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.). 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.

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.

Materials and Methods: The research studywas 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: The recommended dose of fertilizer for cauliflower (120:100:100 kg/ha NPK respectively) was applied through urea, single super phosphate and muriate of potash as per treatment combination(Cauliflower Cultivation Guide, 2023).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 tables 1 to 3. Following the application of 50% RDF through inorganic fertilizers 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.

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 and the area of each leafsignificantly improved but were still similar to those of 2.0 kg of boron per hectare. 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 yield per plot (4.64 kg/plot)and curd yield per hectare (190.89/ha) 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 in Table 4. 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 yield per plot (4.51 kg)and total curd yield per ha (185.49 q) 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 in Table 4. 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 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:On the basis of the present investigation it can be concluded that the combined application of 50 percent RDF through inorganic fertilizers and 50 per cent through vermicompost along with 2.5 kg boron per ha as soil application was found best in terms of growth, yield and quality parameters for better cauliflower crop with maximum yield (220.22 q/ha).

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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: 2. Effect 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