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Effect of growth regulators and micro nutrient on growth and yield of cauliflower cv. 'SNOWBALL-16'

■H.H. SITAPARA, N.J. VIHOL[1], M.J. PATEL[1] AND J.S. PATEL[1]

Associated Authors:
[1]Department of Horticulture, B.A. College of Agriculture, Anand Agriculture University, ANAND (GUJARAT) INDIA

Author for correspondence :
H.H. SITAPARA
Department of Horticulture, B.A. College of Agriculture, Anand Agriculture University, ANAND (GUJARAT) INDIA

Abstract : A field experiment was conducted to study the effect of growth regulators (GA_3 and NAA) and micronutrient (boron) on cauliflower (*Brassica oleracea* L.) cv. SNOWBALL-16 at Horticultural Research Farm, Anand Agricultural University, Anand during *Rabi* season of the year 2007-08 and 2008-09. The study conducted revealed that two foliar sprays (at 15 and 30 DAT) of gibberellic acid @100ppm and boric acid at 0.2 per cent were found better for growth attributes (*viz*, plant height, number of leaves, stem length, stem diameter, days taken for marketable curd etc.), yield attributes (*viz*, diameter, volume and weight of curd) and ultimately the early curd yield of cauliflower cultivar "Snowball-16".

Key words : Growth regulator, Boron, Hollowness, Photosynthates, Curd yield, DAT (Days after transplanting)

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Cauliflower [*Brassica oleracea* (L.) var. botrytis] is the most popular winter vegetable among cole crops. It is propagated through seed and healthy seedling is important to raise a good crop. The edible part, *i.e.* curd is a 'prefloral fleshy apical meristem' and it is generally white in colour and may be enclosed by inner leaves before its exposure. Adopting various improved agro-techniques can enhance the productivity of cauliflower. The application of growth regulators has been found effective in stimulating growth and ultimately yields in vegetablecrops. Among the growth regulators GA_3 and NAA exhibited beneficial effect in several crops including cauliflower. In cauliflower, boron deficiency has been reported in many parts of the country very frequently causing browning and hollow stem and ultimately resulting in lower yield having inferior quality. Considering this, the present investigation was taken up to find out most suitable treatment combination of growth regulators (GA_3 and NAA) and micronutrient (boron).

RESEARCH METHODS

A field experiment was conducted at Horticultural Research Farm, B. A. College of Agriculture, Anand Agricultural University; Anand (Gujarat) during *Rabi* season of the year 2007-08 and 2008-09. The soil of experimental site was typical sandy loam locally known as '*Goradu*' which is well drained and fairly moisture retentive capacity. The experiment was laid out in Factorial Randomized Block Design with three replications, which included fifteen treatment combinations consisting of five levels of growth regulators *i.e.* GA_3 @ 0, 50 and 100ppm and NAA @ 100 and 200ppm and three levels of micronutrient *i.e.* boron (as boric acid) @ 0, 0.1 and 0.2 per cent. Two foliar sprays *i.e.* at 15 and 30 days after transplanting (DAT) were given during clear sun-shine hours.

For raising healthy seedling ideal seed beds were prepared as well as experimental block was well prepared and standard cultural, manurial and plant protection practices were followed to ensure a healthy crop growth. Five random sample plants were tagged in each plot and used for recording the observations of growth and yield attributes. No any serious insect-pest or natural hazard adversely affected the crop growth as well as yield.

RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been summarized under following heads:

Effect of growth regulators :

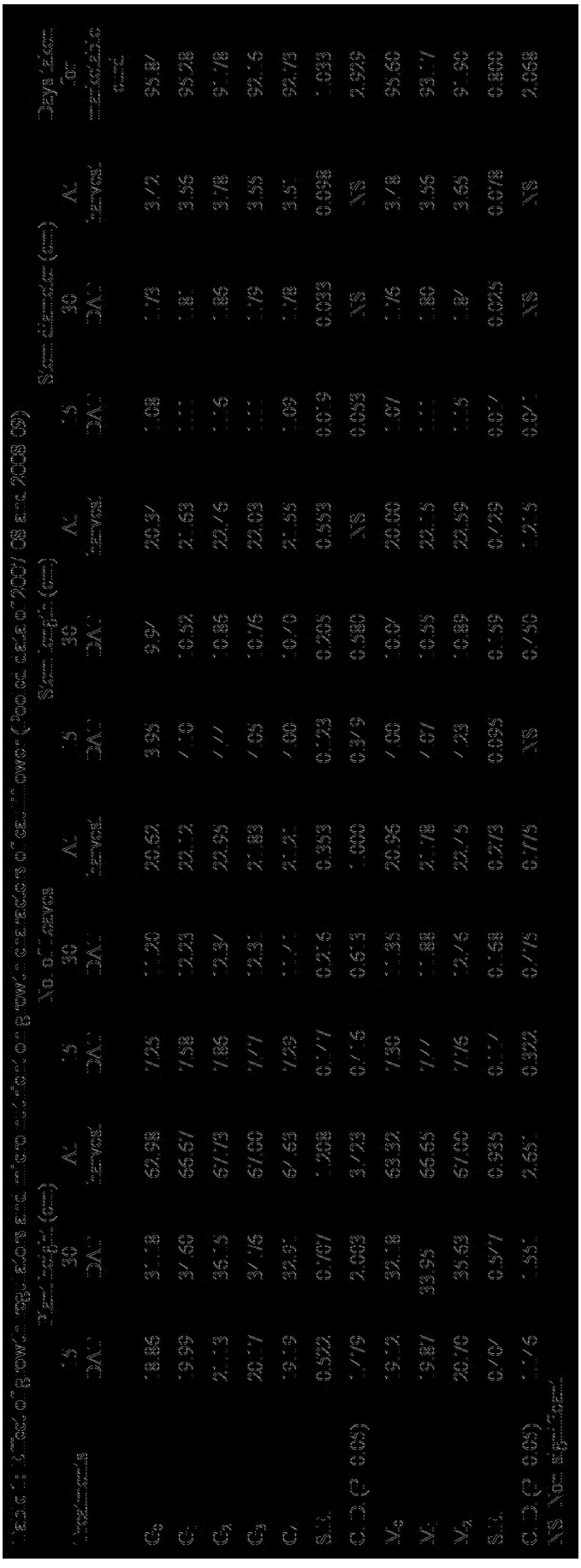
Vegetative growth attributes:

The results indicated that foliar application of GA_3 @ 100ppm was found effective for significant increase in plant height (21.13, 36.15 and 67.73cm, respectively) and number of leaves per plant (7.86, 12.34 and 22.95, respectively) after 15 and 30 days of transplanting DAT and at harvest. On pooled basis, the foliar application of GA_3 @100ppm showed significant effect on stem length after 15 and 30 days of DAT by recording 4.44 and 10.86 cm, respectively. Likewise, the stem diameter was significantly influenced only after 15 DAT due to GA_3 @ 100ppm by recording 1.16cm stem diameter (Table 1). This increase in vegetative growth parameters stated above may be due to significant role of gibberellic acid in enhancing the plant growth through cell division and cell elongation and its activity at the apical meristem resulting in more nucleo-protein synthesis responsible for increasing leaf initiation and expansion. These findings are in agreement with those of Mishra and Singh (1986) and Dhengle and Bhosale (2007).

The minimum days (91.78) required for marketable curd was recorded with treatment GA_3@ 100ppm, while maximum (95.84 days) under control *i.e.* without any spray (Table 1). The possible reason could be an increased rate of photosynthesis and accelerated transport of photosynthates towards the curd by gibberellic acid treatment. Advancement in cauliflower curd maturity was also reported by Muthoo *et al.*(1987). The fresh and dry weight of leaves were not significantly influenced due to varying treatments of growth regulators, whereas significantly maximum fresh and dry weight of plant (2.956kg and 278.61g) was registered with foliar spray of GA_3@ 100ppm (Table 2). The increase in dry and fresh weight of plant could be due to increase in plant height and number of leaves. As the more leaf area produced by GA_3, more photosynthates were produced which were diverted towards the development of stem and curd and ultimately increased fresh and dry weight of plant. The study is in accordance with Muthoo *et al.* (1987) and Dhengle and Bhosale (2007).

Yield attributes:

The findings indicated that all the yield attributing parameters *viz.*, curd diameter (18.07cm), curd volume (1.864cm) and curd weight (896.72g) recorded were found significantly maximum with two sprays (at 15 and 30 days



of transplanting) of GA_3 @ 100ppm (Table 2). The possible explanation for increase in curd diameter and curd volume may be due to professed effect of gibberellic acid on cell enlargement, cell elongation and cambial activity. The increase in curd weight might be due to rapid and better nutrient transport from roots to their aerial parts of the plant. These findings are in accordance with those of Mishra and Singh (1986), Dharmendrakumar *et al.* (1996), Muthoo *et al.* (1987) and Vijaykumar and Ray (2000).

Yield:

It is evident from the results obtained that foliar spray of GA_3 @100ppm recorded significantly maximum curd yield of 32.952 t/ha (Table 2). The increase in final curd yield was the summation of various increased growth parameters (*viz.*, plant height, number of leaves, length and diameter of stem, fresh and dry weight of leaves, stem and plant) as well as yield attributing parameters (*viz.*, diameter, weight and volume of curd). The present study revealed that increased number of leaves, curd weight, curd diameter and curd volume due to foliar spray of GA_3@ 100ppm resulted in higher yield. The results of present study are in conformity with those of Mishra and Singh (1986), Dharmendrakumar *et al.* (1996), Muthoo *et al.* (1987) and Vijaykumar and Ray (2000).

Effect of micronutrient:

Vegetative growth attributes:

An appraisal of the results indicated that among various growth characters the plant height (20.70cm, 35.63cm and 67.00cm, respectively), number of leaves per plant (7.76, 12.46 and 22.45, respectively) were found significantly maximum after 15 and 30 days of transplanting as well as at harvest with foliar application of boric acid @ 0.2 per cent. Likewise, significantly maximum stem length (10.89cm and 22.59cm, respectively) was recorded with same treatment after 30 DAT and at harvest (Table 1). The foliar application of boric acid @0.2 per cent exerted significant effect on stem length after 30 DAT and at harvest (10.89 and 22.59cm). This increase in vegetative growth might be due to an enhancement in cell multiplication and cell elongation because of boron. These results are in agreement with those of Mishra and Singh (1986) and Patel (2002).

Significantly minimum days (91.90) were taken for marketable curd by foliar application of boric acid @ 0.2 per cent (Table 1). The fresh and dry weight of leaves (2.273kg and 214.00g), fresh and dry weight of stem (219.40g and 25.65g) as well as fresh and dry weight of plant (2.940 kg and 278.61g), respectively recorded were

Table 2: Effect of growth regulators and micronutrient on yield attributing characters of cauliflower (Pooled data of 2007-08 and 2008-09)

Treatments	Fresh weight of leaves (kg)	Dry weight of leaves (g)	Fresh weight of stem (g)	Dry weight of stem (g)	Fresh weight of plant (kg)	Dry weight of plant (g)	Curd diameter (cm)	Curd volume (cm³)	Curd weight (g)	Curd yield (t/ha)
C_0	2.103	196.99	231.97	23.37	2.151	259.21	15.15	1.612	785.39	28.854
C_1	2.212	208.08	215.28	25.09	2.811	216.91	17.52	1.784	870.12	31.992
C_2	2.263	212.55	258.22	25.71	2.935	278.61	18.01	1.864	895.12	32.952
C_3	2.226	209.05	256.61	24.92	2.903	211.91	17.08	1.850	870.89	31.990
C_4	2.133	202.91	251.73	24.16	2.803	265.64	16.24	1.750	838.39	30.801
S.E.	0.013	1.823	0.555	0.613	0.013	1.681	0.286	0.031	16.770	0.493
CD (P 0.05)	NS	13.80	NS	0.122	0.113	13.283	0.810	0.096	171.251	1.391
N_0	2.093	196.91	231.35	23.35	2.716	260.19	16.18	1.619	805.53	29.586
N_1	2.196	205.11	256.10	25.16	2.891	272.63	16.71	1.802	861.81	31.662
N_2	2.273	214.00	259.40	25.65	2.940	278.61	17.85	1.853	891.61	32.952
S.E.	0.013	1.823	0.555	0.613	0.013	1.681	0.286	0.031	16.770	0.493
CD (P 0.05)	0.039	5.116	1.713	0.568	0.033	3.631	0.221	0.096	52.000	0.382
CD (P 0.01)	0.054	8.331	10.693	1.111	0.094	10.289	0.621	0.045	36.817	1.082

NS Non significant

found significantly maximum with treatment of boric acid @ 0.2 per cent.The increase in fresh and dry weight of plant might be due to reduction in hollowness of the stem and active photosynthesis as a result of boron application. The present studies are in agreement with Mishra and Singh (1986).

Yield attributes:

The foliar application of boric acid @ 0.2 per cent registered significantly maximum curd diameter (17.85cm), curd volume (1.853 cc) and curd weight (891.07g) followed by the spray of 0.1 per cent boric acid. The increase in curd diameter and curd volume due to boron can be attributed to its beneficial association with enzymes and active participation in physiological processes like cell formation as well as protein and carbohydrate metabolism of plant. These findings are in accordance with the results reported by Patel (2002) and Ghosh and Hasan (1997).

Yield attributes:

The two foliar applications (at 15 and 30 DAT) of boric acid recorded significantly maximum curd yield (32.594 t/ha) followed by the spray of boric acid @ 0.1 per cent (*i.e.* 31.662 t/ha) (Table 2). The higher yield obtained might be due to beneficial role of boron in synthesis of amino acids and proteins and translocation of sugars and starch to growing curds which ultimately leads to higher production of dry matter and consequently more yield. The increase in yield could also be due to the combined effect of better crop growth as well as increase in diameter, volume and weight of curds due to boron. The results are in conformity with those obtained by Mishra and Singh (1986) and Patel (2002).

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