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# Studies on effect of nitrogen and boric acid on growth, yield and quality of red cabbage (*Brassica oleracea var. capitata f. rubra*)

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**Abstract**
The present investigation entitled "studies on effect of nitrogen and boric acid on growth, yield and quality of red cabbage (*Brassica oleracea var. capitata f. rubra*)" was carried out in *Rabi* season 2022-2023 at Department of Horticulture, College of Agriculture, Latur. The treatment were four levels of nitrogen (0, 50, 75, 100 kg $ha^{-1}$) and three levels of boric acid (0, 50, 100 ml/L). The experiment was laid out in FRBD with three replication. Nitrogen and boric acid levels significantly influenced the growth, yield and quality parameters at all growth stages. The maximum plant height, diameter of stem, stem length, number of leaves per head, leaf area, number of outer leaves per plant, diameter of head, height of head, weight of head, yield per plot, yield per ha, total soluble solid content, ascorbic acid content and anthocyanin content were obtained with the application of 100 kg N/ha and 100 ml B/L in red cabbage.

**Keywords:** Red cabbage, nitrogen, boric acid, anthocyanin, growth and quality

## Introduction
Red cabbage (*Brassica oleracea var. capitata f. rubra)* called as purple cabbage or red kraut. Since its leaves are purple or red in color due to the pigment called anthocyanin. It is a kind of cabbage, also known as "Blaukraut" after preparation. It is used as salad, boiled vegetable, cooked in curries, used in pickling as well as dehydrated vegetable. Red cabbage is a member of the Brassicaceae family. It is a popular winter vegetable. It has chromosome no 2n = 18. It is a herbaceous, biennial, dicotyledonous flowering plant. It has short stem above which is a crown with a head of red-coloured leaves. Also, its grown as annual cole crop. Brassicaceae vegetables represent an important part of the human diet worldwide are consumed by people all over the world and are considered important food crops in China, Japan, India and European countries. It is native to Southern Europe. Red cabbage mainly grown in the states of India like Uttar Pradesh, Orissa, Assam, West Bengal, Maharashtra and Karnataka. In India, cabbage including red cabbage is cultivated in an area of 4.03 lakh hectares producing 91.92 lakh metric tonnes (NHB, 2019). It is a rich source of anthocyanin, proteins, fats and minerals like calcium, phosphorus, potassium, sulphur etc. and vitamins are A, B1, B2 and C. Red cabbage distinguished by the presence of exceptional health enhancing properties like anticancer properties due to the presence of Indole-3- Carbinol and many beneficial sensory traits, which has become more and more important in recent years (Wojciechowska *et al.* 2007) [22]. An important advantage of red cabbage is the fact that it is generally consumed raw, which permits the preservation of vitamins sensitive to thermal processing and some polyphenolic compounds (Ismail *et al.* 2004) [7]. Red cabbage is a heavy feeder of mineral elements and it removes large amount of macronutrients from the soil. Thus, a major constraint in increasing crop yields is the supply of nutrients (Arakari *et al.* 1956) [2]. Among the nutrients, nitrogen plays the most important role to promote vigorous vegetative growth, attractive colour, higher yield and good quality heads.

Nitrogen is the major nutrients for influencing growth and proper development of red cabbage. Plants need the nitrogen in large quantities as it constitute 40-50 percent of dry protoplasm weight. It also includes amino acids, amides and vitamins. The demand for nitrogen is high when growth is in rapid stage. Excessive use of nitrogen application results in vegetative growth delay in maturity, poor quality of produce and low yield.

Boron plays an important role in cell division, carbohydrates, proteins, nucleic acids and the hydrophilic relationship in the plant. Loss of boron leads to accumulation in the roots and inhibits their growth. Boron causes large losses in crop production and crop quality.

Red cabbage in India demand is growing very fast with time there has been a change in the eating habits. Because of this, now new types of vegetables demand is increasing in the market. Health conscious people are now staring to include nutritious fruits and vegetables in their diet. Farmers are earing profit by doing farming according to the demand in the market.

## Materials and Methods

The experiment was conducted during *Rabi* season of 2022-2023 at Department of Horticulture, College of Agriculture, Latur. The experiment was laid out in a Factorial Randomized Block Design having two factors i.e., nitrogen and boric acid with three replications. The treatments include four levels of nitrogen and three levels of boric acid. Total numbers of treatments combinations were 12. The treatment details were as 1) Levels of nitrogen (N)-N0:0 kg/ha; N1:50 kg/ha; N2: 75kg/ha; N3: 100 kg/ha. 2) Levels of boric acid (B)-B0: 0 ml/L; B1: 50 ml/L; B2: 100 ml/L. One month old seedlings of red cabbage were transplanted in plots 3m x 2.7m. Half dose of nitrogen and full dose of phosphorus and potash were given as basal dose. Remaining nitrogen was given in one split doses. Five plants from each plot were selected for taking observations on growth, yield and quality parameters. The data were analyzed statistically.

### Observation recorded

1. **Growth parameter: Plant height (cm):** The plant height was measured from ground level to the tip of the mains shoot at 30, 60 days and at final harvest. The mean values of five plants in each treatment and from three replication were used for statistical analysis. It was expressed in centimeters.
2. **Stem length (cm):** Stem length of the plant was measured at the time of harvesting from soil surface to beginning head formation. It was expressed in centimeter.
3. **Number of outer leaves per plant:** The number outer the leaves of plant leaf. Plant, which not formed the head was taken.
4. **Number of leaves per head:** The numbers of leaves from transplanting to the appearance of heads was recorded from selected plants in each plot under each treatment and the average was worked out.
5. **Leaf area ($cm^2$):** The leaf area was recorded from five randomly selected plants on the basis of leaf length and leaf width in square centimeter.
6. **Diameter of the stem (mm):** The diameter of the stem was measured by using Vernier caliper from soil surface to head formation.

### Quantitative parameter

1. **Diameter of Head (cm):** The diameter of 5 head counted by measuring tape from the randomly selected plant from each treatment and average was taken.
2. **Height of the head (cm):** The height of 5 head measured by using measuring tape from the randomly selected plant from each treatment and average was taken.
3. **Weight of head (g):** The weight of head was taken from five plant which are randomly selected from each treatment and average weight sumed up.
4. **Yield per plot (kg):** The weight of total harvested head from each treatment and replication were recorded separately and average yield per plot was calculated in kilograms.
5. **Yield per hectare (q/ha):** Total yield in kg per plot was recorded by weighing individual head at each harvesting. It was multiplied with factor to get estimated yield per hectare and expressed in quintal per hectare.

### Qualitative Parameter

1. **Total Soluble Solid (%):** Total soluble solid was recorded by hand refractometer. Five heads were taken from treatment and finally average value was worked out. A drop of juice was placed on the refractometer and reading was record.
2. **Ascorbic Acid (%):** For process of ascorbic acid about 10 ml of extracted cabbage juice was taken and the volume was made up to 100 ml with 3% meta phosphoric acid, 10 ml of this aliquot solution was taken and titrated with standard dye (2,6 – dichlorophenol indophenol) till a pink end is reached. The ascorbic acid content was estimated using the given formula and expressed as milligrams per 100 grams of juice.

$$\text{Ascorbic acid content} = \frac{\text{Titrated value} \times \text{dye factor} \times \text{volume made up}}{\text{Aliquot taken} \times \text{weight of sample}} \times 100$$

3. **Anthocyanin content in the leaf (mg. $100g^{-1}$)**

For process of anthocyanins, 10 g of sample was blended with 10 ml of ethanolic acid HCl, transferred to a 100 ml volumetric flask and made up to volume and stored it in a refrigerator at 4°C overnight. Filtered through Whatman No.1 filter paper and recorded optical density (O.D) of filtrate at 535 nm in spectrophotometer.

$$\text{Total O.D./ 100 g} = \frac{\text{O.D.} \times \text{Volume made up}}{\text{Wt. of sample}} \times 100$$

$$\text{Total anthocyanin (mg/100g)} = \frac{\text{Total O.D. / 100 g}}{98.2}$$

## Results and Discussion

### Effect of nitrogen

The level of nitrogen 100 kg/ha had significantly increased the growth, yield and quality characters. Significantly maximum The maximum increase in plant height (23.91 cm), diameter of stem (13.39 mm), stem length (10.97 cm) number of leaves per head (38.57), leaf area (210.97 $cm^2$) and number of outer leaves per plant (19.44) were recorded under individual effect of nitrogen (100 kg $ha^{-1}$).The maximum diameter of head (21.87 cm), height of head (16.59 cm), weight of head (862.81 g) and yield per plot (32.39 kg) and yield per ha (420.98 q /ha) were found under individual effect of nitrogen (100 kg $ha^{-1}$). The maximum total soluble solid content (8.10%), ascorbic acid content (55.97%) and anthocyanin content (116.80 mg/g) were observed under individual effect of nitrogen (100 kg $ha^{-1}$).

Nitrogen levels impact on all development characteristics this could be the result of a more nutrient-rich root zone for plant growth and development. Compared to plants grown at an ideal nitrogen supply, plants produced under adequate nitrogen supply have smaller leaves. This might due to better nutritional environment in the root zone for growth and development of plants. The presence of nitrogen in appropriate concentration in the plant is important in many vital activities that occur in the plant, such as the synthesis of

amino acids, which is the building unit of proteins as well as it is included in the synthesis of RNA and DNA and in the cells division.

Similar findings given by Kumar and Rawat (2002) [10] in cabbage cv. Pride of India, Biesiada *et al.* (2010) [3] Meena *et al.* (2010) [12] in cabbage variety Pride of India, Akand *et al.* (2015) [1] in cabbage, Farjana *et al.* (2019) [9] in cabbage, Ubaidy *et al.* (2019), Kavalgi *et al.* (2020) in red cabbage and Tameemi and Juboori (2020) [19] in red cabbage.

**Effect of boric acid**

Application of boric acid showed significantly effect on growth, yield and quality character of red cabbage. The level of boric acid 100 ml/L had significantly increased plant height (22.94 cm), diameter of stem (13.40 mm), stem length (10.84 cm) number of leaves per head (38.13), leaf area (172.72 $cm^2$) and number of outer leaves per plant (18.94) diameter of head (20.79 cm), height of head (15.56 cm), weight of head (827.76 g) and yield per plot (30.52 kg), yield per ha (356.74 q/ha) were recorded under individual effect of boric acid (100 ml $ha^{-1}$).Total soluble solid content (7.76%), ascorbic acid content (55.41%) and anthocyanin content (115.00 mg/g) were found under individual effect of boric acid (100 ml/L).

The effect of boric acid may be attributed to its useful role in physiological activities such as nutrient absorption and transfer to plant parts. It also plays a role in cell division and elongation in active growth areas, such as the apics of roots and meristematic tissues in the vegetative parts. Furthermore, boric acid regulates the rate at which plants absorb water and has a positive effect on the vital activities of enzymes, which increases the opportunity for plant growth. Boric acid stimulates root development with optimal vegetative growth and is necessary for several chemicals that are helpful to plants in different metabolic processes. Another explanation for this increased leaf yield with rising boric acid could be that the plants increased photosynthesis resulted in the production of more carbohydrates.

Similar findings given Thapa *et al.* (2016) [20] in broccoli, Jakhar *et al.* (2018) [8] in sprouting broccoli, Taheri *et al.* (2020) [18], Sadanand and Fatmi (2022) [16] in cabbage, Poudel *et al*. (2022) [15] in cauliflower and Doklega *et al.* (2022) [4].

**Interaction effect of nitrogen and boric acid**

The interaction effect of nitrogen and boric acid were found significant on growth characters likes number of leaves per head (42.07), leaf area (350.11 $cm^2$) and number of outer leaves per plant (20.96) with combined application of nitrogen (100 kg $ha^{-1}$) and boric acid (100 kg ml/L) while interaction effect of nitrogen and boric acid for plant height, diameter of stem and stem length were found non-significant. The interaction effect of nitrogen and boric acid were found significant on yield characters includes diameter of head (22.25 cm), height of head (17.02 cm) weight of head (821.20 g), yield per plot (35.38 kg) and yield per ha (405.54 q/ha) with combined application of nitrogen (100 kg $ha^{-1}$) and boric acid (100 kg $ha^{-1}$).The interaction effect of nitrogen and boric acid were found significant on quality parameters includes, total soluble solid content (8.27%), ascorbic acid content (56.11%) and anthocyanin content (118.95 mg/g) with combined application of nitrogen (100 kg $ha^{-1}$) and boric acid (100 ml/L).

Combined use of nitrogen and boric acid significantly increased the growth characters in red cabbage. This maximum number of outer leaves per plant under nitrogen boric acid levels were connected with increased plant height, leaf area per plant and number of leaves per plant. Application of nitrogen and boric acid has essential role in the development of crop yield. Combined use of nitrogen and boric acid significantly increased the growth, yield and quality characters in red cabbage. Similar findings given by Hossain *et al.* (2012) [6], Singh *et al*. (2015) [17], Metwaly (2016) [13] in broccoli, Manasa *et al.* 2017 [11] and Tameemi and Juboori (2020) [19] in red cabbage.

**Table 1:** Response of nitrogen and boric acid levels on growth, yield and quality of red cabbage

| Treatment | Plant Height (cm) | Diameter of stem (mm) | Stem length (cm) | No. of leaves per head | Leaf Area ($cm^2$) | No. outer leaves per plant | Diameter of head (cm) | Height of head (cm) | Weight of head (g) | Yield Per plot (kg) | Yield Per ha (q/ha) | Anthocyanin content (mg/g) | Total Soluble solid (%) | Ascorbic acid (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nitrogen (N)** | | | | | | | | | | | | | | |
| N0 | 20.60 | 11.77 | 9.65 | 33.72 | 150.63 | 15.78 | 18.99 | 13.30 | 694.26 | 26.89 | 250.97 | 113.82 | 7.41 | 53.44 |
| N1 | 21.94 | 12.34 | 10.32 | 34.97 | 170.26 | 17.01 | 19.70 | 14.79 | 708.78 | 28.83 | 295.78 | 114.73 | 7.53 | 55.00 |
| N2 | 22.76 | 12.83 | 10.81 | 36.81 | 183.51 | 18.40 | 20.98 | 15.77 | 789.72 | 30.93 | 356.70 | 115.00 | 7.71 | 55.41 |
| N3 | 23.91 | 13.39 | 10.97 | 38.57 | 210.97 | 19.44 | 21.87 | 16.59 | 862.81 | 32.39 | 420.98 | 116.80 | 8.10 | 55.97 |
| SE | 0.74 | 0.84 | 0.55 | 0.78 | 7.64 | 0.89 | 0.41 | 0.49 | 58.58 | 0.95 | 45.67 | 4.23 | 0.24 | 1.81 |
| CD | 1.39 | 1.76 | 1.15 | 1.62 | 10.86 | 1.84 | 0.85 | 1.01 | 120.49 | 1.98 | 100.43 | 8.77 | 0.51 | 3.76 |
| **Boric acid (B)** | | | | | | | | | | | | | | |
| B0 | 21.42 | 12.53 | 10.37 | 35.57 | 143.79 | 15.70 | 19.86 | 14.46 | 685.45 | 28.44 | 275.65 | 113.82 | 7.61 | 53.44 |
| B1 | 22.40 | 13.20 | 10.53 | 37.35 | 166.52 | 16.67 | 20.50 | 15.31 | 778.47 | 29.80 | 330.98 | 114.73 | 7.69 | 55.00 |
| B2 | 22.94 | 13.40 | 10.84 | 38.13 | 172.72 | 18.94 | 20.79 | 15.56 | 827.76 | 30.52 | 356.74 | 115.00 | 7.76 | 55.41 |
| SE± | 0.66 | 0.73 | 0.49 | 0.68 | 6.60 | 0.77 | 0.35 | 0.42 | 50.73 | 0.82 | 38.36 | 3.66 | 0.21 | 1.57 |
| CD | 1.23 | 1.52 | 1.00 | 1.41 | 9.59 | 1.60 | 0.74 | 0.88 | 105.21 | 1.71 | 84.21 | 7.60 | 0.44 | 3.25 |

**Table 2:** Interaction effect of nitrogen and boric acid on growth, yield and quality of red cabbage

| Treatment | No. of leaves per head | Leaf Area ($cm^2$) | No. of outer leaves per plant | Diameter of head (cm) | Height of head (cm) | Weight of head (g) | Yield Per plot (kg) | Yield Per ha (q/ha) | Anthocyanin content (mg/g) | Total Soluble solid (%) | Ascorbic Acid (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N0 B0 | 32.84 | 215.23 | 16.73 | 18.22 | 12.24 | 512.1 | 25.92 | 223.90 | 112.70 | 7.36 | 52.33 |
| N0 B1 | 34.23 | 281.75 | 17.21 | 19.49 | 14.08 | 650.3 | 29.26 | 310.50 | 113.12 | 7.51 | 54.79 |
| N0 B2 | 37.01 | 298.67 | 17.88 | 20.30 | 15.45 | 758.0 | 30.51 | 400.80 | 115.57 | 7.63 | 55.27 |
| N1 B0 | 36.23 | 323.52 | 19.69 | 21.42 | 16.09 | 821.4 | 32.08 | 350.87 | 116.88 | 7.95 | 55.80 |
| N1 B1 | 33.88 | 277.08 | 16.95 | 19.26 | 13.64 | 627.0 | 25.96 | 304.70 | 112.70 | 7.41 | 53.38 |
| N1 B2 | 34.46 | 288.86 | 18.50 | 19.52 | 15.05 | 718.4 | 30.00 | 375.43 | 113.22 | 7.53 | 54.97 |
| N2 B0 | 39.66 | 297.19 | 18.68 | 21.29 | 15.90 | 792.6 | 30.58 | 390.58 | 115.71 | 7.72 | 55.33 |
| N2 B1 | 41.44 | 349.28 | 18.77 | 21.95 | 16.66 | 821.2 | 30.22 | 356.90 | 117.58 | 8.10 | 55.99 |
| N2 B2 | 34.46 | 280.60 | 17.70 | 19.47 | 14.03 | 643.7 | 28.80 | 380.86 | 113.09 | 7.48 | 54.63 |
| N3 B0 | 38.20 | 318.89 | 18.34 | 20.10 | 15.25 | 757.7 | 32.71 | 405.54 | 114.87 | 7.54 | 55.27 |
| N3 B1 | 39.77 | 322.99 | 20.55 | 21.35 | 15.96 | 818.6 | 31.70 | 370.65 | 116.74 | 7.77 | 55.66 |
| N3 B2 | 42.07 | 350.11 | 20.96 | 22.25 | 17.02 | 975.9 | 35.38 | 389.76 | 118.95 | 8.27 | 56.11 |
| SE± | 1.35 | 12.24 | 1.54 | 0.71 | 0.84 | 101.47 | 1.62 | 79.04 | 7.33 | 0.42 | 3.14 |
| CD | 2.82 | 18.78 | 3.20 | 1.48 | 1.76 | 210.43 | 3.43 | 178.03 | 15.20 | 0.88 | 6.51 |

## Conclusion

From present investigation it is concluded that, for increasing growth, yield and quality parameters of red cabbage, application of nitrogen and boric acid is essential. The application of 100 kg N $ha^{-1}$ and 100 B ml/L was observed beneficial for producing better growth, yield and quality of red cabbage. Therefore, application of 100 kg N and 100 ml/L B per hectare can be recommended for red cabbage in Marathwada conditions.

## References


1. Akand H, Mazed K, Pulok AI, Moonmoon JF, Partho SG. Influence of different dose of nitrogen on the growth and yield of cabbage (*Brassica oleracea* var. *capitate* L.). Int. J Multidiscip Res Dev. 2015;2:11-14.
2. Arakari HR, Chalam LV, Satyanarayana P, Donathus KL. Soil Management in India. Asia Publ House. Mumbai; c1956.
3. Biesiada A, Nawirska-Olszanska A, Kucharska A, Sokol-Letowska A, Kedra K. The effect of nitrogen fertilization on nutritive value and antioxidative activity of red cabbage. Acta Sci Pol Hortorum Cultus, 2010, 9(2).
4. Doklega SM, El-Ezz SFA, Mostafa NA, Dessoky ES, Abdulmajeed AM, Darwish DBE, *et al*. Effect of Titanium and Vanadium on Antioxidants Content and Productivity of Red Cabbage. Horticulture. 2022;8(6):481.
5. Farjana S, Islam MA, Haque T. Effects of organic and inorganic fertilizers, and mulching on growth and yield of cabbage (*Brassica oleracea* var. *capitata* L.). J Horticulture Postharvest Res. 2019;2(2):95-104.
6. Hossain MF, Ara N, Uddin MR, Dey S, Islam MR. Effect of time of sowing and plant spacing on broccoli production. Trop Agric Res Ext. 2012, 14(4).
7. Ismail A, Marjan ZM, Foong CW. Total antioxidant activity and phenolic content in selected vegetables. Food Chem. 2004;87:581-586.
8. Jakhar RK, Singh SP, Ola AL, Jat HR, Netwal M. Effect of NAA and boron levels on growth and quality of sprouting broccoli (*Brassica oleracea* (L.) var. *italica* Plenck). J Pharmacognosy Phytochemistry. 2018;7(5):3402-3405.
9. Kavalgi A, Rajyalakshmi R, Jyothi KU, Uma Krishna K. Studies on the Effect of Planting Dates on Growth, Yield Components and Quality of Red Cabbage (*Brassica oleracea* var. *capitata* f. *rubra*). Int. J Curr Microbiol Appl Sci. 2019;8:2219-2225.
10. Kumar M, Rawat TS. Effect of nitrogen and spacing on the quality and yield of cabbage (*Brassica oleracea* L. var. *capitata*). Agric Sci Digest. 2002;22(2):90-92.
11. Manasa S, Mukunda L, Sadarunnisa S, Rajasekharam T. Studies on Effect of Spacing on Yield and Yield Attributing Parameters of Red Cabbage (*Brassica oleracea* L. var. *capitata* f. *rubra*). Int. J Curr Microbiol Appl Sci. 2017;6(12):3143-3147.
12. Meena ML, Ruber L, Mallik I, Ram RB, Divya M. Influence of spacing and nitrogen level on growth and yield of cabbage. Mysore J Agric. Sci. 2010;44(4):777-780.
13. Metwaly EE. Effect of nitrogen and boron fertilization on yield and quality of broccoli. J Plant Prod. 2016;7(12):1395-1400.
14. National Horticulture Board. Indian Journal of Agriculture Database; c2018-2019. p. 1-3.
15. Poudel N, Baral P, Neupane M, Shrestha SM, Shrestha AK, Bhatta S, *et al*. Effect of boron on growth and yield parameters of cauliflower (*Brassica oleracea* var. *botrytis* cv *Snow Mystique*) in Terhathum, Nepal. Int. J Appl. Sci Biotechnol. 2022;10(1):41-49.
16. Sadanand S, Fatmi U. Effect of organic and inorganic fertilizers on growth, quality and yield of red cabbage (*Brassica oleracea* var. *capitata* f. *Rubra*) cv. Red Jewel. Pharma Innov J. 2022;11(3):2046-2048.
17. Singh MK, Chand T, Kumar M, Singh KV, Lodhi SK, Singh VP, *et al*. Response of different doses of NPK and boron on growth and yield of broccoli (*Brassica oleracea* L. var. *italica*). Int. J Bioresour. Stress Manage. 2015;6(Feb, 1):108-112.
18. Taheri RH, Miah MS, Rabbani MG, Rahim MA. Effect of different application methods of Zinc and Boron on growth and yield of cabbage. Eur. J Agric. Food Sci. 2020, 2(4).
19. Tameemi AJ, Juboori AW. Effect of levels and frequency of nitrogen application and the foliar spraying of boron on growth and yield of red cabbage. Int. J Agric. Stat Sci. 2020;16:1667-1671.
20. Thapa U, Prasad PH, Rai R. Studies on Growth, Yield and Quality of Broccoli (*Brassica oleracea* L. Var *Italica Plenck*) as Influenced by Boron and Molybdenum. J Plant Nutr. 2016;39(2):261-267.

21. Ubaidy MR, Mohammed MM, Al-Zaidy AK. Influence of chemical fertilizers and foliar spraying with humic acid on growth and yield of Red Cabbage. Biochem Cell Arch. 2019, 19(1).
22. Wojciechowska RS, Kołton A. The content of some nutrients in red cabbage yield depending on the form of nitrogen fertilizer. 2007;41:667-671.