

Effect of Boron and Zinc on growth and yield of Cauliflower (*Brassica oleracea* var. *botrytis* L.) cv. Pusa Snowball K-1.

Abstract

The experiment was conducted at Horticulture Research Farm-1, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow-226025 (U.P) during 2022-2023 (Rabi season). The experiment was laid out in randomized block design with three replications and nine treatments. The plot size was 1.8 m x 1.8 m and planting done with spacing 45 cm x 45 cm. The treatments comprised with use of micronutrients Boron (0.2% and 0.4%), Zinc (0.3% and 0.5%) and their combinations. The B and Zn were applied to plants at 30 and 45 Day after transplanting (DAT). Observations pertained to growth parameters were recorded at various stages (30 DAT to 45 DAT, 45 DAT to 60 DAT and 30 DAT to 60 DAT). Among the foliar application of B and Zn (T₉) i.e. Boron @ 0.4% + Zinc @ 0.5% was found to be significantly superior for plant height, number of leaves, length of leaf, width of leaf and plant spread but application of Boron @ 0.4% + Zinc @ 0.3% (T₈) and Boron @ 0.2% + Zinc @ 0.5% (T₇) were statistically *at par* in case of plant height. T₉ (Boron @ 0.4% + Zinc @ 0.5%) also showed early curd initiation and harvesting, improved curd diameter, fresh weight as well as curd yield. Thus, foliar application of Boron @ 0.4% + Zinc @ 0.5% at 30 and 45 days after planting may be beneficial for good marketable cauliflower production with superior curd size and high yield.

Key word: Cauliflower, curd yield, curd size, growth, Zinc, Boron.

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L., $2n=2x=18$) is one of the important vegetable crops belonging to the family Brassicaceae or Cruciferae. The family Cruciferae is distinguished by having 6 stamens, of which 2 are short and 4 long and a unique type of pod called siliqua. (Thambhuraj, 2018). Cauliflower is a "pre-floral fleshy apical meristem," and before it is exposed, it may be covered by inner leaves. The Latin words "Caulis" and "Floris," which signify stem and flower, respectively are the source of the term "cauliflower". The curd is the edible portion and marketable part of this plant. India harvests and consumes the majority of the cauliflower. At the moment, cauliflower is grown in practically all of the Indian states, though primarily in West Bengal, Uttar Pradesh, Bihar, and Karnataka. India is the world's second-largest producer of vegetables after China, with a approximate

production of 204.84 million metric tonnes of vegetables, India produces food over an area of 11.34 million hectares of land area in the year 2021-22 (Anon., 2022).

Boron (B) and zinc (Zn) nutrients are crucial for proper crop growth and development, the crop responds well to both macronutrients (Nitrogen, Phosphorus, Potassium) and micronutrients (Boron, Molybdenum and Zinc, among others). Micronutrients are important in small amounts and serve a critical function in the plant lifecycle. Boron, Zinc and Molybdenum play a more important role than the other micronutrients among (Boron, Molybdenum, Iron, Copper, Chlorine, Zinc, and Manganese) due to their availability; the movement of nutrients depends on the soil's pH. More micronutrients, particularly Boron, Zinc and Molybdenum, are mandatory in cauliflower. Because it is involved in cell division and promotes root and shoot growth, the mineral borate is essential for the growth and development of cauliflower. It has connections to a wide range of physiological activities, including protein synthesis, auxin production, calcium metabolism and translocation of solutes.

Boron is essential for cell division, cell wall elongation and pollen generation, all of which have an impact on the development of seeds and fruit sets (Sharma *et al.*, 1999). It has also been shown to boost the vegetative growth of Cole crops (Singh, 2003). According to Yang *et al.* (2000), its application in the soil increased the broccoli crop's yield and quality. In green gram, boron promotes the expansion of the pollen tube, the establishment of the pollen grain, the viability of the pollen and the development of the seed (Praveena *et al.*, 2018). Boron application considerably improved curd weight, curd output and curd diameter of cauliflower (Kumar and Chaudhary, 2002). However, increasing Boron doses had a negative impact on cauliflower plant height (Pandey *et al.*, 2020). Boron plays a crucial role in maximizing curd size, production and superiority of cauliflower (Kumar *et al.*, 2002). Thakur *et al.* (1991) claimed that B application increases the plant height of cauliflower.

Like boron, another important plant nutrient Zinc increases curd diameter and curd weight as a result of improved physiological processes including photo synthesis, during which food is created in large quantities by plants moving nutrients from leaves to curd and storing them there (Lashkari *et al.*, 2008). Increase in plant height and stalk length is liable sign of plant growth. This increase in vegetative growth may be attributable to Zinc's role in chlorophyll activation, which also affected cell division, meristematic activity of plant tissues, cell expansion and cell wall formation by active synthesis of the aromatic amino

acid tryptophan, a precursor to IAA and a stimulator of plant growth by cell elongation and cell division (Choudhary and Mukherjee, 1999; Kanuj *et al.*, 2006). Zinc is an activator of enzymes involved in protein synthesis and has direct conclusion on the enzymatic regulation in plants. Keeping these in mind the present experiment was conducted to see the efficiency of boron and zinc on growth and yield of cauliflower cv. Pusa Snowball K-1 grown in subtropical slightly alkaline soil at Lucknow.

MATERIALS AND METHODS

The experiment was conducted at Horticulture Research Farm-1, Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya-Vihar, Raebareli Road Lucknow- 226025 (U.P.) during 2022-2023 (Rabi season). The experimental site was situated at 26°50' N latitude and 80° 52' E longitude and an altitude of 111 meters above mean sea level (MSL). This area is located in Uttar Pradesh in the fifth agricultural climate zone (ICAR). Lucknow has a dry subtropical climate with an average rainfall of 750 to 1100 mm and relative humidity of 60 to 90 % depending on the weather and climatic factors.

The seeds of the cauliflower variety "Pusa Snowball K-1" (*Brassica oleracea* var. *botrytis* L.) were obtained from the Indian Agricultural Research Institute, New Delhi. Raised beds of 1.8 x 1.8 x 0.15 m³ (L x B x H) size were prepared. The upper layer of 5 cm of each bed was mixed with equal quantity of well rotten FYM and sieved soil. Seeds of "Pusa Snowball K-1" were sown during October 2022. Watering was done regularly by rose can. Raised beds were kept clean by weeding regularly. The seedlings were kept healthy by taking two sprays of pesticides as and when required. Recommended doses of nitrogen, phosphorus and potassium (160:80:120 kg ha⁻¹) through urea, SSP and MOP, respectively were applied as basal doses during the experimental period. Nitrogen was applied 50% as basal and remaining at 40 DAT. In the present investigation, micronutrients viz. Boron and Zinc were tried involving nine treatment combinations such as T₁ (Control), T₂ (Boron @ 0.2%), T₃ (Boron @ 0.4%), T₄ (Zinc@ 0.3%), T₅ (Zinc@ 0.5%), T₆ (Boron @ 0.2% + Zinc@ 0.3%), T₇ (Boron @ 0.2% + Zinc@ 0.5%), T₈ (Boron @ 0.4% + Zinc@ 0.3%), and T₉ (Boron @ 0.4% + Zinc@ 0.5%). Boron was applied as Borax and Zinc was applied as Zinc sulphate. The experiment was laid out in Randomized Block Design with three replications. The observations were recorded on vegetative growth, curd yield and yield attributing characters. The collected data was analyzed by statistical method suggested by **Panse and Sukhatme (1985)**.

RESULTS AND DISCUSSION

Vegetative growth characters

Marked variations in increase of plant height were recorded due to foliar application of B and Zn at all the growth stages during crop season (Table 1). The maximum increase (13.51cm & 80.60%) in plant height was recorded from 30 DAT to 45 DAT under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) followed by 12.96 cm & 78.21% increase under treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%) and minimum increase in plant height (7.71cm & 49.35%) was observed under treatment T₁ (Control). Similarly, increase in plant height from 45 DAT to 60 DAT was also found maximum (10.87cm & 35.91%) under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) followed by (10.04 cm & 35.19 %) increase under treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%). It was seen that total increase of plant height from 30 DAT to 60 DAT (24.38 cm & 145.47%) was observed as maximum and it was noted in treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) followed by T₈ (Boron @ 0.4% + Zinc@ 0.3%).

Different foliar application of Boron and Zinc significantly influenced the number of leaves of cauliflower. For 30 DAT to 45 DAT the maximum increase in number of leaves plant⁻¹ (5.88 & 85.71%) was recorded under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) followed by 5.25 & 80.81% increase under treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%). Correspondingly, the highest increase number of leaves plant⁻¹ (6.93 & 54.39%) was observed during 45 to 60 DAT under treatment T₉ (Boron @ 0.4%+ Zinc@ 0.5%) Although, the minimum increased number of leaves plant⁻¹ (2.34 & 28.82%) was seen under control treatment (T₁), it was found that treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) had the highest total increase in number of leaves per plant (12.81 & 186.73%) from 30 DAT to 60 DAT, followed by treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%) with a total increase of (11.22 & 176.97%) (Table 2).

During the crop season, foliar applications of B and Zn similarly influenced leaf length at all growth stages (Table 2). The leaf length increased was a maximum (10.82cm & 77.67%) between 30 DAT and 45 DAT under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) subsequently, (9.19cm & 65.50%) under treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%). Likewise, the maximum improved leaf length of (10.92cm & 44.12%) was recorded at 45 DAT to 60 DAT in treatment T₉ (Boron @ 0.4%+ Zinc@ 0.5%) after wards (9.41 cm & 40.53%) and it had the maximum overall increase in the length of leaves, expanding by

(21.74 cm & 156.06%) between 30 DAT to 60 DAT.

Similar tendency was observed in change of leaf width showing maximum increased leaf width of 6.08 cm & 95.75% was noted under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) followed by 5.30 cm & 88.48% increase under treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%) from 30 DAT to 45 DAT (Table 3). Similar trend was also observed at 45 DAT to 60 DAT, showing maximum increase (8.11cm & 65.25%) under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) followed by T₈ (Boron@0.4%+Zinc@ 0.3%) which continued at total increase from 30 to 60 DAT followed by treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%), with (12.37 cm & 118.03%). Similar to leaf characters, plant canopy spreading was found maximum under T₉ at different stages of growth (30 to 45 DAT, 45 to 60 DAT and total increase from 30 to 60 DAT), followed by treatment T₈ (Boron @ 0.4%+ Zinc@ 0.3%). The control treatment (T₁) exhibited the smallest rise between 30 DAT to 60 DAT, determining (18.31 cm & 106.14%).

Application of Boron @ 0.4% + Zinc@ 0.5% (T₉) was found to be significantly superior for plant height, number of leaf, length of leaf, width of leaf and plant spread but application of Boron @0.4% + Zinc@0.3% (T₈) and Boron @ 0.2% + Zinc@ 0.5% (T₇) applied on width of leaf and plant height are statistically at par that means no difference in plant height. **Meena (2019)** also got similar effect on vegetative growth of cabbage by the application of boric acid @ 0.2%. **Singh et al. (2017)** recommended the use of borax @ 20 kg ha⁻¹ as a soil application produced cauliflower with the highest plant height (60.95 cm), leaf length (51.8 cm), leaf width (20.24 cm) and total plant weight (1.93 kg). Similar, results was found by **Kamal et al. (2013)** that four basal dosages of boron in the form of borax (0, 5, 10 and 15 kg ha⁻¹) and Zinc in the form of Zinc (0, 10, 20 and 30 kg ha⁻¹) showed the highest effect on vegetative growth. **Kant et al. (2013)** also stated that combine application of borax (0, 5, 10 and 15 kg/ha) and Zinc (0, 10, 20 and 30 kg/ha) on cauliflower var. Himani got maximum vegetative growth of plant.

Yield and yield attributes

The mean data pertaining to the effect of various treatments on days to first curd initiation was presented in Table 4. Minimum days of first curd initiation are the desirable character for cauliflower. The minimum days to first curd initiation (56.23 DAT) was observed with application of Boron @ 0.4% + Zinc@0.5% (T₉). It was followed by treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%) with days taken to first curd initiation 57.73 DAT.

Application of Boron @ 0.4% + Zinc@ 0.5% (T₉) caused early harvesting of marketable curds (74.13 days). The minimum days taken from day to first curd initiation to days to first curd marketable harvesting (17.90days) was recorded under T₉ (Boron @ 0.4% + Zinc sulphate @ 0.5) followed by 18.13 days in T₈.

There was a significant effect of Boron and Zinc on cauliflower curd diameter. The treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%) reported the largest curd diameter (13.87 cm) followed by T₈ (Boron @ 0.4% + Zinc@ 0.3%) (13.25cm).

The maximum number of florets was counted (15.66) in the treatment T₈ (Boron @ 0.4% + Zinc@ 0.3%) followed by 14.45 florets under treatment T₉ (Boron @ 0.4% + Zinc@ 0.5%).

The average fresh weight of curd was determined in each treatment and the data so obtained were subjected to statistical computation. The mean data revealed that maximum fresh weight of curd viz 289.47g, 284.66 g was observed at harvest with application of Boron @ 0.4% + Zinc@ 0.5% (T₉) and Boron @ 0.4% + Zinc@ 0.3% (T₈), respectively. Maximum increase in curd weight lead to increase in curd yield and curd yield (per plot and per ha) was estimated higher under foliar application of Boron @ 0.4% + Zinc@ 0.5% (T₉) (14.63kg/plot and 142.96 q/ha) followed by T₈ (Boron @ 0.4% +Zinc sulphate @ 0.3%) and T₇ (Boron @ 0.2% + Zinc@ 0.5%).

The results revealed that different doses of Boron and Zinc significantly improved the day of first curd initiation, day of first marketable curd harvesting, curd diameter, fresh weight of curd, curd yield/plot and curd yield/ha was found superior under the treatment of T₉ (Boron @ 0.4% + Zinc@ 0.5%) then control treatment (T₁). Application of Boron @ 0.4% + Zinc@ 0.5% (T₉) caused earliness in curd initiation and days to first marketable harvesting as compared to other treatment. The maximum floret of cauliflower curd obtained by the foliar application of T₈ treatment (Boron @ 0.4% + Zinc@ 0.3%) is superior then T₉ treatment. Similarly, result was also found by **Kumar *et al.* (2023)**, who observed cauliflower plants got maximum yield in term of greatest net curd weight (410g) and marketable curd weight (695g) by the application of Boron (2 kg ha⁻¹) and Zinc (2.5 kg ha⁻¹). It was also found by **Sardar *et al.* (2022)** that with the foliar application of Zn (0.5%) and B (0.5%) on broccoli observed maximum effect in yield. **Moniruzzaman *et al.* (2007)**, fond the maximum effect by the application of Boron @ 2 kg ha⁻¹ in yield of broccoli. Similarly, **Alam and Jahan (2007)** obtained the highest yield of cauliflower. These effects also sawed in crop of cauliflower that application of 3–4 kg Boron ha⁻¹ (0.4–0.6 g boric acid pot⁻¹) has increased superior yield. Correspondingly, **Prasad and**

Rai in 2008, found out the maximum yield by the 5 kg ha⁻¹ @ boron application on cauliflower cv. Pusa Snowball. A 133% increase in the final yield (15.4 t ha⁻¹) was discovered.

CONCLUSION

The results revealed that foliar application of Zinc and Boron significantly influenced the growth and yield of cauliflower cv. Pusa Snowball K-1. Foliar application of Boron @ 0.4% + Zinc @ 0.5 % showed significantly maximum growth, curd diameter, fresh weight of curd, curd yield/plot and curd yield/ha, and reduce the curd initiation and maturity period. Thus, it was concluded that foliar application of Boron @ 0.4% + Zinc @ 0.5% at 30 and 45 days after transplanting was good for better growth and yield of cauliflower.

References

- Alam, M.N. and Jahan, J.S. (2007).**Effect of boron levels on growth and yield of cabbage in calcareous soils of Bangladesh. *The Asian Journal of Horticulture*, **3**(6): 858-865.
- Anonymous, 2022.** Agricultural statistics at a Glance. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, New Delhi.
- Choudhary D. and Mukharjee, S. (1999).** Effect of boron and zinc concentration on growth and yield of cauliflower cv. Snow Ball-16. Haryana. *Journal Horticulture Science*. **28**(1-2):119- 120.
- Kant, Kamal, Singh, K.P., Singh, V.K. and Ranjan, A. (2013).**Effect of boron, zinc and their combinations on the yield of cauliflower (*Brassica oleracea* var. *Botrytis* Linn.) hybrid cultivar – Himani, *Asian Journal Horticulture*, **8**(1) : 238-240.
- Kanujia, S.P., Ahmed, N., Chattoo, M.A., Jabeen, N. And Naryan, S. (2006).**Effect of micronutrients on growth and yield of cabbage (*Brassica oleracea* var. *Capitata* L.) *Applied Biological Research*.**8**:15-18.
- Kumar, M. Choudhary, S.K. Kumar, R. Singh, S.K. Prabhakar, M.K. Singh, P.K. (2023).** Effect of Boron and Zinc on Growth and Yield Attributes in Early cauliflower (*Brassica oleracea* var. *Botrytis* L). *International Journal of Plant & Soil Science*. **35**(6):104-110.

- Kumar, S., Chaudhury, D.R., Kumar, S. (2002).** Effect of FYM, molybdenum and boron application on yield attributes and yields of cauliflower. *Crop Research Hisar*.**24**(3):494–496.
- Lashkari C.O., Parekh, H.B., Sharma, S.J., Karetha, K.M. and Kakade, D.K. (2008).**Influence of zinc and iron on yield and quality of cauliflower (*Brassica oleracea* var. *Botrytis* Linn.) cv. Snowball-16. *Asian Journal Horticulture*.; **3**(2):380-381.
- Meena, S.L., Aravindakshan, K., Arya, C.K., Meena, K.K. and Meena, M.K. (2019).**Effect of bioregulators and boron on growth attributes of cabbage (*Brassica oleracea* var. *capitata* L.) cv. golden acre, *International Journal of Chemical Studies*, **7**(3), 1540-1543.
- Moniruzzaman, M., Rahman, S.M., Rahman, M.A. (2007).** Effect of boron on yield and hollow stem of cauliflower and broccoli. *Journal Soil Science*.**1**(3):24-29.
- Pandey, S., Parajuli, S., Oli, b. and Dhungana, S. (2020).** Effect of different doses of boron on growth and yield of off-season cauliflower (*Brassica oleracea* var. *botrytis*) in Arghakhanchi, Nepal. *Reviews in Food and Agriculture*. **1**(1): 12–17.
- Panse, V.G. and Sukhatme, P.V. (1985).** Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research Publication, 87-89.
- Prasad, T.H. and Rai, C.H. (2008).**Studies on growth, yield and quality of cauliflower (*Brassica oleracea* var. *botrytis*) as influenced by boron and molybdenum, *Journal of Plant Nutrition*, **39**(2), 167-169.
- Praveena, R., Ghosh, G. and Singh, V. (2018).**Effect of foliar spray of boron and different zinc levels on the growth and yield of kharif green gram (*Vigna radiata*). *International Journal Current Microbiological Applied Science*. **7**(8): 1422–1428.
- Sardar, H., Irshad, M., Anjum, M. A., Hussain, S., Ali, S., Ahmad, R. and Ejaz, S. (2022).**"Foliar application of micronutrients improves the growth, yield, mineral contents, and nutritional quality of broccoli (*Brassica oleracea* var. *italica* L.),"*Turkish Journal of Agriculture and Forestry*: Vol. **46**: No. 6.
- Sharma, S.K.,Singh, H. and Kohli, U.K. (1999).**Influence of boron and zinc on seed yield and quality of radish. *Seed Research*. **27**(2): 154–158.
- Singh, D.N. (2003).**Effect of boron on growth and yield of cauliflower in lateritic soil of Western Orissa, *Indian Journal of Horticulture*.**60**(3). 283-286.
- Singh, G., Saravanan, S., Rajawat, K.S., Rathore, J.S. and Singh, G. (2017).** Effect of different micronutrients on plant growth, yield and flower bud quality of broccoli

(*Brassica oleracea* var. *italica* L.), *Current Agriculture Research Journal*. **5**(1): 108-15.

Thakur, O.P., Sharma, P.P. and Singh, K.K. (1991). Effect of nitrogen and phosphorus with and without boron on curd yield and stalk rot incidence in cauliflower. *Vegetable Science*. **18**(2): 115–121.

Thambhuraj (2018). Textbook of Vegetables, Tuber crops and Spices, Indian Council of Agricultural Research, New delhi, edition 7, p. 76-97.

Yang, X., X.Y. Chen and Z.C. Liu. (2000). Effects of boron and molybdenum nutrition on curd yield and active oxygen metabolism in broccoli (*Brassica oleracea* var. *italica*). *Acta Horticultural. Science*. **27**(2): 112–116.

UNDER PEER REVIEW

Table 1: Effect of boron and zinc on plant height of cauliflower.

Treatment	Increase in cm (30-45 DAT)	Increase in % (30-45 DAT)	Increase in cm (45-60 DAT)	Increase in % (45-60 DAT)	Total Increase in cm (30-60 DAT)	Total Increase in % (30-60 DAT)
T ₁ - Control	7.71	49.36	6.10	26.15	13.81	88.41
T ₂ - Boron @ 0.2%	8.35	50.24	6.70	26.83	15.05	90.55
T ₃ - Boron @ 0.4%	9.12	56.40	7.47	29.54	16.59	102.60
T ₄ - Zinc@ 0.3%	8.76	53.38	7.29	28.96	16.05	97.81
T ₅ - Zinc@0.5%	9.87	57.69	8.20	30.39	18.07	105.61
T ₆ - Boron @ 0.2% + Zinc @ 0.3%	11.89	75.88	8.42	30.55	20.31	129.61
T ₇ - Boron @ 0.2% + Zinc @ 0.5%	12.22	75.34	9.19	32.31	21.41	132.00
T ₈ - Boron @ 0.4% + Zinc@ 0.3%	12.96	78.21	10.04	35.19	22.00	132.77
T ₉ - Boron @ 0.4% + Zinc@ 0.5%	13.51	80.61	10.87	35.91	24.38	145.47
SEm (±)	0.088	0.745	0.094	0.449	0.295	1.403
C.D. (p=0.05)	0.266	2.253	0.284	1.358	0.891	4.242

Table 2: Effect of foliar application of boron and zinc on increase of number of leaves per plant ¹and length of leaf.

Treatment	Increase in number of leaves per plant						Increase in length of leaf					
	Increase in no. (30-45 DAT)	Increase in % (30-45 DAT)	Increase in no. (45-60 DAT)	Increase in % (45-60 DAT)	Total Increase in no. (30-60 DAT)	Total Increase in % (30-60 DAT)	Increase in cm (30-45 DAT)	Increase in % (30-45 DAT)	Increase in cm (45-60 DAT)	Increase in % (45-60 DAT)	Total Increase in cm (30-60 DAT)	Total Increase in % (30-60 DAT)
T ₁ - Control	2.38	41.46	2.34	28.82	4.72	82.23	4.63	34.25	5.41	29.81	10.04	74.26
T ₂ - Boron @ 0.2%	2.53	43.32	2.87	34.29	5.4	92.47	5.14	35.82	6.03	30.94	11.17	77.84
T ₃ -Boron@ 0.4%	2.96	46.54	3.51	37.66	6.47	101.73	5.74	40.62	6.38	32.11	12.12	85.77
T ₄ -Zinc@0.3%	3.2	47.98	3.56	36.07	6.76	101.35	5.59	38.31	6.31	31.27	11.9	81.56
T ₅ - Zinc@0.5%	3.55	51.15	4.16	39.66	7.71	111.10	6.75	47.01	7.12	33.73	13.87	96.59
T ₆ - Boron @ 0.2% + Zinc @ 0.3%	4.1	57.26	4.68	41.56	8.78	122.63	7.6	54.79	8.1	37.73	15.7	113.19
T ₇ - Boron @ 0.2% + Zinc @ 0.5%	4.78	72.87	5.23	46.12	10.01	152.59	8.56	62.62	8.64	38.87	17.2	125.82
T ₈ - Boron @ 0.4% + Zinc@ 0.3%	5.25	82.81	5.97	51.51	11.22	176.97	9.19	65.50	9.41	40.53	18.6	132.57
T ₉ - Boron @ 0.4% + Zinc@ 0.5%	5.88	85.71	6.93	54.40	12.81	186.73	10.82	77.67	10.92	44.12	21.74	156.07
SEm (±)	0.034	0.701	0.049	0.500	0.125	1.716	0.090	0.733	0.079	0.429	0.179	1.380
C.D. (p=0.05)	0.104	2.120	0.148	1.511	0.378	5.188	0.271	2.217	0.238	1.296	0.541	4.174

Table 3: Effect of foliar application of boron and zinc on width of leaf plant⁻¹ and Plant spread of cauliflower.

Treatment	Increase in width of leaf						Increase in plant spread					
	Increase in no. (30-45 DAT)	Increase in % (30-45 DAT)	Increase in no. (45-60 DAT)	Increase in % (45-60 DAT)	Total Increase in no. (30-60 DAT)	Total Increase in % (30-60 DAT)	Increase in cm (30-45 DAT)	Increase in % (30-45 DAT)	Increase in cm (45-60 DAT)	Increase in % (45-60 DAT)	Total Increase in cm (30-60 DAT)	Total Increase in % (30-60 DAT)
T ₁ - Control	3.29	56.34	3.44	37.68	6.73	58.90	9.1	52.75	9.21	34.95	18.31	106.14
T ₂ - Boron @ 0.2%	3.58	58.40	4.36	44.90	7.94	71.13	10.1	54.54	10.13	35.39	20.23	109.23
T ₃ -Boron@ 0.4%	3.62	64.07	4.89	52.75	8.51	86.55	10.65	59.76	10.86	38.15	21.51	120.71
T ₄ -Zinc@0.3%	3.8	61.00	4.65	46.36	8.45	74.64	10.55	55.61	11.14	37.74	21.69	114.34
T ₅ - Zinc@0.5%	4.28	66.25	5.72	53.26	10	88.54	10.8	61.12	11.46	40.25	22.26	125.98
T ₆ - Boron @ 0.2% + Zinc @ 0.3%	4.8	70.07	6.31	54.16	11.11	92.12	11.4	62.02	12.54	42.11	23.94	130.25
T ₇ - Boron @ 0.2% + Zinc @ 0.5%	5.27	77.27	6.77	56.00	12.04	99.27	11.57	63.71	12.84	43.19	24.41	134.42
T ₈ - Boron @ 0.4% + Zinc@ 0.3%	5.3	88.48	7.07	62.62	12.37	118.03	12.01	64.29	14.04	45.75	26.05	139.45
T ₉ - Boron @ 0.4% + Zinc@ 0.5%	6.08	95.75	8.11	65.25	14.19	127.72	13.24	73.84	15.66	50.24	28.9	161.18
SEm (±)	0.063	0.789	0.065	0.661	0.137	0.994	0.138	0.615	0.155	0.426	0.239	1.763
C.D. (p=0.05)	0.190	2.385	0.195	2.000	0.415	3.004	0.418	1.858	0.470	1.289	0.724	5.332

Table 4: Effect of foliar application of boron and zinc on yield and yield attributes of cauliflower.

Treatment	Curd diameter (cm)	Number of floret/curd	Fresh weight of curd (g)	Curd yield/plot (Kg)	Curd yield/ha (q)	Day of first curd initiation (DAT)	Day of first marketable curd harvesting (DAT)	Day of curd initiation to marketable harvesting (Days)
T ₁ - Control	9.67	8.33	256.5	4.1	126.66	61.37	80.65	19.28
T ₂ - Boron @ 0.2%	11.55	10.89	270.75	4.33	133.7	59.35	78.47	19.12
T ₃ -Boron@ 0.4%	12.12	12.67	273.53	4.38	135.06	58.41	77.43	19.02
T ₄ -Zinc@0.3%	11.12	11.23	264.25	4.23	130.49	60.73	79.59	18.86
T ₅ - Zinc@0.5%	11.31	12.75	267.53	4.28	132.09	59.68	78.47	18.79
T ₆ - Boron @ 0.2% + Zinc @ 0.3%	12.37	13.25	275.08	4.4	135.83	59.4	78.06	18.66
T ₇ - Boron @ 0.2% + Zinc @ 0.5%	12.68	13.73	279.58	4.47	138.05	58.53	77.07	18.54
T ₈ - Boron @ 0.4% + Zinc@ 0.3%	13.25	15.66	284.66	4.56	140.58	57.73	75.86	18.13
T ₉ - Boron @ 0.4% + Zinc@ 0.5%	13.87	14.45	289.47	4.63	142.96	56.23	74.13	17.9
SEm (±)	0.175	0.136	3.779	0.049	1.923	0.93	1.176	0.199
C.D. (p=0.05)	0.53	0.412	11.427	0.15	5.813	2.813	3.555	0.603