EFFECT OF NITROGEN AND BORON ON GROWTH AND YIELD OF KHARIF ONION (*Allium cepa* L.) CV. N-53

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ABSTRACT

Five levels of nitrogen viz.; 0, 50, 100, 150 and 200 kg/ha and boron at the rate of 0 and 1.1 kg/ha was given as a soil application to Kharif onion cultivar N-53. Nitrogen nutrition in varying doses affected the vegetative growing attributes in onion plants. The number of leaves, its length and breadth was boosted to the maximum under 150, 200 and 100 kg/ha respectively. The size of bulb in terms of diameter and length was maximized when 100 N/ha was applied. The number of roots and bulb/green top ratio was noted to be greater under 100 kg N followed by 50 kg N/ha. Yield of onion was registered to 33.92 and 33.83 t/ha under N_{150} and N_{200} doses, respectively. Boron nutrition improved the vegetative growth of leaves and bulbs, bulb/green top ratio, number of roots and yield of Kharif onion as compared to control. Interaction of the nutrients further increased the growth and yields attributes of Kharif onion.

INTRODUCTION

Fertilizer is one of the most important inputs for increasing the productivity of onion. The nutrient requirement of this crop is quite high due to its bulb formation and high dry matter production per unit area. The *Kharif* season onion, which accounts nearly 39.55 percent production, is prone to nutrient losses from the soil due to high rainfall and temperature. Indian soils are deficient in nitrogen and as such any manurial schedule without nitrogen cannot be imagined. Boron is an important microelement essential for translocation of carbohydrates and metabolism of nitrogen and calcium. The deficiencies of these nutrients have been increasing due to intensive cultivation particularly in sandy soils. Keeping it in view, present study was conducted to find out the optimum dose of nitrogen, boron and their interaction on growth and yield of *Kharif* onion Cv. N-53.

MATERIALS AND METHODS

The experiment was conducted at the Horticulture Garden, CSAUA&T, Kanpur during *Kharif* season 2000. Ten treatment combinations with five level of nitrogen (0, 50,100, 150 and 200 kg /ha) and two level of boron (0 and 1.1 kg/ha.) were replicated thrice in factorial randomized block design. The soil was sandy loam with 7.5 pH, 1.99 percent OM, 0.2 ppm B and 398, 45 and 300 kg NPK/ha, respectively. Nursery was placed on 22nd June and 45 days old seedlings were transplanted maintaining 20 x 10-cm spacing. Phosphorus and potash were applied as basal @ 50 and 100 kg/ha through SSP and MOP, respectively. Full dose of boron and half dose of 'N' were applied as per treatment through borax and urea, respectively at the time of final land preparation. The total rainfall during experiment period was 706.4 mm and average daily temperature was recorded maximum (31.12^{0}C) in June and minimum (15.10^0 C) in December. Other cultural operations were applied as per recommendation. Observations were recorded on number of leaves, length and breadth of longest leaf, diameter and length of bulb, number of roots, yield of bulbs and bulb to green top ratio.

RESULTS AND DISCUSSIONS

Size of Leaves

Among the five doses of nitrogen, 200 kg/ha proved most effective and produced the largest leaf (45.77 cm) followed by 150 (44.20 cm) and 100 (43.40 cm) kg N/ha treatment, respectively. However, control and 50; 50 and 100 and 150 and again 100 and 200 kg N/ha remained statistically at par. Between two doses of boron, 1.1 kg/ha. produced significantly longer leaf (44.19 cm) than its control (42.50 cm). The interaction N_{200} B_{50} maximized length of leaf (47.23 cm) followed by N_{150}, $B_{1.1}$, N_{50}, B_0, N_{100}, $B_{1.1}$, respectively, the minimum being under N_{50} B_0 (39.47 cm). The details of which are being presented in Table 1.

The breadth of leaf was affected by application of nitrogen only. Wider leaves (1.35 cm) were recorded under 100 kg N/ha, followed by 50 (1.32-cm) kg N/ha. The plants under control showed relatively narrow leaves (1.17 cm). Application of 100 and 50 and 200 kg N/ha proved statistically at par in this regard. The application of boron and its interaction with nitrogen could not affect the breadth of leaves significantly.

Application of nitrogen in maximum dose could cause more succulent leaves and thus more water loss decreasing turgor pressure, which ultimately affected the stomatal conductivity thereby producing wider leaves. In onion, most of the stomata lies at lower surface, which sink when conditions of excess evaporation occurs. Boron plays important role in nitrogen metabolism, hormone movement and in cell division. When boron is in optimum in leaves, the supply of carbohydrate to the meristematic tissues is increased which in turn improve the vegetative growth (Baghel and Sarnaik, 1988). It was interesting to note that application of nutrients increased the length of onion leaves to a greater tune than the width. The findings are in accordance with the reports of Patil *et al.* (1984) and Singh (1995)

Size of Bulb

Application of nitrogen improved the length of bulb from 3.47 cm to 4.0 cm and boron increased it from 3.90 cm to 4.05 cm. The interaction of nitrogen and boron did not show significant effect. The largest bulbs (4.47 cm) were however recorded in N_{100} $B_{1.1}$ treatment followed by N_{200} $B_{1.1}$ (4.11 cm). Longer onion bulbs are however not preferred and therefore have poor market value. Every increase in dose of N increased the diameter of onion bulbs significantly over control. Larger bulbs in terms of diameter (5.33 cm) were harvested when 100 kg N/ha was applied, it was however, followed by 200 and 150 kg N/ha. Smallest bulb showing 4.31 cm diameter were recorded under control N treatments i.e. 50, 100, 150 and 200 kg N/ha were noted to be statistically at par. The growth of bulb increased linearly up to 100 kg N/ha (5.33 cm), which decreased at higher doses. Similarly the applications of boron caused significant increase in the diameter of bulbs from 4.78 cm to 5.11cm. The N x B interactions being statistically not significant varied from 3.82 to 5.57 cm showing numerical increase.

The diameter of bulb is a parameter of paramount importance. Reduction in onion diameter at higher doses as compared with the respective lower level of N indicated that application of more than 100 kg N/ha would be a waste in *Kharif* season onion crop. The findings are in agreement with Rodriguez *et al.* (1999) and Khasia and Flodi (1998) in respect of nitrogen and Baghel and Saranik (1998), Singh and Tiwari (1996) and Singh (1995) in boron.

Number of Roots per Plant

Results in Table 1 indicated that the number of roots per plant was significantly affected by application of boron and its interaction with nitrogen. However, nitrogen alone failed to alter the production of roots in onion to the level of significance. Boron increased the number of roots per plant from 70.13 (B_0), to 78.13 ($B_{1.1}$). N_{50} maximized the production of roots (87.00) per plant followed by $B_{1.1}$ N_{150} (83.63) and $B_{1.1}$ N_{100} (82.00), the minimum being under B_0 N_{150} (61.00) treatment. The onion is a monocot plant and as such it possesses adventitious roots. Since it is not a deep-rooted crop, the increase in the number of roots is more important because greater the number of roots more will be the absorption of food materials from the soil. Nutrition of boron increased the number of roots due to its pivotal role in the production and functioning of plant tissues. The findings are in agreement with the report of Singh (1995) in onion.

Yield of Fresh Bulb (t/ha)

Nitrogen fertilization at the rate of 150 kg/ha produced highest yield (33.92 t/ha) followed by 200 kg N (33.83 t/ha.), where as lowest yield (20367 t/ha) has recorded under control. However, the levels of 100 kg, 150 kg and 200 kg N/ha were found statistically at par. There was a linear increase in yield with every increase in dose of nitrogen up to 150 kg/ha. Boron nutrition increased the yield significantly from 27.97 to 31.33 t/ha. The interaction of nitrogen and boron did not affect the yield significantly. However, the yield/ha varied from 19.33 to 35.00 t/ha exhibiting numerical increases. $B_{1.1}$ N_{100} (35 t/ha) gave the maximum yield where as the minimum was recorded under N_0 B_o (19.33 t/ha). The ultimate aim of experimentation is to maximize the yield of quality bulbs. In the present investigation, both the nutrients, viz., nitrogen and boron increased size and yield of onion bulbs significantly. The findings are in agreement with the reports of Singh *et al.* (1982), Patil et al. (1984), Kashi and Flodi (1998) in respect of nitrogen; and Singh and Tiwari (1996), Sindhu and Tiwari (1996), and Mukhopadhyay and Chattopadhyaya (1999) in boron.

Table 1: Effect of nitrogen and boron on vegetative growth, yield, yield contributing components and number of roots in onion.

Treatments	N_0	N_{50}	N_{100}	N_{150}	N_{200}	Mean		S.E.diff.±	C.D. (5%)
Number of leaves									
B_0	8.53	8.07	8.60	8.27	7.73	8.21	N	0.28	0.60
$B_{1.1}$	8.40	8.73	8.67	9.27	7.06	8.43	B	0.18^{NS}	-
Mean	8.47	8.40	8.63	8.77	7.40	-	NxB	0.41^{NS}	-
Length of leaves (cm.)									
B_0	40.73	39.47	42.47	42.67	47.27	42.50	N	0.96	2.01
$B_{1.1}$	41.20	45.40	44.33	45.73	44.27	44.19	B	0.61	1.27
Mean	40.97	42.43	43.40	44.20	45.77	-	NxB	1.36	2.85
Breadth of leaves (cm.)									
B_0	1.15	1.29	1.32	1.24	1.34	1.27	N	0.04	0.06
$B_{1.1}$	1.18	1.35	1.39	1.32	1.22	1.29	B	0.03^{NS}	-
Mean	1.17	1.32	1.35	1.28	1.28	-	NxB	0.06^{NS}	-
Diameter of bulbs (cm.)									
B_0	3.82	5.04	5.08	4.99	4.96	4.78	N	0.02	0.43.
$B_{1.1}$	4.79	4.84	5.57	5.15	5.21	5.11	B	0.13^{NS}	-
Mean	4.31	4.94	5.33	5.07	5.09	-	NxB	0.06^{NS}	-
Length of bulbs (cm.)									
B_0	3.79	3.89	4.09	3.86	3.89	3.90	N	0.20	0.28
$B_{1.1}$	3.69	4.02	4.47	3.93	4.11	4.05	B	0.13^{NS}	-
Mean	3.74	3.96	4.28	3.90	4.00	-	NxB	0.28^{NS}	-
Number of roots									
B_0	79.00	63.67	74.00	61.00	73.00	70.13	N	2.48^{NS}	-
$B_{1.1}$	67.00	87.00	82.00	83.67	71.00	78.13	B	1.57	3.30
Mean	73.00	75.33	78.00	72.33	72.03	-	NxB	3.51	7.38
Yield of fresh bulbs (t./ha.)									
B_0	19.33	23.33	31.67	32.83	32.67	27.97	N	1.13	2.74
$B_{1.1}$	22.00	29.67	35.00	35.00	35.00	31.33	B	0.83	3.88
Mean	20.67	26.50	33.33	33.92	33.83	-	NxB	1.85^{NS}	-
Bulb: Green top ratio									
B_0	3.16	3.40	3.27	3.02	2.37	3.04	N	0.20	0.43
$B_{1.1}$	3.10	3.78	4.17	3.19	2.70	3.39	B	0.30	0.27
Mean	3.13	3.59	3.72	3.10	2.53	-	NxB	0.29^{NS}	-

Bulb and green top ratio

Application of both the nutrients altered bulb and top ratio significantly. The highest ratio (3.72) was found in 100 kg N/ha, followed by 50 kg N (3.59). However, 50 kg N and 100 kg N proved statistically akin. Nutrition of boron also caused significant variation in the bulb/top ratio (3.04 to 3.39). The improvement in bulb/top ratio caused by fertilization of N and B, may be attributed to the optimal vegetative growth in the particular treatments, which might have facilitated photosynthesis triggering the translocation of photosynthates to the bulbs. It was interesting to note that the interaction of these nutrients was found not to be significant. However, maximum bulb to green top ratio was registered in N_{100} $B_{1.1}$ (4.17) and minimum in N_{200} B_0 (2.37).

REFERENCES

Anonymous (2000) Indian Horticultural Database, Millennium 2000. National Horticultural Board, Ministry of Agriculture, Govt. of India. Aristo Printing Press, A-9, DDH, New Delhi, 20: 170-210.

Baghel, B.S and D.A Sarnaik 1988. Comparative study of soil and foliar application of zinc and boron on growth, yield and quality of onion. (*Allium cepa* L.) Cv. Puspa Red. *Research* and *Development Report*,5 (1-2): 76-79.

Kashia, A. and B.R Flodi 1998. Effect of nitrogen on the yiedl, quality and stroability of edible onion cultivars (*Allium cepa*.L.) *J.* of *agril.Scil*, 29 (3)3: 589-592.

Mulkhopadhyaya. T.P and S.B Chattopadhyaya 1999. Boron and molybdenum in growth and yield of onion, grown in *Terai* region of West Bengal. *Hort. J.*, 12 (2): 71-76.

Patil, P.Y., Y.K. Mahorkar and Y.K. Patil 1984. Effect of nitrogen, phosphorus and potash on the bulb size of onion (*Allium cepa* L.). *Pungab Rao Krishi Vidyapeeth. Res.J.*, 8 (2): 67-68.

Rodriguezed, S.N. N.C. Belmar and D.A. Valenzuela 1999. Effect of nitrogen, phosphorus and potassium states, source and froms upon onion (*Allium cepa*) bulb yield and quality. Agriculture Tecnica Santiago, 59 (2): 122-132.

Sindhau, S.S and R.S Tiwari 1996. Effect of micronutrients on yield and quality of onion (*Allium cepa* L.) Cv. Puspa Red, *Progressive Horticulture*. 1993, Rec. 1996, 25 (B-4): 176-180.

Singh, D. 1995. The effect of different concentration of boron solution for root dipping of seedling of onion yield contributing character in onion. *M.Sc. Ag. Thesis Horticulture*, CSAUA&T, Kanpur-208002 : 6.

Singh, D.P. and R.S Tiwari 1996. Effect of micronutrients on yield and quality of onion. (*Allium cepa* L.) Variety Pusa Red. *Recent Horticulture* 3 (1) : 111-117.

Singh, K.K. M.P Singh, C.C Sharma and U.B Singh 1982. Effect of growth regulators along with nitrogen and potash on growth and yield on onion (*Allium cepa* L.). *J.N.K.C.Res.J.*, 16 (3) : 287-288.