

GROWTH AND YIELD ATTRIBUTES OF CAULIFLOWER (*Brassica oleracea* var. *botrytis* L.) AS INFLUENCED BY SPACING AND NITROGEN FERTILIZER**M. M. Ud-Deen* and S. Islam**

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ABSTRACT

To observe the growth and yield attributes of cauliflower under different spacing and nitrogen fertilizers, a field experiment was conducted with cauliflower (*Brassica oleracea* var. *botrytis* L.) variety "BARI Phulcopi-1 (Rupa)". The experiment was carried out at the research field of the Department of Crop Science and Technology, Rajshahi University, Rajshahi during the period from November, 2021 to February, 2022. The experiment consisted of three spacing i.e. 60cm X 50cm, 60cm X 60cm and 60cm X 70cm as well as three levels of nitrogen fertilizers viz. 80kg/ha, 100kg/ha and 120 kg/ha. The results revealed that different treatments significantly affected the growth and yield attributes of cauliflower. The combination of 60cm X 70cm spacing with highest level of nitrogen fertilizer (120 kg/ha) produced the maximum plant height, leaf length, leaf breadth, curd diameter, curd height, curd weight/plant and yield whereas 60cm X 60cm and highest level of nitrogen fertilizer produced the highest no. of leaves/plant and days to curd initiation. On the other hand, all the studied parameters except days to curd initiation found to be lowest in the treatment combination of 60cm X 50cm spacing with lower level of nitrogen fertilizer (80 kg/ha). The study concluded that cauliflower need to be cultivated at 60cm X 70cm spacing and 120 kg/ha nitrogen fertilizer is to be applied for getting the targeted yield as well as desired return from cauliflower cultivation in "High Ganges River Floodplain zones" of Bangladesh.

Key words: Spacing, nitrogen fertilizer, growth and yield, cauliflower

Introduction

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is a biannual and herbaceous vegetable crop belonging to the family Cruciferae. It is one of the popular winter vegetables in Bangladesh. Cauliflower thrives best in a cool moist climate and it does not withstand very low temperature or too much heat (Din *et al.*, 2007). It is a very tasty and one of the popular winter vegetables in Bangladesh as well as all over the world. 100g edible part of cauliflower contains 89% moisture, 8.0g carbohydrate, 2.3g protein, 40 LU carotene, 0.13mg vitamin B₁, 0.11 mg vitamin B₂, 50mg vitamin C, 30mg calcium and 0.8mg iron and also contains 30 calorie (Rashid, 1993). Edible part of cauliflower is commonly known as 'Curd'. Vegetable consumption in Bangladesh is very low, only 32 g per person per day against the minimum recommended quantity of 200g per day (FAO, 2010). The total vegetable production in Bangladesh is far below the requirement. In 2016- 2017, cauliflower covered an area of 48,725 acres with a total production of 277,500 metric tons (BBS, 2017). The success or failure of cauliflower production is largely depends upon climate, especially temperature and this relationship is very intensive and complex. The life cycle of cauliflower is divided into three stages based on the effect of temperature; they are vegetative growth stage, curd initiation stage and reproductive stage. The suitable temperature for growth stages ranging from 20±5°C. The best temperature for curd growth and development is 15 to 20°C. Cauliflower thrives best in a cool moist climate and it does not withstand very low temperature or too much heat (Din *et al.*, 2007). The temperature in the country remains higher up to mid October after which gradually comes down in mid-December and extends up to mid-February. The temperature increases sharply thereafter. Optimum plant spacing is important for crop production through efficient utilization of light, nutrients and water by the plants. In some cases higher plant population adversely affect yield per unit area hampering vegetative and reproductive growth of plant specially head size and delay in seed maturity. So, it is essential to maintain optimum plant spacing for maximum seed yield of cauliflower. Baloch (1994) recommended that relatively wide spacing (60cm × 60 cm) promotes earliness and larger heads, but yield and number of curds usually increased by close spacing (45cm × 45cm). Increase the plant density limits the availability of space for lateral growth, resulting in increase in plant height (Pandita *et al.*, 2005). Again, the nitrogen (N) is essentially required

nutrients for plant growth and curd development and their recommendation for cauliflower may differ with the soil type and availability of these essential nutrients in the soil (Giri *et al.*, 2013). The positive effect of N on the growth and yield of cauliflower is well documented. A very few research have so far been done with combined application of spacing and nitrogen fertilizer in cauliflower. Keeping in view, the present experiment was conducted to find out the suitable spacing and level of nitrogen fertilizer on the growth and yield of cauliflower cultivation in “High Ganges River Floodplain zones” of Bangladesh.

Materials and Methods

The experiment was carried out at the research field of Department of Crop Science and Technology, University of Rajshahi, Rajshahi, during the period from November, 2021 to February, 2022 with cauliflower (*Brassica oleracea* var. *botrytis* L.) variety “BARI Phulcopi-1 (Rupa)”. The study area is located at 24. 370° N and 88.637° E latitude and 200 cm from the sea level and was belonging to the Agro Ecological Zone (AEZ-11) “High Ganges River Floodplain”. The soil was sandy loam in texture with pH 5.47. The experimental area is under the sub-tropical climate that is characterized by less rainfall associated with moderately low temperature during *rabi* season, (October-March) and high temperature, high humidity and heavy rainfall with occasional gusty winds during *kharif* season (April-September). The two factors Randomized Complete Block Design (RCBD) with three replications was followed to carried out the study. The study consisted three spacing (factor A) i.e. S₁= 60cm X 50cm, S₂= 60cm X 60cm and S₃= 60cm X 70cm as well as three levels of nitrogen fertilizers (factor B) viz. N₁: 80kg/ha, N₂: 100 kg/ha and N₃: 120 kg/ha. The unit plot size was 3m X 3.5m. The seed of cauliflower was collected from the Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. Seeds of variety BARI Phulcopi-1 (Rupa) were sown in the nursery beds at an interval of 10 days started from 20 September. Beds were immediately irrigated with the help of watering cane. After germination, when the seedlings were attained at a height of 3 cm then the seedlings were transplanted in the other nursery beds 10 cm apart for proper growth and development of the seedlings. Thirty days old seedlings were transplanted in the evening time in the experimental plot according to the treatment. Healthy seedlings of uniform size were selected for planting. Before transplantation, the nursery beds were irrigated so that the seedlings could be easily uprooted from the beds without any damage of the root. After one week of transplantation, dead seedlings were replaced by planting fresh seedlings to obtain a uniform stand. Fertilizers were applied following the guidelines of Rashid (1993). Intercultural operations were done as and when necessary. Data were recorded for desired parameters from the sample plants at harvest. Ten plants were randomly selected from each unit plot for the collection of data. The collected data were analyzed using computer package MSTAT and mean differences were adjudged by using Duncan’s Multiple Range Test following Gomez and Gomez (1984).

Results and Discussion

Effect of spacing: Observations on growth and yield attributes of cauliflower revealed that spacing differed significantly in respect of plant height, leaf length, leaf breadth, curd diameter, curd length, curd weight/plant and yield (Table 1). The highest values of all the above parameters (64.24cm, 59.03cm, 26.37cm, 21.57cm, 13.67cm, 1.97kg and 27.369 t/ha) were found from 60cm X 70cm whereas the lowest values (54.69cm, 52.67cm, 20.03cm, 19.54cm, 11.83cm, 1.67kg and 24.98t/h) of those parameters were observed from 60cm X 50cm spacing. No. of leaves/plant and days to curd initiation was statistically non significant. This may be due to the wider spacing where plant received more nutrients, space, aeration and sunlight for better curd growth and development which increased curd diameter and enhanced more branching. The above findings were agreed by Rahman *et al.* (2007), where they revealed that wider spacing gave the highest yield attributes and yield of cauliflower than closer spacing, respectively.

Effect of nitrogen fertilizer: Plant characters and yield varied significantly in response to different levels of nitrogen fertilizer (Table I). The higher level of nitrogen (120 kg/ha) showed superiority in respect of plant height (61.93cm), no. of leaves/plant (17.10), leaf length (57.93cm), leaf breadth 79.89cm), days to curd initiation (53.93), curd diameter (23.50cm), curd length (14.17cm), curd weight/plant (2.15kg) and

yield (28.63t/ha). Except no. of leaves/plant and days to curd initiation, the lowest values of all the above parameters (56.76cm, 52.70cm, 78.78cm, 17.77cm, 11.48cm, 1.67kg and 22.82t/ha) were recorded from 80kg N/ha. Nitrogen at the rate of 100kg/ha produced the lowest no. of leaves/plant (15.13) and days to curd initiation (48.93). Farooq *et al.* (2009) reported that plant height, leaf length and yield of cauliflower were maximum at higher nitrogen level. Westerveld *et al.* (2003) also recorded the higher yield contributing characters and yields by high nitrogen fertilizer management in cauliflower.

Table 1. Main effect of spacing and nitrogen fertilizer on the growth, yield attributes and yields of cauliflower

Treatments	Plant height (cm)	No. of leaves/plant	Leaf length (cm)	Leaf breadth (cm)	Days to curd initiation	Curd diameter (cm)	Curd length (cm)	Curd weight/plant (kg)	Yield (t/ha)
Spacing									
S ₁	54.69c	14.93a	52.67c	20.03c	52.68a	19.54b	11.83b	1.67b	24.98b
S ₂	58.96b	15.38a	54.02b	24.50b	51.53a	20.02b	12.53b	1.85ab	25.78b
S ₃	64.24a	16.15a	59.03a	26.37a	51.47a	21.57a	13.67a	1.97a	27.36a
CV (%)	0.92	3.87	2.42	5.12	2.25	4.14	6.12	13.33	3.09
LSD (5%)	0.543	1.507	1.338	1.210	1.166	0.845	0.775	0.244	0.803
Nitrogen fertilizer									
N ₁	56.76c	15.23b	52.70c	78.78b	52.81a	17.77c	11.48c	1.67b	22.82c
N ₂	59.21b	15.13b	55.09b	79.88a	48.93b	19.96b	12.38b	1.67b	26.67b
N ₃	61.93a	17.10a	57.93a	79.89a	53.93a	23.50a	14.17a	2.15a	28.63a
CV (%)	0.92	9.73	2.42	5.12	2.25	4.14	6.12	13.33	3.09
LSD (5%)	0.543	1.507	1.338	1.210	1.166	0.845	0.775	0.244	0.803

Means followed by the same letter(s) do not statistically differ at 5% level tested by DMRT

Combined effect of spacing and nitrogen fertilizer: All the recorded parameters show the significant variations due to combined effect of spacing and nitrogen fertilizer level (Table 2). Higher plant height (68.10cm); leaf length (62.00cm); leaf breadth (29.00cm); curd diameter (24.50cm); curd length (15.50cm); curd weight/plant (2.50kg) and yield (30.00t/ha) of cauliflower were obtained from wider spacing S₃ (60cm X 70cm) with higher level of nitrogen fertilizer N₃ (120 kg/ha) which were significantly different from all other treatments.

Table 2. Combined effect of spacing and nitrogen fertilizer on the growth, yield attributes and yield of cauliflower

Treatments	Plant height (cm)	No. of leaves/plant	Leaf length (cm)	Leaf breadth (cm)	Days to curd initiation	Curd diameter (cm)	Curd length (cm)	Curd weight/plant (kg)	Yield (t/ha)
S ₁ N ₁	53.25h	12.40c	50.20f	18.00f	47.50f	15.80f	10.95d	1.46c	21.20e
S ₁ N ₂	54.70g	14.10bc	52.70de	20.00f	50.20de	18.63de	11.65cd	1.60bc	26.00c
S ₁ N ₃	56.13f	15.90ab	55.10cd	22.10e	51.70cd	22.50bc	12.90bc	1.95b	27.75b
S ₂ N ₁	57.22e	14.80bc	51.80ef	22.80de	53.80bc	17.80e	11.50cd	1.80bc	23.10d
S ₂ N ₂	58.10e	15.10bc	53.57de	24.50cd	49.10ef	19.75d	12.00cd	1.76bc	26.10c
S ₂ N ₃	61.57c	18.65a	56.70bc	26.20bc	56.10a	23.50ab	14.10b	2.00b	28.15b
S ₃ N ₁	59.80d	15.50b	56.10c	23.00de	52.90bc	19.70d	12.00cd	1.75bc	24.17d
S ₃ N ₂	64.83b	16.20ab	59.00b	27.10ab	51.73cd	21.50c	13.50b	1.66bc	27.90b
S ₃ N ₃	68.10a	16.75ab	62.00a	29.00a	54.00b	24.50a	15.50a	2.50a	30.00a
CV (%)	0.92	9.73	2.42	5.12	2.25	4.14	6.12	13.33	3.09
LSD (5%)	0.941	2.610	2.318	2.095	2.019	1.465	1.343	0.424	1.391

Means followed by the same letter(s) do not statistically differ at 5% level tested by DMRT

On the other hand, cauliflower cultivated with closer spacing S₁ (60cm X 50cm) combination with lower nitrogen fertilizer level N₁ (80kg/ha) produced the lower plant height (53.25cm); leaf length (50.20cm); leaf breadth (18.00cm); curd diameter (15.80cm); curd length (10.95cm); curd weight/plant (1.46kg) and yield

(21.20t/ha) which were also statistically different from all other treatments. In case of no. of leaves/plant and days to curd initiation, the highest value (18.65 and 56.10) were found in treatment S₂N₃ which were statistically similar with treatments S₁N₃, S₃N₂ and S₃N₃. The lowest values of above parameters (12.40 and 47.50) were found in treatment S₁N₁ (Table 2) which were statistically similar with treatments S₁N₂, S₂N₁ and S₂N₂. The results obtained in the present study were supported by various authors. The higher yield in above treatment is due to better plant survival owing to the favourable conditions for growth and development of plant and the closer spacing accommodates more number of plants per unit area. Similar results were reported by Rehman and Ali (2000). Rahman *et al.* (2007) and Farzana *et al.* (2016) conducted an experiment on cauliflower with spacing and reported that the maximum yield of cauliflower where the plants were spaced 45×50cm apart. The results were also supported in the term of nitrogen by Islam *et al.* (2010) who showed the maximum amount of nitrogen gives the high production of cauliflower.

Conclusion

The study concluded that cauliflower need to be cultivated at the spacing of 60cm X 70cm with 120kg/ha nitrogen is to be provided for getting the targeted yield as well as desired return from cauliflower cultivation in “High Ganges River Floodplain zones” of Bangladesh.

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