RESEARCH ARTICLE

# INTEGRATED EFFECT OF ORGANIC AND INORGANIC FERTILIZER ON GROWTH AND YIELD ATTRIBUTES OF CAULIFLOWER (*BRASSICA OLERACEA VAR. BOTRYTIS L.)*

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**Abstract:** A field experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Jaipur) during Rabi season 2016-17, consisting five levels of fertility and four levels of boron in randomized block design with three replications. Results revealed that different fertility levels influenced growth and yield of cauliflower significantly, chlorophyll content (1.36 mg/g), average weight of curd (386.56 g) and Volume of curd (261.27 cc) were recorded highest with application of 50% RDF through inorganic fertilizer and 50% RDF through vermicompost but remained at par with application of 25% RDF through inorganic fertilizers and 75% RDF through vermicompost. It is also revealed that fresh weight of plant at harvest (1.73 kg/plant) was recorded highest with application of 50% RDF through inorganic fertilizer and 50% RDF through vermicompost but remained at par with application of 75% RDF through inorganic fertilizers and 25% RDF through vermicompost and observed the day taken to curd initiation in cauliflower was found non-significantly with different fertility levels. However, curd formation was found earliest (62.49 days) in application of 25% RDF through inorganic fertilizers and 75% RDF through vermicompost. Similarly, the boron level with 2.5 kg per ha significantly increased the chlorophyll content (1.35 mg/g), fresh weight of plant at harvest (1.73 kg/plant), average weight of curd (375.51 g), Volume of curd (246.58 cc) and earliest curd initiation (62.45 days) as compared to control and 1.5 kg boron per ha but statistically at par with 2.0 kg boron per ha.

**Keywords:** Boron, Cauliflower, Growth, Yield

## INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.*)* is the most popular vegetable crop in cole crops belong to the family brassicaciae or cruciferae it is widely cultivated in all over India and abroad for its high productivity, nutritive values and wider adaptability under various ecological conditions. In India, commonly grown two groups of cauliflower are as Indian or tropical types (originate in India) and Temperate type also known as snowball type. These have more variability and strong self-incompatible. Whereas, temperate types have less variability with less or no self- incompatible. Cauliflower has small thick stem, branched tap root system and bearing whorl of leaves. It is used as fried as well as dried vegetable, pickles and soup. It is a rich source of nutrient including vitamin-A (51 IU), riboflavin (0.10 mg), vitamin-C (56 mg), thiamin (0.04 mg), calcium (33 mg), nicotinic acid (1.0 mg), potassium (138 mg), phosphorus (57 mg), moisture (90.8 g), protein (2.6 g), carbohydrates (4.0 g), fiber (1.2 g), fat (0.4 g) and iron (1.5 mg) as per 100 g of edible portion of cauliflower (Fageria *et al*.,2012).

Cauliflower is a heavy feeder crop of nutrients, and takes a lot of macronutrients from the soil. Heavy manuring has been recommended for getting high yield of cauliflower. The yield of cauliflower is directly influenced with fertilization and manuring. Being heavy feeder crop, balanced fertilization is very important for better productivity. It is evident that without use of macro and micro nutrients, not possible to get the maximum benefit in cauliflower. Nitrogen content could increase the production of cauliflower, but the curd quality is affected by high nitrogen with deficits of other nutrients could reduce the storage life of cauliflower and increase buttoning problem. The soils of Rajasthan are deficient in nitrogen with a high pH 8.5. Its deficiency causes interveinal yellowing, development of anthocyanine pigment, rolling of leaves, chlorosis and necrosis. Phosphorus is necessary constituent of phosphoric acid, nucleic acid and several enzymes. It is also an essential constituent for majority of enzymes which is the great important in transformation of energy in carbohydrate and fat metabolism and also in respiration in plants. Potassium also play important role in crop productivity of cauliflower. It imparts increased disease resistance to plant and function as in activator of many enzymes. Application of NPK fertilizer through inorganic source can enhances the growth and yield crop but soil fertility and productivity can be retained for longer period. Therefore, it is important supplement to the recommended dose of fertilizer through organic and inorganic source of nutrients. Vermicompost is a good source of organic fertilization. It is a mixture of worm carting, organic material, humus, and living earthworm and their cocoon and other organism. Earthworm reduces the Carbon: Nitrogen ratio,

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increase cation exchange capacity, humic acid content and soluble carbohydrate (Talasilkar *et al*., 1999). Boron is also concerned primary role with metabolism both uptake and its efficient use in plants. Boron also affect the cambial and phloem tissues of storage root or stem apical meristems and leaves, vascular cambium of fruits and other organs which are capable of meristematic activities.

## MATERIALS AND METHODS

The field experiment entitled "Integrated effect of organic and inorganic fertilizer on growth and yield attributes of cauliflower (*Brassica oleracea var. botrytis* L.) was conducted at horticulture farm, department of horticulture, S.K.N. college of agriculture, Jobner, Jaipur during *Rabi* season during November, 2016 to February, 2017. The experiment consisting five levels of fertility (Control, 100% (inorganic fertilizers) RDF, 75% (inorganic fertilizer) + 25% (vermicompost) RDF, 50% (inorganic fertilizer) + 50% (vermicompost) RDF and 25% (inorganic fertilizer) + 75% (vermicompost) RDF and four levels of boron (0, 1.5, 2.0 and 2.5 kg boron/ha) tested alone and its combination. The total 20 treatment combinations were evaluated in randomized block design with three replications. Treatment application: The recommended dose of nitrogen, phosphorus and potash fertilizer for cauliflower is 120:100:100 kg/ha were applied, respectively through urea (46% N), single super phosphate (16% $P_2O_5$) and muriete of potash (60% $K_2O$) as per treatment combination. Full dose of SSP, MOP and half dose of urea in different treatments were applied as the basal dose at the time of transplanting of cauliflower in main field. Remaining dose of urea was given as top dressing in two split doses at 30 and 45 DAT. The required vermicompost was applied given as per treatment combination. The whole quantity of vermicompost was uniformly apply at the time of field preparation and then properly mixed. Boron was applied in the field as per treatment combination through agriculture grade elemental borax contenting 11% boron was broadcasted before transplanting and incorporated in the soil. Data were collected from five randomly selected plants for each plot and the recorded parameters were chlorophyll content (mg/g), fresh weight of plant at harvest (kg/plant), day taken to curd initiation, average weight of (g) and Volume of curd (cc).

## RESULTS AND DISCUSSION

**Growth attributes:** The maximum chlorophyll content (1.36 mg/g) was recorded under $F_3$ (50 per cent RDF through inorganic fertilizers and 50 per cent through vermicompost), which was found to be significantly higher over $F_0$ and $F_1$ but statistically to at par to $F_2$ and $F_4$ treatments. The increase in chlorophyll content under the treatment $F_4$ was found to be 16.17 and 9.55 per cent higher over $F_0$ and $F_1$ treatments, respectively. The chlorophyll content significantly affected by soil application of different boron levels. Soil application of boron @ 2.5 kg per ha registered maximum value (1.35 mg/g) of chlorophyll content that was significantly superior to $B_0$ (control) and $B_1$ (1.5 kg/ha) but statistically at par with 2 kg boron per ha. The per cent increase under $B_3$ treatment was found to be 13.33 and 7.40 more than $B_0$ and $B_1$ treatments, respectively. The effect of fertility level had significant influence on fresh weight of plant (1.73 kg) was observed in 50 per cent RDF through inorganic fertilizer and 50 per cent through vermicompost ($F_3$), which was found to be significantly higher over $F_0$, $F_1$ and $F_4$ but it was statistically at par with 75 per cent RDF through inorganic fertilizer and 25 per cent through vermicompost ($F_2$). The increase in fresh weight of plant under $F_3$ treatment was found to be 27.74, 9.24 and 9.82 per cent higher as compared to $F_0$, $F_1$ and $F_4$ treatments, respectively. Whereas, minimum fresh weight of plant (1.25 kg) was recorded under $F_0$ treatment. The maximum fresh weight of plant (1.73 kg) was recorded under 2.5 kg boron per ha whereas minimum was recorded under control (1.39 kg). The increase in fresh weight of plant under $B_3$ treatment was found to be 19.65 and 13.29 per cent higher over control and $B_1$ treatments, respectively. Day taken to curd initiation in cauliflower was found non-significantly with different fertility levels. However, cauliflower taken 64 days to initiation curd formation and treatment $F_4$ was found earliest (62.49 days) curd formation. Curd initiation found to be non-significantly affected to different boron levels of control, 1.5, 2.0 and 2.5 kg boron per ha. This might be due to the better nutritional environment in the root zone for growth and development of the plant. The significant influence of inorganic fertilizers in combination with vermicompost on plant growth of cauliflower seems to be account of urea, SSP and MOP supplied at initial growth stages whereas, vermicompost provided the nutrients throughout the cropping season matching to the need of the plants. An added advantage of vermicompost is that besides supplying the entire essential nutrient it improves the physical and biological properties of soil in respect of granulation, friability, porosity and water holding capacity. The positive effect of inorganic fertilizers and vermicompost on growth by providing a balanced nutritional favorable in both environment of soil rhizospheres and in plant system. The results are close conformity with findings of Patil (2003) in tomato and Kumhar *et al*. (2004) in cauliflower. There was significant increase in the growth parameters *viz*. plant height, number of leaves per plant, leaf area, chlorophyll content and fresh weight of plant of cauliflower with the application of 2.5 kg boron per hectare but remained at par with 2.0 kg boron per hectare (Table 1 to.5). These findings

clearly indicated that boron played a significant role for enhancing the growth of cauliflower. It might be due to supply of micronutrients and availability of uptake nutrients in soil due to favorable conditions. These results are close conformity with findings of Singh *et al.* (2011) in cauliflower and Devi *et al.* (2012) in cabbage.

**Table 1.** Effect of fertility levels and boron on chlorophyll content (mg/g), fresh weight of plant at harvest (kg/plant), day taken to curd initiation, average weight of curd and volume of curd (cc) of cauliflower.

| Treatments | Chlorophyll content in leaves (mg/g) | Fresh weight of plants at harvest (Kg) | Days taken to curd initiation | Average weight of curd (g) | Volume of curd (cc) |
|---|---|---|---|---|---|
| **Fertility levels** | | | | | |
| **$F_0$ (Control)** | 1.14 | 1.25 | 64.34 | 224.26 | 129.51 |
| **$F_1$ (100% RDF through inorganic fertilizers)** | 1.23 | 1.57 | 64.21 | 299.27 | 193.83 |
| **$F_2$ (75% RDF through inorganic fertilizers + 25 % through VC)** | 1.30 | 1.71 | 63.63 | 340.53 | 228.54 |
| **$F_3$ (50% RDF through inorganic fertilizers + 50 % through VC)** | 1.36 | 1.73 | 63.25 | 386.56 | 261.27 |
| **$F_4$ (25% RDF through inorganic fertilizers + 75 % through VC)** | 1.34 | 1.56 | 62.49 | 376.82 | 253.99 |
| SEm+ | 0.03 | 0.04 | 1.75 | 4.18 | 3.49 |
| CD (P=0.05) | 0.10 | 0.12 | NS | 11.96 | 9.98 |
| **Boron levels** | | | | | |
| **$B_0$ (Control)** | 1.17 | 1.39 | 64.43 | 232.25 | 152.14 |
| **$B_1$ (1.5 kg/ha)** | 1.25 | 1.50 | 64.05 | 328.61 | 215.45 |
| **$B_2$ (2.0 kg/ha)** | 1.32 | 1.65 | 63.41 | 365.58 | 239.54 |
| **$B_3$ (2.5 kg/ha)** | 1.35 | 1.73 | 62.45 | 375.51 | 246.58 |
| SEm+ | 0.03 | 0.04 | 1.56 | 3.74 | 3.12 |
| CD (P=0.05) | 0.09 | 0.11 | NS | 10.79 | 9.01 |

VC = Vermicompost

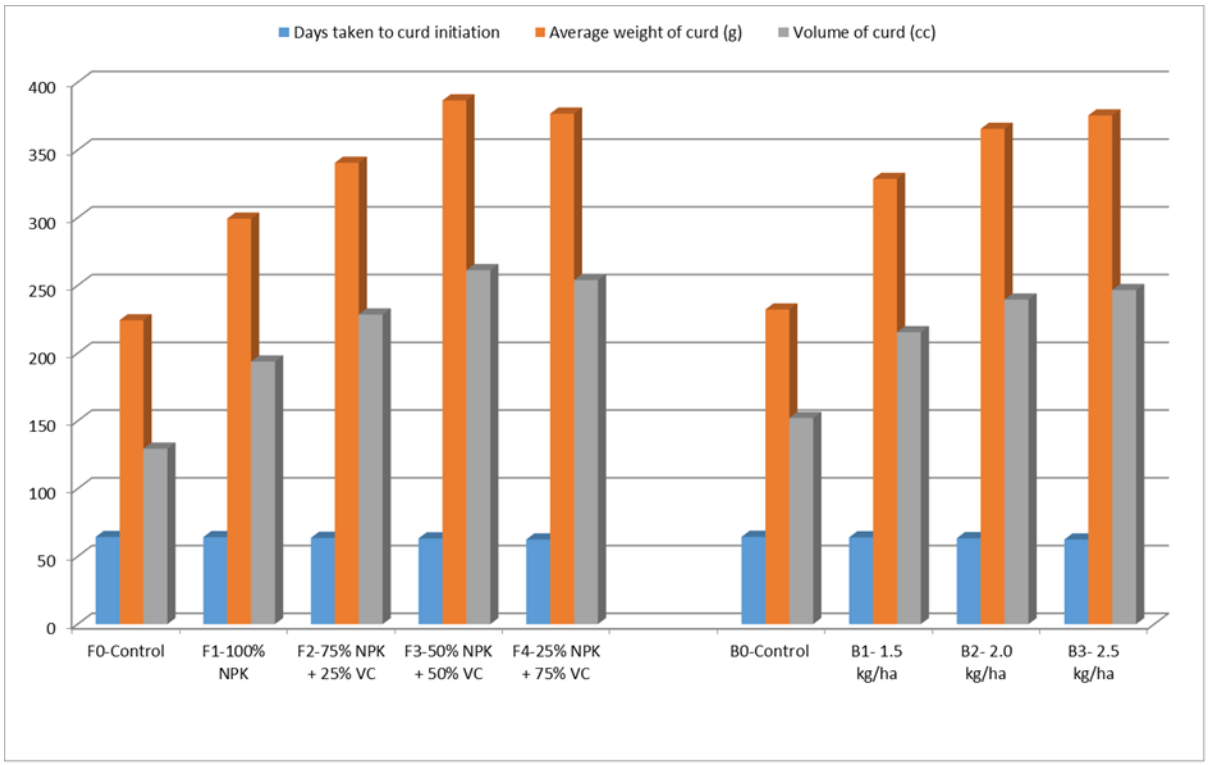


**Fig. 1 Effect of fertility levels and boron on day taken to curd initiation, average weight of curd and volume of curd (cc) of cauliflower**

**Yield attributes:** The maximum average weight of curd (386.56 g) was recorded under $F_3$ (50 per cent RDF through inorganic fertilizers and 50 per cent through vermicompost), which was found to be significantly higher over $F_0$, $F_1$ and $F_2$ but statistically at par with $F_4$ treatment. The increase in average weight of curd in $F_3$ treatment was found to be 72.37, 29.17 and 13.52 per cent higher over $F_0$, $F_1$ and $F_2$ treatments, respectively. The maximum average weight of curd (375.51 g/plant) was recorded with soil application 2.5 kg boron per ha which was statistically at par with 2 kg boron per ha. The increase in average weight of curd under $B_3$ treatment was found to be 38.15 and 12.48 per cent higher than $B_0$ and $B_1$ treatments, respectively. The maximum volume of curd (261.27 cc) was observed in $F_3$ (application of 50 per cent RDF through inorganic fertilizer and 50 per cent through vermicompost), which was found to be significantly higher over $F_0$, $F_1$ and $F_2$ but it was statistically at par with 25 per cent RDF through inorganic fertilizer and 75 per cent through vermicompost ($F_4$). The increase in volume of curd under $F_3$ treatment was found to be 50.43, 25.81 and 12.52 per cent higher over as compared to $F_0$, $F_1$ and $F_2$ treatments, respectively, whereas, minimum volume of curd (129.51 cc) was recorded under control ($F_0$) treatment. The application of different boron levels had significant effect on volume of curd of cauliflower. The highest volume of curd (246.58 cc) was recorded under 2.5 kg boron per ha whereas, minimum was recorded under control (152.14 cc). The increase in volume of curd under $B_3$ treatment was found to be 38.29 and 12.62 per cent higher over control and $B_1$ treatments, respectively, but it was statistically at par with 2.0 kg boron per ha treatment. The beneficial effect of boron on yield attributes might be due to enhanced supply of micronutrients during complete growing season, significant increase in yield under the influence of boron was largely function of improved growth and the consequent increase in different yield and yield attributes. These, results are in accordance with the findings of Batal *et al*. (1997) and Khadka *et al*. (2005) in cauliflower where head yield per plant and per hectare highest up to 1.5 kg boron per ha.

## CONCLUSION

On the basis of of present investigation results it can be concluded that the combined application of 50 per cent 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 and yield parameters for better cauliflower crop production.

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