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Impact of foliar feeding of paclobutrazol, triacontanol and complex micronutrients on growth, curd yield and B:C ratio of cauliflower (*Brassica oleracea* L. var. *botrytis*)

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Abstract

A field experiment was conducted during the Rabi season 2024-25 at the Centre of Excellence on Protected Cultivation and Precision Farming, Indira Gandhi Krishi, Raipur, Chhattisgarh, India, to study the effect of foliar application of paclobutrazol, triacontanol and complex micronutrients on growth, curd yield and B:C ratio of cauliflower. The experiment was laid out in a Randomized Block Design (RBD) with three replications and fourteen treatments using the variety White Crystal. Foliar sprays were applied at 30, 45 and 60 days after transplanting (DAT). Significant variation among treatments was observed for several growth and yield parameters. Among the treatments, T₁₀ (Triacontanol @ 4 ppm + Complex Micronutrient @ 0.3%) recorded the maximum plant height (54.47 cm at 60 DAT) and the highest number of leaves per plant (19.22), and was found statistically at par with T₁₂ and T₈ for plant height. Stem height was also highest under T₁₀ (15.00 cm), showing parity with several other treatments, while stem diameter remained non-significant across treatments. Similarly, no significant differences were observed in leaf size parameters, including length and width of the largest leaf. Overall, T₁₀ demonstrated superior performance in key vegetative growth attributes, indicating the positive influence of combined foliar application of triacontanol and micronutrients on cauliflower growth. However, the maximum curd yield (114.47 q ha⁻¹) was obtained in T₁₄ (Complex Micronutrient @ 0.3% + Paclobutrazol @ 100 ppm). Economic analysis revealed the highest B:C ratio (2.56) and net return in the same treatment. The results suggest that foliar application of Complex Micronutrient @ 0.3% + Paclobutrazol @ 100 ppm is effective in improving yield and profitability of cauliflower.

Keywords: Cauliflower, paclobutrazol, triacontanol, foliar application, micronutrient management

Introduction

Cauliflower (*Brassica oleracea* L. var. *botrytis*) is one of the most important vegetables among the all-Cole crops. Eastern Mediterranean region is its centre of origin and probably developed from broccoli. Its chromosome number is 2n = 18. Cauliflower crop (*Brassica oleracea* L. var. *botrytis*) was introduced in India in 1822. The crop is highly responsive to balanced nutrition and proper crop management practices. Micronutrients play a vital role in plant metabolism, enzymatic activity and photosynthesis, thereby influencing plant growth and productivity. Paclobutrazol is a triazole-based plant growth regulator that inhibits gibberellin biosynthesis, resulting in reducing vegetative growth and enhanced reproductive development. In cauliflower, paclobutrazol has been reported to enhance curd quality by increasing compactness and chlorophyll content. It also reduces leaf size and stem elongation, thereby producing more compact plants. PBZ application increases 4 carbohydrate accumulation in plant tissues, which can lead to earlier curd initiation and better marketability of the produce. (Yadav *et al.*, 2016) ^[8]

TRIA improves the quality and yield of cauliflower by promoting larger curds, higher curd weight, and improved nutritional composition. The compound also helps in stress tolerance by regulating antioxidative enzyme activities (Mishra, 2019) ^[4]. Plant growth regulators such as paclobutrazol and triacontanol are known to modify plant physiological processes and improve crop performance. Paclobutrazol regulates vegetative growth and improves assimilate partitioning, while triacontanol enhances photosynthetic activity and nutrient

uptake. Foliar application of micronutrients and growth regulators ensures rapid absorption and efficient utilization by plants. Therefore, the present investigation was undertaken to evaluate the impact of foliar feeding of paclobutrazol, triacontanol and complex micronutrients on growth, curd yield and B:C ratio of cauliflower.

Materials and Methods

The experiment was conducted during the Rabi season of 2024-25 at the Centre of Excellence on Protected Cultivation and Precision Farming, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh, India. The study was carried out on cauliflower (*Brassica oleracea* L. var. *botrytis*) variety White Crystal.

The experiment was laid out in a Randomized Block Design (RBD) with three replications and fourteen treatments consisting of foliar application of paclobutrazol, triacontanol and complex micronutrients applied individually and in different combinations along with a control. Foliar sprays were applied at 30, 45 and 60 days after transplanting (DAT).

Observations were recorded on plant height, number of leaves per plant, stem diameter, stem height, curd weight, curd diameter and curd yield per hectare. Economic parameters including net return and benefit-cost (B:C) ratio were also calculated. The data obtained were statistically analysed using analysis of variance (ANOVA) appropriate for Randomized Block Design.

Treatment	Treatment Details
T ₁	Control (water spray)
T ₂	Paclobutrazol @ 50 ppm
T ₃	Paclobutrazol @ 100 ppm
T ₄	Triacontanol @ 4 ppm
T ₅	Complex Micronutrient @ 0.2%
T ₆	Complex Micronutrient @ 0.3%
T ₇	Paclobutrazol @ 50 ppm + Triacontanol @ 4 ppm
T ₈	Paclobutrazol @ 100 ppm + Triacontanol @ 4 ppm
T ₉	Triacontanol @ 4 ppm + Complex Micronutrient @ 0.2%
T ₁₀	Triacontanol @ 4 ppm + Complex Micronutrient @ 0.3%
T ₁₁	Complex Micronutrient @ 0.2% + Paclobutrazol @ 50 ppm
T ₁₂	Complex Micronutrient @ 0.2% + Paclobutrazol @ 100 ppm
T ₁₃	Complex Micronutrient @ 0.3% + Paclobutrazol @ 50 ppm
T ₁₄	Complex Micronutrient @ 0.3% + Paclobutrazol @ 100 ppm

Results and Discussion

The results revealed significant variation among treatments for growth, curd yield and B:C ratio of cauliflower. Foliar application of plant growth regulators and complex micronutrients significantly influenced vegetative growth and curd development.

Treatment T₁₀ (Triacontanol @ 4 ppm + Complex Micronutrient @ 0.3%) recorded the maximum plant height (54.47 cm) and number of leaves per plant (19.22). The improved vegetative growth might be attributed to enhanced photosynthetic efficiency and metabolic activity induced by triacontanol, along with improved nutrient availability through micronutrient application. These findings are in close agreement with Bhandari *et al.* (2020) ^[1], Teixeira *et al.* (2025) ^[7]

Stem diameter and stem height were not significantly affected; however, T₁₄ (Complex Micronutrient @ 0.3% + Paclobutrazol @ 100 ppm) showed comparatively higher stem thickness, possibly due to reduced internodal elongation. Leaf size parameters (length and width) also remained non-significant, though numerically higher values were observed under T₁₀. Days to curd initiation and maturity were non-significant; however, earlier curd development was observed under paclobutrazol-based treatments, particularly T₁₄. similar result was also reported by Chaudhari *et al.* (2017) ^[2]

The highest curd yield (114.47 q ha⁻¹) was recorded in T₁₄ (Complex Micronutrient @ 0.3% + Paclobutrazol @ 100 ppm), which was statistically at par with treatments T₁₂, T₁₀, T₁₁ and T₁₃. The increase in yield may be due to the combined effect of micronutrients in enhancing physiological processes and paclobutrazol in regulating plant growth and improving assimilate partitioning towards curd development. The present findings are in close agreement with the reports of Patel *et al.* (2017) ^[2], Moklikar *et al.* (2018) ^[5] and Khan *et al.* (2012) ^[3].

Curd weight and yield were significantly increased by the combined application of growth regulators and micronutrients over individual treatments and control. This improvement may be due to enhanced assimilate partitioning by paclobutrazol, increased photosynthetic efficiency by triacontanol, and improved nutrient uptake by micronutrients. Curd diameter showed a non-significant but numerical increase under combined treatments, likely due to better cell expansion and assimilate translocation. The results indicate a synergistic effect of growth regulators and micronutrients in improving curd development and yield of cauliflower, supporting earlier findings

Economic analysis indicated that T₁₄ recorded the highest B:C ratio (2.56) and net return (Rs. 209,386.40 ha⁻¹), demonstrating greater profitability compared to other treatments. Similar findings have also been reported by Yadav *et al.* (2009) ^[9] and Singh *et al.* (2015) ^[6] in cauliflower.

Conclusion

The study revealed that combined foliar application of growth regulators and complex micronutrients significantly improved growth, yield, and economic returns in cauliflower. Treatment T₁₀ (Triacontanol @ 4 ppm + Complex Micronutrient @ 0.3%) was most effective for enhancing vegetative growth, while T₁₄ (Complex Micronutrient @ 0.3% + Paclobutrazol @ 100 ppm) recorded the highest yield and profitability. The results highlight the synergistic effect of growth regulators and micronutrients in improving curd development and overall productivity, and T₁₄ can be recommended for higher yield and economic returns in cauliflower cultivation.

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