

Effect of nitrogen level on growth and yield attributing characters of radish

Abstract

Radish is one of the well-known root crops that belong to family Brassicaceae. Its popularity could be due to its wider climatic adaptation, easy cultivation methods and wider ranges of its uses. The cultivar “Minow Early” was selected for experiment. Field trial was conducted on horticultural farm of Lamjung campus between October-January 2017/18 in Randomized Complete Block Design with four replications and five treatments to assess the role of five different levels of nitrogen (100, 150, 200, 250 and 300 kg per ha) application on growth and yield attributes of Radish. The different growth and yield parameters like plant height, number of leaves, root length, root girth, root weight were measured. Significant differences were found on root length and plant height. Maximum root length and plant height was observed at 250 and 300 kg per ha reflecting better yield performance in these levels of nitrogen. This indicates that 250 kg per ha of nitrogen was best for better yield (mean root weight = 121.3 g per plant).

Keywords: doses, favorable, growth; plant response, root yield

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Poudel P,² Shrestha A,¹ Shrestha RK²

¹Technical Officer, Department of Plant Breeding and Genetics, Nepal Agriculture Research Council, Nepal

²Department of Plant Protection, IAAS, Nepal

Correspondence: Poudel P, Department of Plant Protection, IAAS, Lamjung Campus, TU, Nepal, Email poudelpratima08@gmail.com

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Introduction

Radish (*Raphanussativus* L.) is one of the well-known root vegetable crops. It is grown as annual or biennial plants that belongs to family Brassicaceae and genus *Raphanus*. It is mainly grown for its succulent taproot. It has low caloric value in both root and leaves. In Nepal, the area under radish cultivation is 16915.7 ha, its production 268119.6 mt and its productivity 15.9 m/ha. It can be successfully grown throughout the year in the hills of Nepal.¹ Its popularity could be due to its wider climatic adaptation, easy cultivation methods and wider ranges of its uses. Nitrogen is a paramount element for plant since it is a core component of many plant structures and for both their internal and external metabolic (Greenway Biotech, Inc. (Accessed via: <https://www.greenwaybiotech.com/blogs/news/whats-the-function-of-nitrogen-n-in-plants>). May 18, 2018, 10:25am). Healthy plants often contain 3-4 % nitrogen in their above-ground tissues. This is a much higher concentration compared to other nutrients. Among macro nutrients nitrogen plays a vital role in the growth and development of plants. It is an essential constituent of metabolically active compounds like protein, nucleic acids, chlorophyll and enzymes etc. When nitrogen is deficient in soil, the harvest is poor in size, weight and quality.² Nitrogen fertilization is widely adopted to enhance crop production and improve nitrogen utilization all over the world. Among the factors deciding about successful cultivation of this vegetable nitrogen fertilization is of a special meaning and application level of this element should be targeted not only on the yield size, but, first of all, yield.³ The role of nitrogen is acceptable as it is a necessary component of protein nucleic acids, chlorophyll and certain important enzymes.⁴ On the other hand, deficiency of nitrogen in soil results into poor crop yield with low quality. While, excessive use of negatively affects the quality as well as yield of agricultural crops. Nitrogen is very essential for leafy vegetable production.⁵ Its application upholds the overall growth, yield and quality of radish. The application according to the government recommendation and application according to the farmers is totally different. Farmers think Urea as only one fertilizer source for the crop growth which is considered to be factor directly or indirectly involving in effecting

the total yield of radish.

Materials and methods

Field trial was conducted on horticultural farm of Lamjung Agriculture Campus, Lamjung, Nepal (latitude: 28.125896; longitude: 84.416133 and altitude: 630.02m) between October-January 2017/18 on radish following single factorial Randomized Complete Block Design with four replications and five treatments. Different dose of Nitrogen viz. 50%, 75%, 100%, 125% and 150% of government recommended dose were evaluated for their field efficacy in growth and yield attributes of Radish. Government recommended dose of NPK is 200:180:60 kg/ha respectively (Krishi Diary 2074). Full dose of P and K while 50% of N was supplied during sowing while remaining N was supplied in equal proportion in 30 and 45 days after sowing. 1.28 kg well rotten farm yard manure (Krishi Diary 2074) was applied per plot before sowing. Irrigation was applied frequently during germination period and after this period, scheduled in the intervals viz. 3 days and 5 days as per the soil moisture condition. Plots were partitioned at the distance of 50 cm. The radish cultivar Minow Early, widely grown in this locality was used for the trial. The plot size was maintained at 0.8 × 0.8 m holding 16 plants per plot keeping row to row distance as 20 cm and plant to plant distance 20 cm. 4 plants per plot were under observation. Different growth and yield parameters were recorded. Plant height was taken from the point of root attachment to the top of the leaves. Root length was recorded by measuring the length of white part of root and the means were worked out and expressed in centimeter. Root girth refers to the average width at the widest point in the middle portion of mature root. Root weight was taken with the help of weighing balance. The data were analyzed statistically using computer package program SPSS version 16.0 and R-STAT. Homogeneity test was conducted. Mean separation was done using Least Significant Difference (LSD) and Duncan's Multiple Range Test (DMRT) at 5% significance level. ANOVA were done at 1% and 5% level of significance or mean comparison. The correlation between root length and N level, plant height and N level were calculated and graphed using SPSS.

Result and discussion

Growth attributing characters

Effect of nitrogen level in plant height

Highly Significant results of Plant height for different nitrogen levels were observed. Highest plant height was observed in 250Kg/haN (49.875cm) which is statistically at par with 200Kg/ha and 300Kg/haN. Minimum plant height was observed in 100Kg/haN that is statistically at par with 150Kg/haN. Similar results were obtained by Sharma and Kanuzia. Height of plant can be considered as one of the indices of plant vigor ordinarily and it depends upon vigor and growth habit of the plant. Soil nutrients are also very important for the height of plants. So, higher dose of nitrogen increased plant height. These results are in conformity with the findings of Sharma and Rastogi et al.⁶ Plant height is an indicator of vegetative growth. Minimum plant height might be due to the result of unavailability of nitrogen and other nutrients required by the plants for their normal growth and development. It was observed that an increase in nitrogen levels positively affected the plant height character which might be due to the role of nitrogen for cell division, cell enlargement and protein synthesis characteristics. An improvement in plant height with increasing nitrogen applications has also been confirmed with the findings of Balooch et al.⁷(Figure 1).

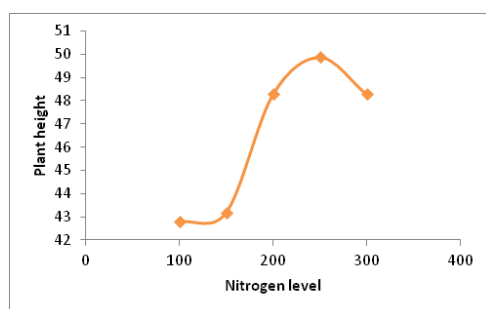


Figure 1 Relationship between plant height and different nitrogen level of radish at Lamjung Agriculture Campus, Lamjung, Nepal during Oct 2017- Jan 2018.

Effect of nitrogen level in number of leaves

Data for number of leaves spelt out non-significant results. However, it shows some trend for different nitrogen levels indicating superiority of 300kg/ha and 250kg/ha over other treatment. 300kg/ha and 250kg/ha produced 20.125 number of leaves per plant, respectively (Table 1). Similar results were obtained by Sharma & Kanaujia.⁸ These results are also confirmed by the findings of Shrivastava et al.⁹ The leaves are the plant factories, manufacturing carbohydrates. The photosynthesis occurs in leaf cells and carbohydrates are formed there. Vegetative growth was increased with increase in Nitrogen level.

Table 1 Effect of different levels of nitrogen on yield parameters of Radish at Lamjung Agriculture Campus, Lamjung, Nepal during Oct 2017- Jan 2018

Nutrients (Kg/ha)			Yield parameters		
N	P	K	Root Weight	Root Girth	No. of leaves
100	180	60	0.1290 ^a	12.242 ^a	19.062 ^a
150	180	60	0.1180 ^a	11.087 ^a	20.062 ^a
200	180	60	0.1095 ^a	10.587 ^a	20.087 ^a
250	180	60	0.1213 ^a	11.882 ^a	20.125 ^a
300	180	60	0.1043 ^a	10.83 ^a	20.125 ^a

Table continued..

Nutrients (Kg/ha)	Yield parameters		
Significant	NS	NS	NS
LSD	0.044	1.937	2.219
CV	24.82	11.105	7.243
SEm (±)	0.0008	1.582	2.076
Grand Mean	0.116	11.326	19.892

NS= Non-significant, LSD= Least Significant Difference, CV= Coefficient of Variation, SEm (±) = Standard Error of Mean, Means followed by the same letters in a column are not significantly different by DMRT at 5% level of significance

Yield attributing characters

Effect of nitrogen level in root length

Nutrient levels had exerted very significant effect on length of root. Mean values in relation to different nitrogen levels indicated significant superiority of 300kg/haN over other treatments. 300 Kg/ha N produced maximum root length of 24.012cm which is statistically at par with 250Kg/ha (23.769cm) and 200Kg/ha (22.537cm). 200kg/ha N is also statistically at par with 100Kg/ha N and 150Kg/ha N. Minimum root length was produced by treatment 100Kg/ha i.e. 20.996cm. An increase in root length might be due to effect of environment, soil texture and on time and balanced manuring practices. Similar results were also explained by Nargave K¹⁰ that nitrogen level have significant influence on root length. These results are in accordance with Parrhasarathi et al.,¹¹ and Pervez et al.⁴ There could be attributed to the positive influence of nitrogen on cell division, cell elongation, cell expansion synthesis, of amino acids, enzymes and chlorophyll which might increase the root length. The results are in agreement with the findings of Houchmuth¹² who noted that the application of NPK fertilizer significantly increased the root length in radish (Figure 2).

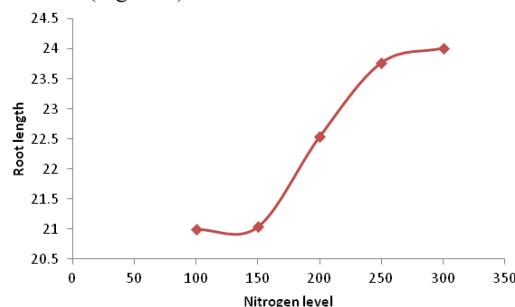


Figure 2 Relationship between root length and different nitrogen level of Radish at Lamjung Agriculture Campus, Lamjung, Nepal during Oct 2017- Jan 2018.

Effect of nitrogen level in root weight

The results entails that there is no difference in the effect of nitrogen on root weight. As in previous research in temperate regions showing little response of carrot to applied N,¹³⁻¹⁶ carrot yield did not respond to N application rate or preplant available N on organic soil. In addition to this, it have a deep and extensive root system^{17,18} and may be accessing residual N applied the previous season that has leached into lower levels of soil profile.

Effect of nitrogen level in root girth

The results entails that there is no difference in the effect of nitrogen on root girth. The results are in conformity with Bloom

AJ¹⁹ that the growth-promoting effect of N (up to the optimum level) increases cytokinin production, which subsequently affects cell wall elasticity, number of meristematic cells, and cell growth. In contrary, Higher N level provided more N and more space for the development of root which resulted in maximum diameter that is applicable up to certain limit, further increment will decrease the diameter.¹⁸

Conclusion

Nitrogen dose of 250kg/ha and 300Kg/ha in radish is significantly better than other dose for providing increased plant height with longest radish root. Future studies should be directed to determine the relationship in multiple location and multiple seasons.

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Conflict of interest

Author declares that there is no conflict of interest.

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