

Research Article

Effect of different nitrogen levels on growth and yield of radish under the agro-climatic condition of district Bajaur

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Abstract

Nitrogen is a primary macronutrient which having a key role in protein synthesis and an essential constituent of amino acids. It is immensely required for better production of radish crop. An experimental research with different nitrogen levels on growth and yield of radish under the climatic condition of Bajaur was performed at Research Farm of Agriculture Research (MAs), district Bajaur. The experimental study was carried out in RCBD with total eight treatments replicated three times and size of each plot was 2 x 2 m². Eight different nitrogen doses (0, 30, 60, 90, 120, 150, 180 and 210 kg ha⁻¹ N) were given in two split doses, first dose was given during sowing and another dose was applied after 30 days of sowing. The statistical results showed that application of nitrogen positively affected all the studied attributes. Maximum number of leaves per plant (19.68), plant height (37.68 cm), root diameter (7.69 cm), root length (31.62 cm), root weight (412.11 g) and total yield (102.63 t ha⁻¹) were recorded in the plants applied with nitrogen @ 210 kg ha⁻¹. Less number of leaves plant⁻¹ (10.55), plant height (21.07 cm), root length (21.23 cm), root diameter (4.59 cm), root weight (328.47 g) and total yield (83.54 t ha⁻¹) were recorded in the control treatment. It is concluded from the present experiment that utilization of nitrogen @ of 210 kg ha⁻¹ could be applied for higher yield of radish crop under the agro-climatic condition of district Bajaur.

Keywords: Growth; Nitrogen; Radish; Root diameter; Yield

Introduction

Radish (*Raphanus sativus* L.) is an essential root vegetable which belongs to the family cruciferae. It is an annual as well considered as a biennial vegetable in nature. The fleshy edible part is root which basically grows from tap root. Its origin might be from Central and Western China as well as in the Indo-Pak regions of sub-continent [1]. Radish is a popular as well as an ancient vegetable of

temperate and tropical zones of the world, abundantly used as a root vegetable and its tender leaves can be used as salad or in cooked form [2]. It favors winter season and monthly average temperature range from 10-15°C enhances its growth and yield. It is grown on total area of 9769 hectares with annual production 160265 tons in Pakistan, while in KPK it is grown on area of 1038 hectares and gave production of 12858 tons

[3]. It is a best source of protein carbohydrates and vitamins C & A [4]. It plays a key role in cooling effect, increases appetite and prevents constipation, its leaves and roots have a delicious taste when cooked together. It is very essential for those patients who are suffering from jaundice, liver trouble, piles and enlarged spleen. The decline in quality and yield of radish are due to several factors. Among these factors, nutrients play an essential part in the yield and quality of many crops and its utilization is one of the easiest and fastest way in improving productivity. The function and role of nitrogen is too important as it is considered a vital constituent of nucleic acids, protein, chlorophyll pigment and several important enzymes. Among the macro essential nutrients nitrogen is required by the crops for its normal development, growth and yield [5, 6]. However, use of nitrogen in large amount affects negatively the quality as well as production of agricultural crops [7]. Nitrogen is very important especially for leafy vegetable yield. Deficiency of nitrogen in soil creates problems and then crop is poor in weight, size and quality [8]. Yield and quality of the radish being cultivated in Pakistan is low which ultimately decreasing production. The consumers like the fresh and healthy radish for salad. The best quality and maximum yield is generally dependent on adequate fertilizers, appropriate cultural practices, sowing method, soil type and irrigation etc. Nitrogen improves the growth and yield of radish crop [9].

Keeping in view the importance of nitrogen fertilizer for achieving better quality and higher yield, current research was performed to find out the impact of various nitrogen levels on the growth, quality and yield of radish within the agro-climatic conditions of district Bajaur.

Materials and Methods

This experiment was conducted at experimental farm, Agriculture Research (MAs), district Bajaur, KP, Pakistan in winter season during the 2020-21, to investigate the effect of different nitrogen doses on growth and yield related attributes of radish. Research was carried out in RCBD with eight treatments replicated three time grown in plots having size of 2 x 2 m² each. The field was ploughed deeply and prepared well. Ridges were made and on the top of ridge seeds were sown, row to row distance was 30 cm and plant-plant distance of 10 cm were kept. Eight various nitrogen doses of Nitrogen (0, 30, 60, 90, 120, 150, 180 and 210 kg ha⁻¹ N) were given in two split form, first application was given at the sowing time and another one was applied after 30 days of sowing. Urea was utilized as a source for nitrogen. Potash and phosphorus were also given as recommended doses at rate of 100 and 65 kg ha⁻¹, respectively during sowing. All cultural practices required for crop like hoeing, weeding, irrigation, disease and pest control etc. were performed uniformly whenever needed. The radish was reaped when maximum of the leaves changed to yellow and after obtaining full final size root. Research was inspected on daily basis and randomly five plants were chosen from each treatment. Data were taken for root diameter plant⁻¹ (cm), number of leaves plant⁻¹, plant height plant⁻¹ (cm), root length plant⁻¹ (cm), root weight plant⁻¹ (g) and total yield (t ha⁻¹). The data were analyzed statistically using analysis software statistic 8.1 and 5% probability level was used for mean comparison.

Results and Discussion

Number of leaves plant⁻¹

The statistical data showed that results obtained for numbers of leaves per plant were significantly affected by the application of various doses of nitrogen. Highest numbers of leaves per plant (19.68) were noted in

plants treated at rate of 210 kg/ha of nitrogen. Less numbers of leaves per plant (10.55) were recorded in control treatment (Table 1). Our current findings are in similarity with results observed by [10] who recorded the significant impact of nitrogen on number of leaves and leaf length and in garlic. [11] Also reported similar results. These findings are also confirmed by the findings of [12]. The rise in number of leaves per plant might be due to role of nitrogen in photosynthesis which ultimately increases vegetative growth. The photosynthesis process held in leaves and carbohydrates are prepared. As the nitrogen's levels were increased the vegetative growth was enhanced.

Plant height plant⁻¹ (cm)

The mean data regarding plant height positively affected by different levels of nitrogen. Highest plant height (37.68 cm) was recorded in the plants applied with nitrogen @ 210 kg ha⁻¹, followed by (34.03 cm) at rate of 180 kg ha⁻¹ N. Less plant height (21.07 cm) was observed in the control plants (Table 1). Our results are parallel in line with the results observed by [13]. The nutrients play a vital role in increasing plant height. Increase photosynthesis for cell division and enlargement which increase plant height. So, with higher dose of nitrogen plant height was increased. Findings of our research are in

parallel with the results of [14]. As more vegetative growth occurred plant height was increased. It may be because of key function of nitrogen for cell enlargement, cell division, protein synthesis and photosynthesis. An enhancement in plant height with maximum level of nitrogen dose has also been recorded by [1].

Root length plant⁻¹ (cm)

The mean data regarding the root length was highly influenced by the use of various doses of nitrogen on radish crop. Maximum root length (31.62 cm) was taken in the plants treated with 210 Kg ha⁻¹ N. Less root length (21.23 cm) was obtained in control treatment (Table 1). Nitrogen levels had depicted very significant impact on length of root. Same results were also described by [13] who reported that nitrogen level has significant influence on root length. These findings are in coherence with [14, 15]. This might be due to significant influence of nitrogen on cell elongation, cell division, cell expansion, enzymes, protein synthesis and chlorophyll which may enhance the root length of radish. The obtained findings are similar with the results of [16] who recorded that the use of NPK fertilizer positively improved the root length in radish crop. [15] Also observed highest root length in radish when applied @ 200 kg/ha N.

Table 1: Different levels of nitrogen significantly affected number of leaves plant⁻¹, leaf length (cm) and root length (cm)

Nitrogen level (kg ha ⁻¹)	No. of leaves plant ⁻¹	Plant height (cm)	Root length (cm)
Control	10.55h	21.07h	21.23g
30	12.76g	23.42g	24.36f
60	14.18f	24.94f	25.30e
90	15.77e	26.82e	27.02d
120	16.66d	28.57d	28.23c
150	17.94c	31.23c	29.10bc
180	18.99b	34.03b	30.08b
210	19.68a	37.68a	31.62a
LSD at α 0.05	0.55	0.98	1.09

Means followed by same letters are not significantly different at $p < 0.05$; Significant probability level at 5 %

Root diameter plant⁻¹ (cm)

The mean data for root diameter of radish had significantly influenced with the application of different doses of nitrogen. Maximum root diameter (7.69 cm) was attained in plants treated with 210 kg ha⁻¹ N, followed by root diameter (7.36 cm) at application of 180 Kg ha⁻¹ N. Minimum root diameter (4.59 cm) was noted in control plots (Table 2). It might be due to getting higher rate of nitrogen plants will be receiving more photosynthesis, vigorous and healthy as compared to other taking less nitrogen. The findings of our research are in coherence with the results of [17]. [18] Also observed that radish root diameter significantly increased with use of nitrogen.

Root weight plant⁻¹ (gm)

The mean data concerned for root weight (gm) was positively affected by the use of various nitrogen doses on root weight of radish. Maximum root weight (412.11 g) was obtained in the treatments applied with 210 kg ha⁻¹ N. Minimum root weight (328.47 g) was observed in control treatment (Table 2). This might be due to the increase in yield of radish root which may contribute to increase the root weight plant⁻¹ and more number of leaves plant⁻¹ [19]. The increase in root weight with NPK fertilization was might be

due to improving the growth and yield components like as root girth, length and weight. Our findings are in line with the investigations of [20], who discussed that enhance of nitrogen use could improve the weight of root.

Total yield (t ha⁻¹)

The data from the statistical results depicted that the application of various level of nitrogen fertilizer had positively influenced the yield of radish crop. Maximum yield (102.63 tons/ha) was recorded in the plants treated at 210 kg/ha nitrogen, followed by (99.96 t ha⁻¹) in plants applied with 180 kg ha⁻¹ of N. Minimum data for yield (83.54 t ha⁻¹) was observed in the control (Table 2). Findings of our research are similar to the results recorded by [8]. This might be correlated to enough application of nitrogen fertilizer that significantly affected the plant performance and as a result increase in root yield occurred. These findings are in agreement with [21], who also recorded that root yield and root weight of turnip improved when the radish crop was fertilized with optimum level of nitrogen. Many other researchers have also reported the better effect of nitrogen in enhancing the total root yield and root weight of radish crop [22].

Table 2: Application of different levels of nitrogen significantly affected root weight (gm), root diameter (cm) and total yield (t ha⁻¹)

Nitrogen level (kg ha ⁻¹)	Root weight (gm)	Root diameter (cm)	Total yield (t ha ⁻¹)
Control	328.47g	4.59g	75.54g
30	347.55f	5.30f	83.26f
60	350.40f	5.90e	85.12f
90	366.56e	6.40d	89.97e
120	377.68d	6.77c	92.30d
150	388.25c	6.92c	95.48c
180	399.86b	7.36b	99.96b
210	412.11a	7.69a	102.63a
LSD at α 0.05	8.26	0.27	2.47

Means followed by same letters are not significantly differ at $p < 0.05$; Significant probability level at 5 %

Conclusions and Recommendations

Nitrogen is very important for vegetative growth of radish crop. On the basis of results obtained from the research it was derived that application of various levels of nitrogen i.e. 0, 30, 60, 90, 120, 150, 180 and 210 kg ha⁻¹ had significantly affected yield and yield associated attributes of radish crop. However, for maximum yield of radish the nitrogen level of 210 kg ha⁻¹ is recommended.

Authors' contributions

Experiments was conceived and designed: MU Din, Performed the research experiment: A Ullah, Analyzed & manipulated the data: Hammad, Z Shah & M Raza, Contributed materials/ analysis/ tools: Z Jan & T Ahmad, Wrote the paper: A Ullah.

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