International Journal of Multidisciplinary Research and Development

IJMRD 2015; 2(2):11-14
www.allsubjectjournal.com
Received: 16-01-2015
Accepted: 04-02-2015
E-ISSN: 2349-4182
P-ISSN: 2349-5979
Impact factor: 3.762

Juthika Paul
MS in Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

Md. Hasanuzzaman Akand
Professor, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207. Bangladesh.

H. E. M. Khairul Mazed
MS Student, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

Md. Ashraful Islam Pulok
MS Student, Seed Technology Discipline, Sher-e-Bangla Agricultural University, Dhaka-1207. Bangladesh.

Subrato Gope Partho
MS Student, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

Correspondence:
H. E. M. Khairul Mazed
MS Student, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

Influence of different doses of nitrogen on the growth and yield of cabbage (*Brassica oleracea* var. *capitata* l.)

Juthika Paul, Md. Hasanuzzaman Akand, H. E. M. Khairul Mazed, Md. Ashraful Islam Pulok, and Subrato Gope Partho

Abstract
An experiment was conducted in the Horticultural Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2013 to February 2014 to find out the influence of different dose of nitrogen on growth and yield of cabbage. The experiment was laid out in RCBD with five replications. The experiment considered three dose of nitrogen; N_0 =0 kg, N_1 =150 kg and N_2 =200 kg N ha^{-1}. For nitrogen, N_2 gave the maximum thickness (20 cm) and highest yield (61.57 t/ha) and N_0 gave the minimum thickness (18.66 cm) and lowest yield (49.53 t/ha). So, 200 Kg N ha^{-1} may be used for cabbage cultivation.

Keywords: Cabbage, nitrogen, growth and yield.

1. Introduction
Cabbage (*Brassica oleracea* var. *capitata* L.) belongs to the family Cruciferae and is biennial herbacious in nature. It is one of the important vegetables crop in Bangladesh. The origin of cabbage is the Western Europe and north shores of the Mediterranean Sea (Chauhan, 1986). Cabbage was reported to be grown in the subcontinent during Mughal period, but the vegetable become popular during British rule (Bose and Som, 1986). In Bangladesh cultivation of cabbage is mainly in winter months. The edible portion of cabbage plant is head which is formed by the fleshy leaves overlapping one another. It has been reported that 100 g of green edible portion of cabbage contains 92% water, 24 kilocalories of food energy, 1.5 g of protein, 4.8 g of carbohydrate, 40 mg of calcium, 0.6 mg of iron, 600 IU of carotene, 0.05 mg of riboflavin, 0.3 mg of niacin and 60 mg of vitamin C (Rashid, 1993).
Cabbage occupied an area of 11.33 thousand hectares of land during 1999-2000 growing season with a total production of 112 thousand metric tons in Bangladesh (BBS, 2000). Thus the average yield was 9.39 t/ha. This is considered as low yield compared to that of other countries of the world, viz. South Korea (61.17 t/ha), Germany (54.81 t/ha.), Japan (40.32 t/ha) and India (19.10t/ha). Such a poor yield attributed to a greater extent on the method of production technology followed by the farmers.
Higher yield of cabbage is related to judicious application of fertilizer proper cultural management etc. Nitrogen can play vital role on the vegetative growth of the plant. A plant deficient in the nitrogen will tend to make little growth having usually is small leaves of yellowish in nature, frequently being rather brittle and thin. If a plant is supplied optimum amount of nitrogen, there is a tendency to increase leaf cell number and cell size with an overall increase in leaf production (Morton and Waston, 1948). Nitrogen plays an important role in the building up of protoplasm and protein which induce cell division and initiate meristematic activities when applied in optimum quantity. Low nitrogen availability causes a decrease in cell size especially cell division. Considering the above facts, the present investigation was undertaken with the following objectives to know the optimum dose of nitrogen on growth and yield of cabbage.

2. Materials and method
The research work was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, and Dhaka, Bangladesh during the period from October, 2013 to February, 2014. The location of the site was 23.714° N Latitude and 90.335° E Longitude with the elevation of 8.2 meter from the sea leve.

The experimental site is situated in subtropical zone, the macro climate is characterized by heavy rainfall during the months from April to September (Kharif season) and scantly rainfall during the rest month of the year (Rabi season). The variety of cabbage used in the experiment was "Atlas-70". The seeds were collected from a seed trader of China seed store, Dhaka. Twenty grams of seeds were sown in two seed bed. The seeds were sown in the seed bed on 25 October, 2013. The experiment consisted of three dose of nitrogen; N_0 =0 kg, N_1 =150 kg and N_2 =200 kg N ha^{-1}. The experiment was laid out in the Randomized Complete Block Design (RCBD) with five replications. There were 20 unit plots altogether in the experiment. The size of the plot was 1.8 m x 1.2 m. Seedlings were transplanted on the plots with 60 cm x 45 cm spacing. The land was opened on 02 November, 2013 with the help of the power tiller and then it was kept open to sun for seven days prior to further ploughing, cross ploughing followed by laddering. A fertilizer dose of 10 ton ha^{-1} of cow dung and 150-175 kg ha^{-1} of TSP, MP was applied at the time of final land preparation. Urea was applied @ 200 kg ha^{-1} at three times equal splits at 15, 30 and 45 days after transplanting (DAT) (BARI, 2012). Thirty days old healthy and uniform sized seedlings were transplanted in the experimental plots on 25 November, 2013. Spraying was done 25 days after transplanting. An adhesive Tween-20 @ 0.1% was added to each solution according to (Roy *et al.* 1991). Control plots were treated only with distilled water. The crop was harvested during the period from 20 to 30 January, 2014 when the plants formed compacted heads.

Five plants were selected at random at the time of collecting data from each plot and mean data on the following parameters: plant height (cm), number of leaves per plant, spread of plant (cm), stem length (cm), stem diameter (cm), number of roots per plant, root length (cm), length of large leaf (cm), width of large leaf (cm), diameter of head (cm), thickness of head (cm), percent dry matter of head, yield per plot (kg) and yield per hectare (ton) were recorded. The mean value for all the treatments was calculated and the analysis of variance for most of the characters was accomplished by F variance test. The significance of difference between pair of means was tested by the Least Significant Difference (LSD) test at 5% level of probability (Gomez and Gomez, 1984).

3. Results and discussion

3.1 Plant height

Different levels of nitrogen showed significant variation on plant height at different days after transplanting (DAT) (Figure 1). At 60 DAT, the maximum plant height (36.82 cm) was obtained from N_2 (200 Kg ha^{-1}) and the minimum (33.30 cm) was recorded from N_0 (0 Kg ha^{-1}). Hossain (1998) obtained the maximum plant height from 250 kg N/ha. Pramanik (2007) reported that the maximum plant height was obtained with 260 kg N/ha.

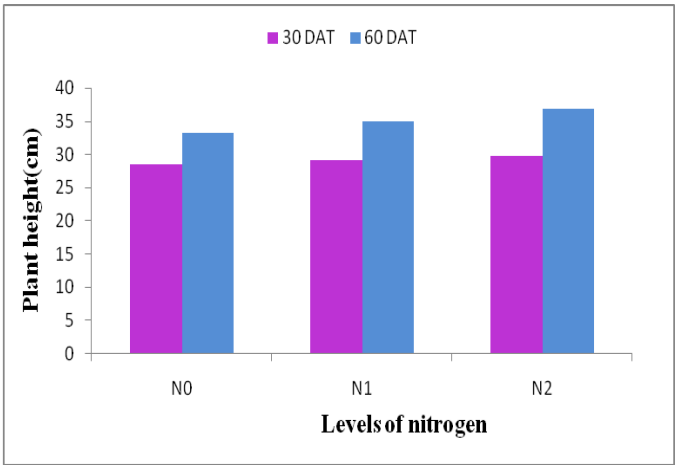

Fig 1: Effect of nitrogen on the height of cabbage plant.

3.2 Number of leaves per plant

Different levels of nitrogen showed significant variation on number of leaves per plant at different days after transplanting (DAT) (Figure 2). At 60 DAT the maximum leaves per plant (14.30) was obtained from N_2 (200 Kg ha^{-1}) and the minimum (12.73) was recorded from N_0 (0 Kg ha^{-1}). Man and Sandhu (1956) reported maximum number of leaves by 168 kg/ha N application. Khadir *et al.* (1989) obtained increased number of leaves per plant from 276 kg N/ha. Hossain (1998) obtained maximum number of leaves per plant from 250 kg N/ha.

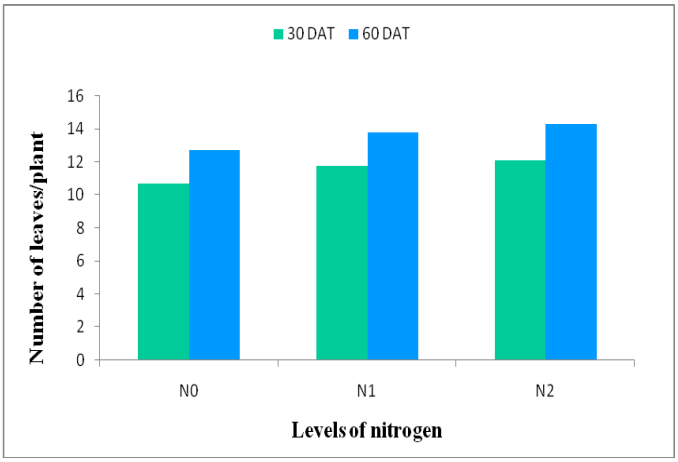

Fig 2: Effect of nitrogen on the number of leaves per cabbage plant.

3.3 Spread of plant

Different levels of nitrogen showed significant variation on plant spreading at different days after transplanting (DAT) (Table 1). At 60 DAT, the maximum plant spreading (57.14 cm) was obtained from N_2 (200 Kg ha^{-1}) and the minimum (54.99 cm) was recorded from N_0 (0 Kg ha^{-1}). Khadir *et al.* (1989) obtained increased plant growth from 276 kg N/ha. Pramanik (2007) reported that the maximum spread of plant was obtained from 260 kg N/ha.

3.4 Length of stem

Different levels of nitrogen showed significant variation on stem length (Table 1). The maximum stem length (7.79 cm) was observed in N_2 (200 Kg ha^{-1}) and the minimum (6.90 cm) was found from N_0 (0 Kg ha^{-1}) Pramanik (2007) reported that the maximum length of stem was obtained from 260 kg N/ha.

Table 1: Effect nitrogen on spread of plant, stem and root characteristics of cabbage

Treatments	Spread of plant (cm) at		Stem characteristics		Root characteristics	
	30 DAT	60 DAT	Length (cm)	Diameter (cm)	Number of roots/plant	Root length (cm)
N_0	41.96	54.99	6.90	3.51	36.78	19.39
N_1	43.27	56.08	7.52	3.90	41.42	21.71
N_2	44.48	57.14	7.79	4.03	43.26	22.97
LSD $_{(0.05)}$	1.001	1.026	0.199	0.167	2.349	1.822
CV (%)	8.86	9.21	3.16	5.17	6.85	10.08

3.5 Diameter of stem

Different levels of nitrogen showed significant variation on stem diameter (Table 1). The maximum stem diameter (4.03 cm) was observed in N_2 (200 Kg ha^{-1}) and the minimum (3.51 cm) was obtained from N_0 (0 Kg ha^{-1}). Pramanik (2007) reported that the maximum diameter of stem was obtained from 260 kg N/ha.

3.6 Number of roots per plant

Different levels of nitrogen showed significant variation on roots per plant (Table 1). The highest number of roots per plant (43.26) was observed in N_2 (200 Kg ha^{-1}) and the lowest number (36.78) was found from N_0 (0 Kg ha^{-1}). Hossain (1998) obtained the maximum number of lateral roots from 250 kg N/ha. Pramanik (2007) reported that the maximum number of roots per plant was obtained from 260 kg N/ha.

3.7 Length of root

Different levels of nitrogen showed significant variation on root length (Table 1). The longest root (22.97 cm) was obtained from N_2 (200 Kg ha^{-1}) and the minimum (19.39 cm) was found for N_0 (0 Kg ha^{-1}). Pramanik (2007) reported that the maximum length of root was obtained from 260 kg N/ha.

Table 2: Effect of nitrogen on leaf and head characteristics of cabbage

Treatments	Characteristics of large leaf		Head characteristics		Dry matter Of head (%)	Yield per plot (kg)
	Length (cm)	Width (cm)	Diameter (cm)	Thickness (cm)		
N_0	33.10	26.39	10.73	18.66	7.02	10.70
N_1	34.58	28.25	11.71	19.42	7.93	12.22
N_2	35.44	30.04	12.43	20.00	8.97	13.30
LSD $_{(0.05)}$	0.923	1.279	0.601	0.884	0.017	1.08
CV (%)	3.17	5.35	6.11	5.40	8.44	9.93

3.8 Length of large leaf

Different levels of nitrogen showed significant variation on length of large leaf (Table 2). The maximum leaf length (35.44 cm) was observed in N_2 (200 Kg ha^{-1}) and the minimum (33.10 cm) was found in N_0 (0 Kg ha^{-1}). Man and Sandhu (1956) reported that the largest leaf size was obtained from 168 kg/ha N application. Pramanik (2007) reported that the maximum length of large leaf was obtained from 260 kg N/ha.

3.9 Width of large leaf

Different levels of nitrogen showed significant variation on width of large leaf (Table 2). The maximum leaf width (30.04 cm) was observed in N_2 (200 Kg ha^{-1}) and the minimum (26.39 cm) was recorded from N_0 (0 Kg ha^{-1}).

3.10 Diameter of head

Different levels of nitrogen showed significant variation on head diameter (Table 2). The maximum head diameter (12.43 cm) was observed in N_2 (200 Kg ha^{-1}) and the minimum (10.73 cm) was found in N_0 (0 Kg ha^{-1}). Man and Sandhu (1956) reported bigger heads by 168 kg/ha N application. Hossain (1998) obtained maximum head diameter from 250 kg N/ha.

3.11 Thickness of head

Different levels of nitrogen showed significant variation on head thickness (Table 2). The maximum head thickness (20.00 cm) was observed in N_2 (200 Kg ha^{-1}) and the minimum (18.66 cm) was found from N_0 (0 Kg ha^{-1}). Man and Sandhu (1956) reported heavier heads by 168 kg/ha N application. Batsei *et al.* (1979) reported highest head weight at 240 kg N/ha. Csizinszky and Schyster (1985) observed that the high N rate (257 kg/ha) increased head size. Hossain (1998) obtained the maximum head thickness from 250 kg N/ha.

3.12 Percent dry matter of head

Different levels of nitrogen showed significant variation on dry matter content of head (Table 2). The maximum dry matter content (8.97 %) was observed from N_2 (200 Kg ha^{-1}) and the minimum (7.02 %) was found from N_0 (0 Kg ha^{-1}). Lawande *et al.* (1986) found 240 kg N/ha was good for cabbage yield. Hill (1990) reported that the maximum

marketable yield of 126.6 t/ha and 123.6 t/ha with the N-rates of 200 and 300 kg/ha, respectively and the yield decreased when the N-rate was increased to 400 kg/ha. Hossain (1998) obtained maximum marketable yield from 250 kg N/ha. Pramanik (2007) reported that the maximum dry matter content of head was obtained from 260 kg N/ha.

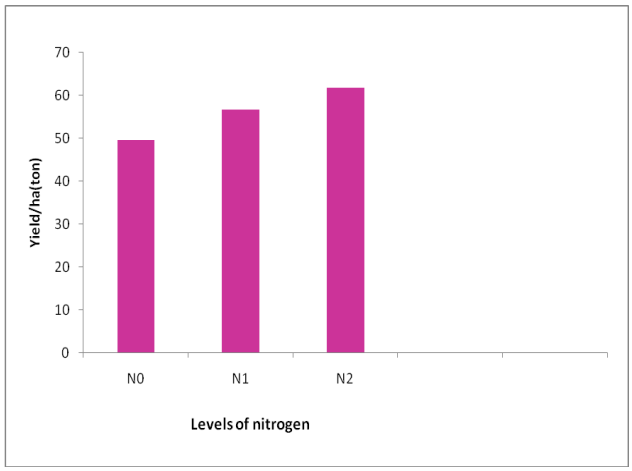

Fig 3: Effect of nitrogen on yield of cabbage.

3.13 Yield per plot

Different levels of nitrogen showed significant variation on yield per plot (Table 2). The highest yield per plot (13.30 kg) was observed in N_2 (200 Kg ha^{-1}) and the lowest (10.70 kg) was found in N_0 (0 Kg ha^{-1}). Singh and Naik (1988) found that 180 kg N/ha performed the highest yield.

3.14 Yield per hector

Different levels of nitrogen showed significant variation on yield per ha (Figure 3). The highest yield (61.57 t/ha) was observed from N_2 (200 Kg ha^{-1}) and the lowest (49.53 t/ha) was found in N_0 (0 Kg ha^{-1}). Singh and Naik (1988) found that 180 kg N/ha performed the highest yield.

4. Conclusion

The maximum (13.30 kg) yield per plot was recorded from N_2 (200 Kg ha^{-1}) and the minimum (10.70 kg) was recorded from N_0 (0 Kg ha^{-1}) at 60 DAT .The maximum (61.57 ton) yield per ha was recorded from N_2 (200 Kg ha^{-1}) and the minimum (49.53 ton) was recorded from N_0 (0 Kg ha^{-1}) at 60 DAT. So, 200 Kg N ha^{-1} may be used for cabbage cultivation.

5. References

1. BARI, Fertilizer Recommendation Guide. Published by Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh, 2012, 56.
2. Batsei SI, Polyakov AA, Nedel RF. Effect of organic mineral fertilizers on the yield and quality of irrigated late white cabbage. Khimiya V. Sel. Skon hhozyistve 1979; 17(3):18-20.
3. BBS, Monthly Statistical Bulletin of Bangladesh Bureau of Statistics, Ministry of planning, Govt. of the people's republic of Bangladesh, Dhaka, 2000, 136.
4. Bose TK, Som MG. Vegetable Crops in India. Naya Prokash, Calcutta, India, 1986, 167-180.
5. Chauhan, OVS. Vegetable production in India. Ram Prasad and sons, India, 1986, 131-140.
6. Csizinszky AA, Schyster DJ. Response of Cabbage to insecticide schedule, plant spacing and fertilizer rates. J Amer Soc Hort Sci 1985; 110(6):888-893.
7. Gomez AK, Gomez AA. Statistical Procedures for Agricultural Research. Second Edition. John Wiley and Sons, New York, U.S.A, 1984.
8. Hill TR. Effect of plant spacing and nitrogenous fertilizer on the yield and plant conformation of Chinese cabbage. Australian J Eapcri Agric 1990; 30(3):437-439.
9. Hossain ATZ. Effect of different planting time, spacing and nitrogen on growth and yield of cabbage. Ann Agrill Res 1998; 14(2):1-4.
10. Khadir GA, Marazat S.K, Doun SA. Effect of different levels of urea fertilizer and plant spacing on growth and yield of cabbage. Dirasat 1989; 16(9):88-105.
11. Lawande KE, Bhore DP, Kale PN, Patil JD. Effects of spacing, nitrogen, phosphrus and potassium on yield and yield contributing characters of cabbage. J Maharashtra Agril Univ 1986; 11(2):192-196.
12. Man KS, Sandhu BB. On the nitrogen requirement of cabbage. Indian J Hort 1956; 12:188-195.
13. Moazzama K. Effect of different doses of GA_3 and potassium on growth and yield of cabbage. MS Thesis. Dept of Hort. SAU, Dhaka, 2008, 24-47.
14. Morton AG, Waston DJ. A physiology study of leaf growth. Ann Bot 1948; 12:281.
15. Pramanik S. Effect of nitrogen and phosphorus on the growth and yield of cabbage. MS Thesis. Dept of Hort. SAU, Dhaka, 2007, 21-42.
16. Rashid MM. Sabjibiggan. Bangla Academy, Dhaka, 1993, 189-196.
17. Roy DSK, Kabir J, Chatterjee R, Mitra SK. Effect of post-harvest foliar spray of some chemicals on storage behavior of onion. Onion for the tropics 1991; 3:23-25.
18. Singh RV, Naik LB. Repose of cabbage to plant spacing nitrogen and phosphorus levels. Indian J Hort Sci 1988; 39(2):1026-1028.