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Effect of different doses of Nitrogen on growth and yield parameters of Cauliflower (*Brassica oleracea* var. *Botrytis*) variety Snowball-16

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Abstract

The present investigation on evaluation Effect of different doses of Nitrogen on growth and yield parameters of Cauliflower variety Snowball-16 was carried out at the Agriculture Research Farm of Rama University, Mandhana, Kanpur, U.P, India, during *Rabi* season 2022-2023. The research material comprised of eight treatments along with three replications in Randomized Block Design (RBD). The results showed that application of T₇ (Nitrogen 35 kg + FYM + Vermicompost) has resulted in the maximum canopy spread (44.56 cm), maximum leaf counting (18.90), minimum blooming and fruiting days (57.89), minimum earliest flowering harvest dates (98.12), leaf area (889.60), curd length (18.32cm), curd diameter (18.65cm), curd weight (298.54gm), and curd yield per hectare (9865.86 kg/ha).

Keywords: Cauliflower var. snowball, nitrogen, FYM, vermicompost, growth and yield parameter

Introduction

Cauliflower (*Brassica oleracea* var. *Botrytis* L.) is most famous vegetable among all the Cole-crops derived from wild cabbage and the island of Cyprus is believed to be its center of origin (Kohli *et al.*, 2008) [4]. The word cauliflower is derived from the Latin words “Caulis” meaning stem and “Floris” meaning flower. Cauliflower is regarded as an economically important crop of the cole group, having a high market value and the potential for off-season production in the different parts of the country.

Cauliflower is the rich sources of many vitamins and minerals, which can protect from many diseases like heart disease and maintain cholesterol level. It's mainly grown for white tender curd which is used as a vegetable, soup pickles etc. Fresh curd of cauliflower is highly nutritive contain 2.6g protein, 0.4g fat, 1g mineral, carbohydrate 4.0g, fibre 1.2g, moisture 90.8 g, energy 30kcl, calcium 33mg, phosphorus 57mg, Iron 1.5mg carotene 30 mg, thiamine 0.04 mg, riboflavin 0.10mg, niacin 1.0mg and vitamin-C 56.0mg per 100 g of edible portion (Jood and Khetrappaul 2011) [3]. India's agro-climatic conditions are favorable for the production of cauliflower even in the summer season with the possibility for export. The crop is extremely sensitive to soil and climatic conditions. It is less able to tolerate harsh, cold and frost. It needs a temperature between 15 °C - 25 °C to grow and develop properly. It grows well in soil with a pH range of 6.5-7.5 but grow poorly in extremely acidic soil. Nitrogen is an essential plant nutrient, which is involved in physiological processes and enzyme activities. Farmers use urea excessively as a nitrogen fertilizer, to enhance flowering, curd set and increase curd size in cauliflower. Nitrogen (N) significantly affects the crop productivity as well as quality attributes (Konstantopoulou *et al.*, 2010) [5], through controlling the synthesis of several key products in plant cell, such as nucleic acids, proteins, phospholipids and other secondary metabolites. The optimum supply of N enhances plant growth and crop productivity however, the excessive and overuse of N fertilization may increase the accumulation of compounds such as nitrates and non-protein nitrogen in the edible parts, which may be harmful to human health and cause several environmental pollution and economical losses. Application of different doses of Nitrogen have been reported that the better growth and yield in cauliflower variety ‘Snowball-16’.

Materials and Methods

The experiment was carried out during the *Rabi* season 2022-23 at the main experiment station is Agriculture Research Farm of Rama University, Mandhana, Kanpur, UP, India. Geographically Kanpur is situated in the Gangetic plain's alluvium of central U.P. It lies in altitude and longitude ranging between 25.28° to 28.50° north and 79.31° to 84.34° east at elevation of 125.90 m above mean sea level. The experiments were laid out in Randomized Block Design with three replications. There were eight treatments and each treatment was allocated randomly in each plot during the period of investigation. The experimental field was thoroughly ploughed and cross-ploughed thrice with the help of mould board plough with tractor, Stones, pebbles and residues of the previous crops were removed from the fields manually followed by planking and levelling to bring the field to a good tilth. Field was divided into three strips and plots of 1.8 x 1.5m were prepared with bunds of 30 cm width and paths and channels were also prepared according to the layout of the experiment. The seedlings were on second week of October 2022 in the evening. To protect the seedlings from the scorching effect of sunlight, an artificial shade was provided by using rice straw until the establishment of the seedlings. After transplanting, various intercultural operations such as gap filling, hoeing, weeding, earthing up, irrigation pest and disease control were done for better growth and development of the tomato. Irrigation was given as per requirement. The technique of representative sample was adopted for recording the observations on various morphological characters in cauliflower. At every observation, five plants from each plot were randomly selected and tagged. The observations were recorded from these samples. Measuring tape was used to measure Canopy spread (cm), Leaf counting, Blooming and fruiting (days), Earliest flowering harvest dates (days), Leaf area (cm²), Curd length (cm), Curd diameter (cm), Curd weight (gm) and Curd Yield (kg/ha).

Table 1: Treatment combinations

Treatment	Treatment combinations
T1	Control (No Nitrogen)
T2	Nitrogen (10kg) + FYM + Vermicompost
T3	Nitrogen (15kg) + FYM + Vermicompost
T4	Nitrogen (20kg) + FYM + Vermicompost
T5	Nitrogen (25kg) + FYM + Vermicompost
T6	Nitrogen (30kg) + FYM + Vermicompost
T7	Nitrogen (35kg) + FYM + Vermicompost
T8	Nitrogen (40kg) + FYM + Vermicompost

*The application of FYM @ 15 t/ha and Vermicompost @ 5 t/ha applied as per recommended doses.

Results and Discussion

The result of various growth and yield parameters such as canopy spread (cm), leaf counting, blooming and fruiting days, earliest flowering harvest dates, leaf area (cm²), curd length (cm), curd diameter (cm), curd weight (g) and curd Yield (kg/ha) effect by different doses of Nitrogen.

Growth parameters

Canopy Spread (cm)

In the present investigation, canopy spread was significantly influenced the growth over control by different doses of nitrogen treatment. Data recorded in respect of canopy spread presented in Table 2. The maximum canopy spread (44.56

cm) were recorded in T₇ (Nitrogen 35kg + FYM + Vermicompost). The canopy spread reduced with the reduction in doses of different levels of different doses of nitrogen. These traits were minimum canopy spread (23.14cm) were recorded with control, respectively. The increase in canopy spread gets the support with the findings of Shree *et al.* (2014)^[9] in cauliflower cv. Poosi.

Leaf Counting

Regarding the leaf counting, it was observed that the impact of different treatment combination has been presented in Table 2. The maximum leaf counting (18.90) at the time of maturity stage were produced in the plants treated with T₇ (Nitrogen 35kg + FYM + Vermicompost) whereas, the minimum leaf counting (11.30) at the time of maturity stage were recorded under T₁ (control). These findings are in agreement with the reports of Yadav *et al.* (2012)^[11] in cabbage cv. Pride of India and Mohanta *et al.* (2018)^[7] in Sprouting Broccoli cv. Shayali

Leaf areas (cm)

The maximum leaf area (889.60 cm²) at the time of maturity stage were produced in the plants treated with T₇ (Nitrogen 35kg + FYM + Vermicompost) whereas, the minimum leaf area (613.16 cm²) at the time of maturity stage were recorded under T₁ (control). These findings are in agreement with the reports of Mohanta *et al.* (2018)^[7] in Sprouting Broccoli cv. Shayali.

Blooming, fruiting days and earliest flowering harvest dates

The earliest blooming, fruiting and earliest flowering harvest dates were recorded in days after transplanting. The minimum number of days was observed in T₇ (Nitrogen 35kg + FYM + Vermicompost) 57.89 days and 98.12 days. These traits were maximum 67.13 and 110.10 days were recorded with T₁ (control). These findings are in agreement with the reports of Bozkurt *et al.* (2011)^[1] and Giri *et al.* (2020)^[2] in cauliflower.

Table 2: Effect of different doses of nitrogen on growth parameters

Treatment	Canopy spread (cm)	Leaf counting	Blooming and fruiting (days)	Earliest flowering harvest dates(days)	Leaf area (cm ²)
T1	23.14	11.30	67.13	110.10	613.16
T2	37.43	13.53	59.32	98.67	723.43
T3	38.16	14.46	58.87	103.47	726.64
T4	38.74	14.87	61.12	102.78	786.87
T5	39.47	15.17	60.57	108.12	793.41
T6	40.12	16.76	59.43	106.43	805.63
T7	44.56	18.90	57.89	98.12	889.60
T8	42.24	18.54	59.64	98.56	887.54
SEm(±)	0.79	0.87	3.64	0.43	0.73
C.D. (P=0.05)	0.53	0.76	5.67	0.94	0.85

Yield parameters

Curd length (cm)

Regarding the curd length, it was observed that the impact of different treatment combination has been presented in Table 3. The maximum curd length (18.32 cm) was observed in the treatment T₇ (Nitrogen 35kg + FYM + Vermicompost). Whereas, the minimum curd length (10.86 cm) recorded with the T₁ (control). These results get support of the findings of

Mohanta *et al.*, (2018)^[7] in Sprouting Broccoli cv. Shayali and Rana *et al.*, (2020)^[8] in cabbage.

Curd diameter (cm)

Curd diameter (cm), it was observed that the impact of different treatment combination has been presented in Table 3. The maximum curd diameter (18.65 cm) was observed in the treatment T₇ (Nitrogen 35kg + FYM + Vermicompost). Whereas, the minimum curd diameter (12.40 cm) recorded with the T₀ (control).

This may be due to an increase in the photosynthetic activity of the plant with overall growth and an increase in chlorophyll content. Increased chlorophyll content produced more photosynthesis that was diverted for curd growth and resulted in better curd nutrition, leading to an increase in curd diameter. These results get support of the findings of Yadav *et al.* (2012)^[11] in cabbage cv. Pride of India and Mohanta *et al.* (2018)^[7] in Sprouting Broccoli cv. Shayali Rana *et al.* (2020)^[8] in cabbage.

Curd weight (gm)

Regarding the curd weight was recorded after harvesting of curd, it was observed that the impact of different treatment combination has been presented in Table 3. The maximum curd weight (298.54 gm) was observed in the treatment T₇ (Nitrogen 35kg + FYM + Vermicompost). whereas, the minimum curd weight (197.03 gm) recorded with the T₁ (control). These results get support of the findings of Mehedi *et al.*, (2018)^[6] in broccoli and Rana *et al.* (2020)^[8] in cabbage.

Curd Yield (kg/ha)

Regarding the curd yield was recorded after harvesting of curd, it was observed that the impact of different treatment combination has been presented in Table 3. The maximum curd yield (9865.86 kg/ha) was observed in the treatment T₇ (Nitrogen 35kg + FYM + Vermicompost). whereas, the minimum curd yield (2123.54 kg/ha) recorded with the T₁ (control). The maximum in curd yield can be attributed to the increase in canopy spread, maximum leaf, curd length and diameter which may have enhance the photosynthetic surface area and led to greater synthesis and translocation of photosynthetase towards curd formation. These findings are in line with the findings of Upadhyay *et al.* (2012)^[10] and Rana *et al.* (2020)^[8] in cabbage.

Table 3: Effect of different doses of nitrogen on yield parameters

Treatment	Curd length (cm)	Curd diameter (cm)	Curd weight (gm)	Curd yield (q/ha)
T1	10.86	12.40	197.03	2123.54
T2	11.91	12.59	239.60	3286.13
T3	12.56	13.32	256.58	3667.46
T4	14.23	14.87	263.47	4285.59
T5	16.58	16.54	267.43	5375.65
T6	17.13	17.41	271.89	6432.16
T7	18.32	18.65	298.54	9865.86
T8	17.96	17.84	295.34	8763.56
SEm(±)	5.42	0.54	1.67	1.09
C.D. (P=0.05)	4.07	0.63	0.72	0.46

Conclusion

Based on the results obtained from the present investigation, it is conducted that the highest growth and yield of broccoli *viz.*,

maximum canopy spread (44.56 cm), maximum leaf counting (18.90), minimum blooming and fruiting days (57.89), minimum earliest flowering harvest dates (98.12), leaf area (889.60), curd length (18.32cm), curd diameter (18.65.cm), curd weight (298.54gm) and curd yield per hectare (9865.86 kg/ha) were observed with the treatment T₇ (Nitrogen 35 kg + FYM + Vermicompost). From this study it can be recommend that the application of nitrogen 35-40kg with FYM and Vermicompost as recommended a can be applied to obtain maximum growth and yield of Cauliflower variety Snowball.

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