

EFFECT OF NITROGEN ON GROWTH AND YIELD OF RADISH

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ABSTRACT

Effect of different levels of nitrogen on growth and yield of radish was studied at Gomal University, D. I. Khan, Pakistan during winter season 2007. Five N levels (50, 100, 150, 200 and 250 kg/ha) alongwith a control (no nitrogen) were tried. The results showed that higher N levels gave better results for all parameters studied. Maximum number of leaves (18.70, 18.17 and 18.10), leaf length (33.33, 32.80 and 31.10 cm), weight of leaves (160.67, 132.83 and 140.82 g), root length (23.77, 22.10 and 22.23 cm), root diameter (4.43, 4.87 and 4.15 cm), root weight (139.28, 122.73 and 127.16 g) and yield (99.88, 85.10 and 89.24 t/ha) were recorded when N was applied @ 200, 250 and 150 kg per hectare, respectively.

KEYWORDS: *Raphanus sativus*; agronomic characters; nitrogen fertilizer; Pakistan.

INTRODUCTION

Radish (*Raphanus sativus* L.) belongs to cruciferae family and can be considered as an annual as well as a biennial crop. Its fleshy edible portion is the root which develops from primary root. It is probably originated in Central or Western China and the Indo-Pak sub-continent (4). It is cool season vegetable and monthly mean temperature of 10-15°C favours its growth and development. For an early and good crop stand, sandy to sandy loam soils are considered suitable for it. Its roots can be eaten raw as salad or cooked as a vegetable. It has cooling effect, prevents constipation, increases appetite and its roots and leaves are very tasty when cooked together. It is recommended to the patients suffering from piles, liver trouble, enlarged spleen and jaundice. The average yield of radish in Pakistan is far less as compared to its potential. Although, a slight increase in average yield (15.57 t/ha in 2004-05 and 15.91 t/ha in 2005-06) was noted, yet it is still very low as compared to other agricultural countries of the world (1). There are many

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factors responsible for decline in its quality and yield. Apart from other factors, nutrients play vital role in the production of certain crops and its application is one of the quickest and easiest way in increasing yield per unit area. Among nutrients, nitrogen is one of major nutrients required by the plants for their growth, development and yield (15). Roy and Seth (14) noted significant response of radish growth and yield to N application at 60 and 120 kg and P₂O₅ at 30 and 60 kg per hectare. Nichols (11) reported that addition of nitrogen had no effect on growth rate. Muthuswamy and Muthukishnan (10) observed a marked increase in fresh top weight and root diameter with 200 kg N per hectare. Cabonce (5) reported that radish plant supplied with 80 kg N per hectare produced longer, bigger and heavier roots over all other treatments. Sounda *et al.* (16) reported that N significantly influenced the root length and girth, root fresh weight, length, number/weight of leaves per plant and number of marketable roots. The highest yield of marketable roots (503.73 q/ha) was obtained with the highest N level. Hegde (8) stated that nitrogen fertilization upto 120 kg increased the root yield. Pandey and Joshua (12) reported that N at 80 kg per hectare with ridge sowing gave maximum average yield (11.37 t/ha). Ghanti *et al.* (7) tried different nitrogen levels with various irrigation treatments. They found that N significantly influenced radish yield, leaf and root length, root girth and number of marketable roots per hectare. The highest radish yield (369.40 q/ha) was obtained with 100 kg N. Kakar *et al.* (9) reported that increasing nitrogen level upto 100 kg resulted in longer leaves (64.83), greater number of leaves per plant (17.90), maximum single bulb weight (42.60 g) and bulb yield per plant (7.08 kg) and total bulb yield (6746.03 kg/ha) of garlic. Further, increase in nitrogen levels had no appreciable effect on the performance of garlic. Ali *et al.* (2) reported that root yield increased progressively and significantly with increased application of nitrogen in carrot. Pervez *et al.* (13) reported maximum plant height (83 cm), root length (38.4 cm), root diameter (4.5 cm) and root yield (16.6 kg) of radish with 200 kg N per hectare at different plant spacings. Ali *et al.* (3) obtained maximum number of leaves, plant height, root length, root diameter, fresh and dry weight of shoot, fresh and dry weight of root and root yield, when 150 kg N per hectare was applied in carrot.

In view of importance of nitrogen fertilizer for getting higher yield, present experiment was designed to study the response of radish growth and yield to various nitrogen fertilizer levels under agro-climatic conditions of Dera Ismail Khan.

MATERIALS AND METHODS

This study was carried out at Horticultural Research Farm, Faculty of Agriculture, Gomal University, D. I. Khan, Pakistan during the winter season

of 2007. The experiment was laid out in RCBD with six treatments replicated thrice using a plot size of 1.5 x 3 m². The seeds were sown on the top ridges with row to row distance of 30 cm and plant to plant distance of 10 cm. Six nitrogen levels (0, 50, 100, 150, 200 and 250 kg N/ha) were tried. Urea was used as a source of nitrogen fertilizer and was applied in two split doses, first half at the time of sowing and remaining half 30 days after sowing. Phosphorus and potash were also applied as constant doses @ 65 and 100 kg per hectare, respectively at the time of sowing. All required cultural practices like irrigation, hoeing, weeding, pest and disease control, etc. were given uniformly whenever necessary. The crop was harvested when most of the leaves turned and after attaining full size root. The experimental plot was regularly observed and ten plants were randomly selected from each subplot. Data were recorded for number of leaves, leaf length (cm), weight of leaves (g), root length (cm), root diameter (cm), root weight (g), root to shoot ratio and yield. The data were analyzed statistically using analysis of variance technique (17) and Duncan's multiple range test (6) and 5 percent probability level was applied to compare different treatment means, using MSTATC computer software.

RESULTS AND DISCUSSION

Number of leaves

The data regarding number of leaves differed non-significantly for N @ 200,250 and 150 kg with 18.70,18.17 and 18.10 leaves, respectively (Table 1). Minimum number of leaves (9.47) was noted in control. Similar results have been reported by Kakar *et al.* (9) who noted significant effect of nitrogen upto a certain limit, on leaf length and number of leaves in garlic.

Leaf length

The data (Table 1) revealed significant effect also on leaf length which increased proportionally with an increase in nitrogen fertilizer level upto a certain level and vice versa. N @ 200, 250 and 150 kg was statistically similar having 33.33, 32.80 and 31.10 cm leaf length, respectively. However, the lowest leaf length (19.73 cm) was recorded in control. Kakar *et al.* (9) also noted that higher application of nitrogen upto a certain limit encouraged the growth in garlic.

Table 1. Effect of nitrogen on number of leaves/plant, leaf length, weight of leaves and root length of radish.

Nitrogen levels (kg/ha)	Number of leaves/plant	Leaf length (cm)	Weight of leaves (g)	Root length (cm)
00	9.47c	19.73d	62.31b	11.03b
50	15.60b	25.20c	71.18b	22.70a
100	16.73ab	27.90bc	92.81b	19.60a
150	18.10a	31.10ab	140.82a	22.23a
200	18.70a	33.33a	160.67a	23.77a
250	18.17a	32.80a	132.83a	22.10a
LSD value	2.454	6.687	45.59	6.932

Means sharing common letter(s) are statistically similar at 5% level of probability.

Leaf weight

The data regarding leaf weight showed significantly more leaf weight (160.67 g) in 200 kg N which was statistically at par with 150 and 250 kg N with an average leaf weight of 140.82 and 132.83 g, respectively (Table 1). Here again minimum response was noted in control plots (no N) compared to all other treatments. These results agree to the findings of Muthuswamy and Muthukishanan (10) who reported that fresh top weight was markedly increased with nitrogen application in radish. The production of heavier leaves with 200 kg N was due to balanced fertilization, necessary for growth and development against control where no fertilizer was used.

Root length

The mean data showed a non-significant difference in root length due to nitrogen doses (Table 1). However, comparatively longer roots i.e. 23.77, 22.23, 22.10 and 19.60 cm were recorded in 200, 50, 150, 250 and 100 kg N, respectively. Minimum root length (11.03 cm) was recorded in control. Pervez *et al.* (13) reported maximum root length in radish when 200 kg N per hectare was applied.

Root diameter

The mean data clearly showed that root diameter of radish increased with an increase in each level of nitrogen (Table 2). Maximum root diameter (4.87 cm) was recorded in 250 kg N closely followed by 200 kg N (4.43 cm) and 150 kg N (4.15 cm). All these treatments behaved non-significantly with each other. Intermediate response was also recorded in 50 (2.83 cm) and 100 kg N (2.64 cm). Minimum root diameter (1.82 cm) was recorded in control. All these three treatments were statistically at par with each other. Muthuswamy

Table 2. Effect of nitrogen on root diameter, root weight, root shoot ratio and yield of radish.

Nitrogen levels (kg/ha)	Root diameter	Root weight (g)	Root shoot ratio	Yield (t/ha)
00	1.82b	82.19c	1.33b	48.12d
50	2.83b	109.81b	1.52b	60.27 cd
100	2.64b	118.96ab	1.28b	70.52bc
150	4.15a	127.16ab	0.87c	89.24ab
200	4.43a	139.28a	0.87c	99.88a
250	4.87a	122.73ab	0.96c	85.10ab
LSD value	1.266	30.86	0.2153	24.38

Means sharing common letter(s) are statistically similar at 5% level of probability.

and Muthukrishnan (10) also reported that root diameter of radish markedly increased with nitrogen application. The reason for maximum root diameter in plots receiving more nitrogen may be due to the fact that these plants were more healthy and vigorous than others.

Root weight

The data revealed highly significant effect of N doses on root weight. It increased gradually with an increase in nitrogen level upto 200 kg N and then it started to decline (Table 2). Maximum root weight (139.28 g) was observed in 200 kg N level followed by 150, 250 and 100 kg N with an average root weight of 127.16, 122.73, 118.96, respectively. All these treatments differed non-significantly. However, root weight decreased with decrease in nitrogen levels and minimum root weight (82.19 g) was recorded in control.

Root shoot ratio

The data on root to shoot ratio was also highly significant. Statistically higher root shoot ratio (1.52) was recorded in 50 kg N (Table 2) followed by control (1.33) and 100 kg N (1.28). Both these treatments were statistically at par with each other. Minimum root shoot ratio was recorded in 150, 200 and 250 kg N. All these treatments showed a non-significant difference among themselves.

Radish yield

Once again high N doses excelled in root yield with a non-significant difference among themselves (Table 2). High N level (200 kg) topped the list (99.88 kg) followed by 150 kg N (89.24). Minimum yield (48.12 t/ha) was recorded in control. Higher marketable root yield was also obtained with

higher nitrogen levels by Sounda *et al.* (16). Similar results have also been reported by Ali *et al.* (2).

CONCLUSION

The use of higher levels of nitrogen i.e. 150, 200 and 250 kg per hectare had a beneficial effect on fresh top weight as well as root yield of radish. However, 200 kg N is recommended for maximum radish yield.

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