Effects of boron on fertility levels on the development and production of cauliflower

Abstract:A field experiment consisting five levels of fertility and four levels of boron in RBD with three replications was conducted at Horticulture Farm, SKNAU, (Jaipur) during *Rabi* season.The findings showed that different levels of fertility used to have a significant impact on the growth, yield and quality of cauliflower. Plant height at 30 and 60 DAT, the number of leaves per plant at 30 and 60 DAT and leaf area were all highest when 75% RDF through inorganic fertilizers and 25% RDF through vermicompost were applied. Also, it was found that the application of 50% RDF using inorganic fertilizers and 50% RDF through vermicompost treatment resulted in the highest average weight of curd volume, curd yield per plant and curd yield per ha (190.89 q/ha).

Keywords:RDF, Boron, yield, growth, cauliflower

Introduction:The most common cruciferous vegetable crop is cauliflower (*Brassica oleracea* var. botrytis L.), which belongs to the cruciferous family of crops. It is grown all year round for its tender and white curd. Due to its unique nutritional properties, high productivity and wide range of adaptability under various ecological situations, it is widely cultivated both in India as well as worldwide. Cauliflower is a crop that consumes a lot of minerals and absorbs a lot of macronutrients from the soil. Several Indian employees have suggested heavy manuring to obtain a good output of cauliflower. Despite the fact that Rajasthan has a key location for growing cauliflower, other issues relating to improved crop productivity and a viable yield must be addressed.

Using nutrients properly is one of the most crucial aspects of growing cauliflower that can provide health benefits. Manuring and fertilization have a direct impact on the production of cauliflower. Since that this crop is a heavy feeder, balanced fertilization is essential for increased productivity. It is clear that it is impossible to take advantage of every advantage of cauliflower without using macro- and micronutrients. It is a well-known fact that a variety of nutrients have a significant impact on the growth and yield of plants. The most insufficient element in Rajasthan's coarse-textured, sandy soils is nitrogen. It is the primary component of pigments, chlorophyll and proteins.

The most effective nitrogen treatment promotes the transformation of carbohydrates into protein, increases the production of protoplasm and makes the plant more tender. A sufficient nitrogen supply is connected to active vegetative development and more effective use of the available nutrients. As a result, productivity increases. Micronutrients are also very important for the growth and production of cauliflower, in addition to macronutrients like NPK. In addition, because it is a component of cell membranes and is necessary for cell division, boron is an essential micronutrient for plants.

Boron deficiency may lead in abnormal cell division at particular areas, which can lead to disorders like the hollow stem of cauliflower. Furthermore, boron is involved in the buffering

effect, maintenance of conducting tissues, precipitation of extra cations and help with nitrogen absorption. Its main function relates to metabolism in plants, including absorption and efficient usage. The vascular cells of fruits, the cell elongation and phloem tissues of storage root or stem apical meristemand leaves and other organs capable of meristematic activities are similarly affected by boron (Singh, 1991). Boron increases auxin activity and decreases the growth-retarding endogenous inhibitors, according to Shirvona et al. (1988). As a result, it encourages the formation of plant characteristics, especially the stem and curd peduncle.

A study titled "Effect of Fertility Levels and Boron on Growth, and Yield of Cauliflower (*Brassica oleracea* var. botrytis L.)" was conducted while keeping the above information in perspective.

Materials and Methods: The research study, "Effect of Fertility Levels and Boron on Growth and Yield of Cauliflower (*Brassica oleracea* var. botrytis L.)," was carried out in the horticulture farm of the S.K.N. College of Agriculture at Jobner, Jaipur, from November 2016 to February 2017. The experiment included four levels of boron (0, 1.5, 2.0, and 2.5 kg boron/ha) that have been evaluated both separately and together, as well as five levels of fertility (Control, 100% RDF through inorganic fertilisers, 75% RDF through inorganic fertiliser + 25% through vermicompost, 50% RDF through inorganic fertiliser + 50% through vermicompost and 25% RDF through inorganic fertiliser + 75% through vermicompost). Three replications with RBD were used to evaluate all 20 treatment combinations.

Treatment application: Cauliflower should receive 120:100:100 kg/ha of fertiliser, on average. The treatment mixture included the following: urea (46% N), single super phosphate (16% P), and muriate of potash (60% K). As the base dose, full doses of single super phosphate, muriate of potash, and half doses of urea were applied in various treatments when seedlings were transplanted into the main field. At 30 and 45 days after transplant, half of the urea was given as a stop-treatment in two separate doses. The required quantity of vermicompost was given in accordance with the treatment combination. The entire weight of vermicompost was spread fairly, then well mixed, before being put in the bed. As part of the treatment, agro-based elemental borax with 11% boron was broadcast into to the bed. The soil was then treated with boron before it was planted.

Results and Discussion:

Growth: Different fertility levels significantly increased plant height, number of leaves per plant, and leaf area, according to the results presented in the chapter before (Table 1 to 4).

Following the application of 50% RDF through inorganic fertilisers and 50% through vermicompost, maximum plant height (30.99 cm and 56.47 cm at 30 DAT and 60 DAT, respectively), leaf area (151.96 cm2 and 319.21 cm2 at 30 DAT and 60 DAT, respectively) and number of leaves per plant (12.12 and 22.54 at 30 DAT and 60 DAT, respectively) were seen. Different fertility levels were observed to have no effect on the initiation of the cauliflower curd,

.

This may be because the root zone provides a better nutritional environment for plant growth and development. The significant effect of inorganic fertilizers combined with vermicompost on cauliflower plant growth appears to be due to the urea, SSP, and MOP supplied at the start of growth, whereas vermicompost provided the nutrients throughout the crop growth period in keeping with the need of the plants. Vermicompost does have the additional benefit of improving the physical and biological characteristics of soil in terms of granulation, deformability, porosity, and water holding capacity in addition to providing all of the necessary nutrients. The beneficial effects of inorganic fertilizers and vermicompost on growth are achieved through a nutritionally balanced environment that is beneficial to production systems and soil rhizospheres. The results are in close agreement with those of Kumhar*et al*. (2004) in the case of cauliflower, Patil (2003) in the case of tomatoes, and Mahmood*et al.* (2007) in the case of cauliflower With the application of 2.5 kg of boron per hectare, the growth parameters of the cauliflower plant—including plant height, the number of leaves per plant, the area of each leaf, the percentage of chlorophyll, and the fresh weight of the plant—significantly improved but were still similar to those of 2.0 kg of boron per hectare (Table 1 to.5). These results clearly showed that boron contributed significantly to the enhancement of cauliflower growth. It can be due to the sufficient micronutrients available and because soil conditions are good enough even for nutrients to be taken.These findings closely match that of Moniruzzaman*et al.* (2007) in the field of broccoli, Singh *et al*. (2011) in the field of cauliflower, Kumar *et al*. (2012) in the field of cauliflower as well, and Devi *et al.* (2012) in the field of cabbage.

Yield and yield attributes: The average weight of curd (386.56 g), curd yield per plot (4.64 kg/plot), curd yield per hectare (190.89/ha) and volume of curd all significantly increased with the application of 50% RDF through chemical fertilizer and 50% through vermicompost (261.27 cc). However, 25% RDF from inorganic fertilizers and 75% from vermicompost were statistically similar in all the characters mentioned above (Table 5 to 7). The significant increase in yield and yield attributes following the application of fertilizers and vermicompost may be attributed to the position of nutrients in the soil that the plant takes up. Moreover, increased vegetative development might have provided photosynthetes more sites for translocation, ultimately increasing production.

Kumhar*et al.* (2004) in cauliflower, Mahala (2011) in spouting broccoli, Choudhary*et al*. (2012) in broccoli and Rai*et al*. (2013) in cabbage support the conclusions of earlier research.

The average weight of curd (375.51 g), curd yield per plot (4.51 kg), total curd yield per ha (185.49 q), and volume of curd were all significantly higher following applying 2.5 Kg of boron

per hectare (246.58 cc). So far, 2.0 kg of boron per hectare was found to be statistically comparable to this treatment in all the characters above (Table 6 and 8). A significant increase in yield under the influence of boron was mainly the result of improved growth and the resulting increase in various yield attributes and yield. This beneficial effect of boron on yield attributes and yield may be attributable to an increased supply of micronutrients throughout the a whole growing season. The findings of Batal*et al*. (1997), Ghosh and Hasan (1997), Mukhopadhayay and Chattopadhyay (1999), Khadka*et al*. (2005), and Moniruzzaman*et al*. (2007) in broccoli, where head yield per plant and per hectare was highest and up to 1.5 kg of boron per ha, are all in contract with these results for cauliflower.

Conclusion: According to the findings of the current investigation. The combined application of 50% RDF through inorganic fertilizers and 50% through vermicompost along with 2.5 kg boron per ha as a soil application was found to perform the best in terms of growth, yield, and quality parameters for better cauliflower crop with maximum yield (220.22 q/ha).

ACKNOWLEDGEMENT.I sincerely appreciate Prof. (Dr.) L.N. Bairwa, my major adviser, and the members of my advisory committee for providing me with good advice throughout T the course of study. I also want to express my gratitude to COASKN Jobner for helping me set up the research facility.

References:

Batel,K.M., Granderry, D.M. and Mullinix, B.G. (1997). Nitrogen, magnesium and boron application affect cauliflower yield, curd mass and hollow stem disorder. *Hort Science*, 32(1): 75-78.

Choudhary,S., Soni, A.K. and Jat, N.K. (2012).Effect of organic and inorganic source of nutrient on growth, yield and quality of sprouting broccoli (*Brassica oleracea* var. italica L.) cv. CBH. *Indian Journal of Horticulture*, 69 (4): 550-554.

Devi, N., Montessori., Devi, R. K. Bhanishana and Das Ranjan (2012). Enhancement of physiological efficiency of cabbage (*Brassica oleracea* var. capitata L.) using foliar nutrition of boron.*Crop Research*, 43 (1, 2 & 3): 76-80.

Ghosh, S.K. and Hasan, M.A. (1997).Effect of boron on growth and yield of cauliflower.*Annals of Agricultural Science*, 18(3): 391-392.

Khadka, Y.G., Rai S.K. and Raut S. (2005).Effect of boron on cauliflower production. *Nepal Journal of Science and Technology*, 6:103-108.

Kumhar, R.D., (2004).Effect of NPK and vermicompost on growth and yield of cauliflower (*Brassica oleracea* var. botrytis L.) cv. PusaKatki. M.Sc. (Ag.)Thesis, Submitted to Rajasthan Agricultural University, Bikaner, Campus-Jobner.

Mahala, S.C. (2011). Integrated Nutrient Management in sprouting broccoli (*Brassica oleracea* var. italica L). Cv. Fiesta. M.Sc. (Ag). Thesis, submitted to Rajasthan Agriculture University, Bikaner, CampusJobner.

Mahmoud, S.S.; Haider; M.; Moniruzzman and Islam, M.R. (2007).Optimization of fertilization requirement for cauliflower under field condition.*Bangladesh Journal Agric. Research*, 32 (3): 487-491.

Moniruzzaman,M., Rahman, S. M. L., Kibria, M. G., Rahman, M. A. and Hossain,M.M. (2007). Effect of boron and nitrogen on yield and hollow stem of broccoli.*Journal of Soil Nature*, 1 (3):24-29.

Mukhopadhayay,T.P. and Chattopadhyay, S.B. (1999).Boron and molybdenum in growth and yield of cauliflower grown in Trai region of West Bengal. *Horticultural Journal*, 12(2): 71-76.

Patil, A.R., (2003).Effect of spacing and nitrogen levels on growth and yield of knol-khol (*Brassica oleracea* var. caulorapa) cv. White Vienna. *Annals of Plant Physiology*, 17: 110-113.

Rai,R., Thapa,U., Mandal, A.R. and Roy, B.(2013).Growth, yield and quality of cabbage (*Brassica oleracea* var. capitata L.) as influenced by vermicompost. *Environment and Ecology*, 31 (1A): 314-317.

Shirvona,I.P., Skvortsov, V.G., Smirnov,P.S. and lyalin, G.S. (1988).Effect of boron compound on growth process and auxin activity in cauliflower plants. In mineral noepitanicprotessayRostaRazvitiyaRostenil,Kursk, USSR.21-27.

Singh, K. P., Singh, V.K., Kant, K. and Roy, R.K. (2011).Effect of different levels of boron and its methods of application on growth and yield of cauliflower (*Brassica oleracea* var. botrytis L.). Vegetable Science, 38 (1): 76-78.

Singh, K.(1991).Manurial requirement of vegetable crop. Indian Council of Agricultural Research: 4-12.

Table: 1.Effect of fertility levels and boron on plant height at 30 and 60 DAT of cauliflower

Treatments	Plant height (cm)	
	30 DAT	60 DAT
Fertility levels		

F_0– Control	22.36	40.74
F_1 – 100% RDF through inorganic fertilizers	28.17	51.34
F_2 – 75% RDF through inorganic fertilizers + 25 % through VC	30.99	56.47
F_3 – 50% RDF through inorganic fertilizers + 50 % through VC	30.64	55.85
F_4 – 25% RDF through inorganic fertilizers + 75 % through VC	27.83	50.71
SEm±	0.78	1.41
CD (P=0.05)	2.24	4.04
Boron levels		
B_0– Control	25.05	45.22
B_1 – 1.5 kg/ha	27.05	48.84
B_2 – 2.0 kg/ha	29.21	53.67
B_3 – 2.5 kg/ha	30.67	56.36
SEm+	0.70	1.26
CD (P=0.05)	2.01	3.61

VC = Vermicompost

Table: 2Effect of fertility levels and boron on number of leaves per plant at 30 and 60 DAT of cauliflower

Treatments	**Number of leaves per plant**	
	30 DAT	**60 DAT**
Fertility levels		
F_0– Control	8.75	16.27
F_1 – 100% RDF through inorganic fertilizers	11.02	20.50
F_2 – 75% RDF through inorganic fertilizers + 25 % through VC	12.12	22.54
F_3 – 50% RDF through inorganic fertilizers + 50 % through VC	11.99	22.30
F_4 – 25% RDF through inorganic fertilizers + 75 % through VC	10.88	20.25
SEm±	0.30	0.57
CD (P=0.05)	0.87	1.63
Boron levels		
B_0– Control	9.71	18.05
B_1 – 1.5 kg/ha	10.48	19.50
B_2 – 2.0 kg/ha	11.52	21.43
B_3 – 2.5 kg/ha	12.10	22.50
SEm+	0.27	0.51
CD (P=0.05)	0.78	1.46

VC = Vermicompost

Table: 3. Effect of fertility levels and boron on leaf area at 30 and 60 DAT of cauliflower

Treatments	Leaf area (cm^2)	
	30 DAT	**60 DAT**
Fertility levels		
F_0 - Control	109.64	230.31
F_1 – 100% RDF through inorganic fertilizers	138.14	290.19
F_2 – 75% RDF through inorganic fertilizers + 25 % through VC	151.96	319.21
F_3 – 50% RDF through inorganic fertilizers + 50 % through VC	150.29	315.70
F_4 – 25% RDF through inorganic fertilizers + 75 % through VC	136.46	286.65
SEm+	3.80	7.98
CD (P=0.05)	10.88	22.85
Boron levels		
B_0 - Control	121.68	255.61
B_1 – 1.5 kg/ha	131.42	276.07
B_2 – 2.0 kg/ha	144.43	303.39
B_3 – 2.5 kg/ha	151.65	318.57
SEm+	3.40	7.14
CD (P=0.05)	9.73	20.43

VC = Vermicompost

Table: 4 .Effect of fertility levels and boron on curd yield per plot and per hectare of cauliflower

Treatments	Curd yield (Kg/plot)	Curd yield (q/ha)
Fertility levels		
F_0– Control	2.69	110.74
F_1 – 100% RDF through inorganic fertilizers	3.59	147.78
F_2 – 75% RDF through inorganic fertilizers + 25 % through VC	4.09	168.15
F_3 – 50% RDF through inorganic fertilizers + 50 % through VC	4.64	190.89
F_4 – 25% RDF through inorganic fertilizers + 75 % through VC	4.52	186.07
SEm+	0.05	1.95
CD (P=0.05)	0.14	5.58
Boron levels		
B_0– Control	2.79	114.69
B_1 – 1.5 kg/ha	3.94	162.27
B_2 – 2.0 kg/ha	4.39	180.52
B_3 – 2.5 kg/ha	4.51	185.43

SEm+	0.04	1.74
CD (P=0.05)	0.13	5.04

VC = Vermicompost