N was top dressed at 45 days after planting followed by topdressing with remaining N and K ; 90 days after transplanting dithane Z-78 (0.2%) was applied to protect the crop against the fungal diseases. The plot size was 3.0 × 2.0 m with a spacing of 15 × 10 cm. Data on yield were recorded for statistical interpretation. Observation on different growth parameters and yield attributing characters were recorded from 10 randomly selected plants from each plot. Statistical analysis of the data was done following the method suggested by Gomez and Gomez (3).

Results and Discussion

All the growth parameters, viz. plant height, length of leaves, number of leaves and diameter of bulb neck characteristics showed a significant increase (Table 1) with the application of N and S. The N and S showed both individual and interaction effect on different growth, yield and yield-attributing characters. Maximum plant height (60.39 cm) and length of leaves (48.05 cm) were recorded with the combination of N and S both at 45 kg and 120 kg/ha

Table 1. Effect of different levels of N, S and their interactions on growth parameters of onion cv Nasik Red.

Nutrient level (kg/ha)	Plant height (cm)	Length of leaves (cm)	Number of leaves	Diameter of bulb neck (cm)
N ₀	56.92	38.98	6.40	1.02
N ₁	58.27	42.73	7.29	1.21
N ₂	59.60	46.73	7.89	1.25
CD (0.05%)	1.18	1.22	0.44	0.04
S ₀	56.78	40.86	6.07	1.09
S ₁	58.55	42.78	7.40	1.25
S ₂	59.23	44.01	7.85	1.22
S ₃	58.35	43.55	7.46	1.18
CD (0.05%)	1.36	1.41	0.51	0.05
S ₀ N ₀	54.91	37.10	5.01	0.92
S ₀ N ₁	57.15	41.20	6.05	1.15
S ₀ N ₂	58.30	44.29	7.15	1.21
S ₁ N ₀	57.02	39.15	6.65	1.00
S ₁ N ₁	58.69	42.95	7.59	1.20
S ₁ N ₂	59.65	46.25	7.97	1.25
S ₂ N ₀	58.15	40.25	7.15	1.11
S ₂ N ₁	59.15	43.75	7.95	1.26
S ₂ N ₂	60.39	48.05	8.45	1.29
S ₃ N ₀	57.60	39.45	6.80	1.06
S ₃ N ₁	58.10	43.05	7.60	1.22
S ₃ N ₂	59.36	47.55	8.00	1.25
CD (0.05%)	2.36	2.44	0.89	0.09

(S₄₅ and N₁₂₀). The interaction recorded significant differences in respect of number of leaves. The maximum number of leaves (8.45) was recorded with the combination of (S₄₅ and N₁₂₀) followed by S₆₀ N₁₂₀ (8.00). Maximum diameter of bulb neck (1.29 cm) was recorded in the treatment in S₄₅ N₄₅.

The data revealed that application of both nutrients produced a progressive trend in increasing bulb yield/plot (Table 2). Maximum diameter of bulb (5.15 cm) was noticed in S₆₀ N₁₂₀. However, fresh weight of bulb (68.26 g) was observed with S₆₀ N₈₀ followed by S₆₀ N₁₂₀ (68.20 g) compared to minimum fresh weight of bulb (56.15 g) with S₀ N₀ treatment. Sulfur was most effective in increasing the yield. Maximum yield (27.37 kg/plot) was recorded under S₄₅, which was found to be 3.7 kg/plot more than produced under lowest level of S₀ N₀. An yield increase of 3.26 kg/plot at 120 kg N/ha over the lowest level of N₀ (control) was registered. Projected yield at medium and high levels of N were statistically at par. A combination of 45/ha of S and 120 kg/ha of N recorded maximum bulb yield (29.38 kg/plot) followed by S₄₅ N₈₀ (27.80 kg/plot). The effect of N and S and their interaction on plant height

Table 2. Effect of different levels of N, S and their interactions on yield and yield attributing characters of onion cv Nasik Red.

Nutrient level (kg/ha)	Diameter of bulb (cm)	Fresh wt of bulb (g)	Yield of bulb/plot (kg/m ²)
N ₀	4.26	62.64	24.07
N ₁	4.90	65.97	26.60
N ₂	5.20	66.72	27.33
CD (0.05%)	0.17	1.75	1.33
S ₀	4.84	61.56	23.63
S ₁	4.90	65.32	26.36
S ₂	5.13	67.16	27.37
S ₃	5.07	66.40	26.64
CD (0.05%)	0.20	2.02	1.54
S ₀ N ₀	4.53	56.15	21.35
S ₀ N ₁	4.65	64.23	24.25
S ₀ N ₂	5.34	65.25	24.10
S ₁ N ₀	4.82	64.23	24.20
S ₁ N ₁	4.85	65.25	27.05
S ₁ N ₂	5.05	66.48	27.83
S ₂ N ₀	5.06	63.25	24.93
S ₂ N ₁	5.08	67.96	27.80
S ₂ N ₂	5.26	68.26	29.38
S ₃ N ₀	5.03	64.94	25.61
S ₃ N ₁	5.05	68.26	27.30
S ₃ N ₂	5.15	67.23	27.00
CD (0.05%)	0.35	3.50	2.67

was not significant but a general increase in plant height was registered due to N application, indicating that its influence on vegetative growth. On other hand, combined application of N and S levels had pronounced effect on vegetative characters, suggesting augmentating effect of S on N availability. In fact application of S reduced the fixation of NH₄⁺ and thereby increase the utilization of N by the growing plant (4). Sulfur is a constituent of fessodonin and some lipids found in chloroplasts. Sulfur bridges has an important role in determining position structure and sulphydryl group are often parts of the active center of enzymes. For this reason, increase in vegetative growth, due to 45 kg/ha sulfur, was more effective at high level of N application. Influence of N on vegetative growth was also recorded by several workers (5–7). Different yield and yield-attributing parameters were increased marked with 45 kg/ha sulfur application in the presence of high N levels. Influence of N and their combination favoring the development of bulb and ultimately yield was reported by several workers (8–10). High nutrition along with in-

creased N availability due to S nutrition helped in developing greater photosynthesis are translocated to the bulb, increasing their size. Sulfur as suggested (11) was to be involved in cystine, methionine and protein synthesis to bulb which helped in better bulb growth and size, ultimately yield in combined application of N and S at 120 kg/ha and 45 kg/ha level respectively. Sulfur along with N plays a major role in growth and yield, as it is involved in translocation of photosynthesis in storage organ of bulb.

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