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Efficiency of organic manures on growth, yield and quality of cauliflower (*Brassica oleracea* var. *botrytis* L.) var. Snowball-16

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Abstract

A field experiment on “Efficiency of Organic Manures on Growth, Yield and Quality of Cauliflower (*Brassica oleracea* var. *botrytis* L.) Var. Snowball-16” was conducted during the *Rabi* season of 2025-26 at Rama University, Mandhana, Kanpur, Uttar Pradesh. The study was laid out in a Randomized Block Design with nine treatments replicated three times. Treatments comprised farmyard manure (FYM), vermicompost, poultry manure and goat manure, each applied at 15 and 20 t ha⁻¹, along with the recommended dose of chemical fertilizers (RDF: 120:80:40 kg NPK ha⁻¹) as control.

Poultry manure @ 20 t ha⁻¹ (T₈) recorded the highest growth and yield parameters, including plant height (52.6 cm at 60 DAT), number of leaves (19.6 plant⁻¹), plant spread (68.5 cm), polar curd diameter (18.9 cm), equatorial curd diameter (20.4 cm), fresh curd weight (812 g plant⁻¹), curd volume (1480 cm³) and curd yield (29.7 t ha⁻¹). It also produced excellent curd compactness, extended shelf life and high total soluble solids (6.6 °Brix). Goat manure @ 20 t ha⁻¹ (T₉) and vermicompost @ 20 t ha⁻¹ (T₇) were statistically at par with T₈ for most traits. The RDF treatment showed faster early growth but was inferior to higher doses of poultry and goat manure in curd size, weight, marketable yield and economic returns. Lower manure doses (15 t ha⁻¹), especially FYM (T₂), performed the poorest. Economically, T₈ gave the highest net return (₹3, 03,500 ha⁻¹) and benefit-cost ratio (2.48).

The study concludes that poultry manure @ 20 t ha⁻¹ is the most effective, economically viable and sustainable practice for achieving superior growth, curd yield, quality and profitability in cauliflower var. Snowball-16 under Middle Gangetic Plain conditions of Uttar Pradesh. Goat manure and vermicompost @ 20 t ha⁻¹ are promising alternatives that also enhance long-term soil health.

Keywords: Cauliflower, organic manures, poultry manure, vermicompost, curd yield, quality, economics

Introduction

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is a prominent cool-season vegetable crop belonging to the Brassicaceae family. It is widely appreciated for its compact, edible curd (immature inflorescence), mild flavour, and high nutritional value. A 100 g serving of raw cauliflower supplies approximately 25-27 kcal, 2 g dietary fibre, more than 50% of the daily requirement of vitamin C, along with notable amounts of vitamin K, folate, choline, potassium, and manganese. The crop is also rich in glucosinolates and isothiocyanates bioactive sulphur compounds known for their antioxidant, anti-inflammatory, and potential anticancer properties. These features make cauliflower a low-calorie, nutrient-dense food that supports immunity, digestion, detoxification, and overall health.

Demand for cauliflower has grown significantly in recent years due to increasing health awareness and the popularity of low-carbohydrate and keto diets, where it is commonly used as a substitute for rice or wheat-based products. India ranks as the world's second-largest producer of cauliflower and broccoli. As per the final estimates for 2024-25, the country's total vegetable production stood at approximately

207.21 million tonnes, with cauliflower contributing a major share, especially during the *Rabi* season in the northern and eastern plains. Uttar Pradesh is one of the leading producing states. Under optimal management, progressive farmers commonly achieve yields of 25-30 t ha⁻¹.

However, long-term dependence on synthetic fertilizers has led to soil degradation, nutrient imbalances, reduced microbial activity, and several environmental concerns. Consumers are increasingly seeking residue-free, organically produced vegetables. Organic manures play a vital role by improving soil structure, enhancing water-holding capacity, stimulating beneficial microbes, and providing steady nutrient release. Despite these advantages, location-specific comparative data on the performance of different organic manures for cauliflower var. Snowball-16 under the Middle Gangetic Plain conditions of Uttar Pradesh are still limited.

Research methodology

The field experiment was conducted during the *Rabi* season of 2025-26 at the Agricultural Research Field, Rama University, Mandhana, Kanpur, and Uttar Pradesh. The

experimental soil was sandy loam in texture, slightly alkaline (pH 7.8), with electrical conductivity of 0.28 dS m⁻¹, organic carbon 0.48%, available nitrogen 142.5 kg ha⁻¹, available phosphorus 24.8 kg ha⁻¹ and available potassium 168 kg ha⁻¹.

Cauliflower variety Snowball-16 was used. Thirty-day-old healthy seedlings were transplanted in the first week of December. The experiment was laid out in a Randomized Block Design with nine treatments and three replications. Each plot measured 3.0 m × 0.90 m (2.70 m²) with a spacing of 60 cm × 45 cm (10 plants per plot). The treatments were:

- T₁: RDF (120:80:40 kg NPK ha⁻¹)
- T₂: FYM @ 15 t ha⁻¹
- T₃: Vermicompost @ 15 t ha⁻¹
- T₄: Poultry manure @ 15 t ha⁻¹
- T₅: Goat manure @ 15 t ha⁻¹
- T₆: FYM @ 20 t ha⁻¹
- T₇: Vermicompost @ 20 t ha⁻¹
- T₈: Poultry manure @ 20 t ha⁻¹
- T₉: Goat manure @ 20 t ha⁻¹

Well-decomposed organic manures were incorporated into the soil two weeks before transplanting. Standard agronomic practices including irrigation at 7-10 day intervals, manual

weeding, hoeing and plant protection measures were followed uniformly. Observations were recorded on growth parameters (plant height, number of leaves, plant spread), curd characters (polar and equatorial diameter, fresh curd weight, curd volume), yield, quality (TSS) and economics. Post-harvest soil samples were also analysed. Data were statistically analysed using ANOVA appropriate for Randomized Block Design. Treatment means were compared by Critical Difference (CD) at 5% probability level. Standard error of mean (SEm±) and coefficient of variation (CV %) are presented with each table.

Results and Discussion

Growth parameters

Application of different organic manures significantly affected vegetative growth. Poultry manure applied at 20 t ha⁻¹ (T₈) produced the maximum plant height of 52.6 cm at 60 DAT, which was statistically at par with T₇ and T₉ (Table 1). The lowest height was recorded in T₂ (FYM @ 15 t ha⁻¹). Similar trends were observed for number of leaves per plant and plant spread. The superior performance of T₈ is attributed to the high content of readily available nitrogen and phosphorus in poultry manure, which supported rapid cell division and canopy development.

Table 1: Effect of different organic manures on plant height (cm) of cauliflower at 30 and 60 DAT

Treatment	30 DAT	60 DAT
T ₁ (RDF)	28.4	50.9
T ₂ (FYM 15 t ha ⁻¹)	21.2	44.6
T ₃ (VC 15 t ha ⁻¹)	24.8	51.8
T ₄ (PM 15 t ha ⁻¹)	25.6	48.7
T ₅ (GM 15 t ha ⁻¹)	23.9	47.2
T ₆ (FYM 20 t ha ⁻¹)	22.5	46.8
T ₇ (VC 20 t ha ⁻¹)	25.9	52.3
T ₈ (PM 20 t ha ⁻¹)	26.7	52.6
T ₉ (GM 20 t ha ⁻¹)	25.4	51.5
SEm±	0.48	0.74
CD (P=0.05)	1.42	2.18
CV (%)	6.85	5.12

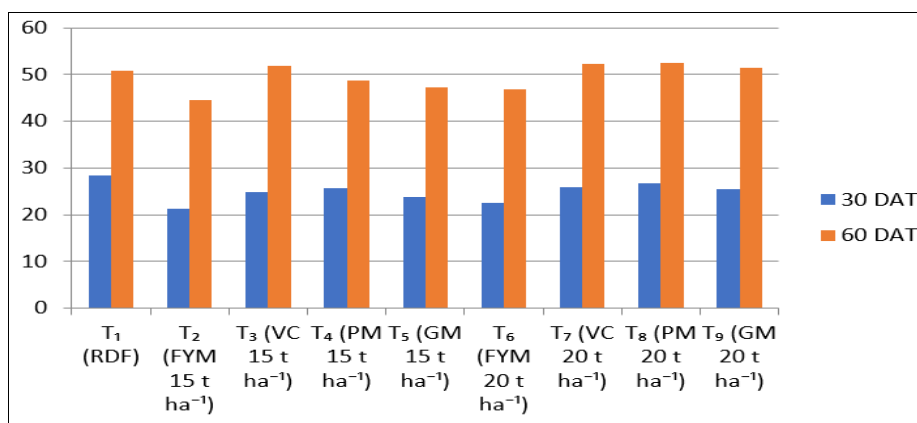


Fig 1: Effect of different organic manures on plant height (cm) of cauliflower at 30 and 60 DAT

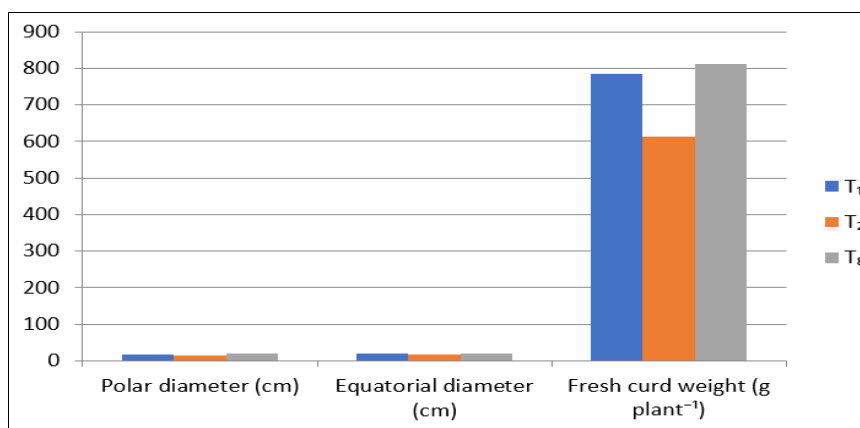
Curd characters and yield

T₈ recorded significantly superior curd dimensions, fresh curd weight (812 g plant⁻¹), curd volume (1480 cm³) and curd yield (29.7 t ha⁻¹) (Tables 4-5). T₉ and T₇ were statistically at par with T₈ for most curd characters. The

lowest values were observed in T₂. The rapid mineralisation and balanced nutrient supply from poultry manure at higher dose promoted efficient photosynthate translocation towards curd development.

Table 2: Effect of different organic manures on polar diameter (cm), equatorial diameter (cm) and fresh curd weight (g plant⁻¹)

Treatment	Polar diameter (cm)	Equatorial diameter (cm)	Fresh curd weight (g plant ⁻¹)
T ₁	17.8	19.2	785
T ₂	15.2	16.5	612
T ₈	18.9	20.4	812
SEm±	0.31	0.39	1.4
CD (P=0.05)	0.92	1.15	4.6
CV (%)	5.68	6.24	2.15

**Fig 2:** Effect of different organic manures on polar diameter (cm), equatorial diameter (cm) and fresh curd weight (g plant⁻¹)**Table 3:** Effect of different organic manures on curd yield (t ha⁻¹)

Treatment	Yield (t ha ⁻¹)
T ₈	29.7
T ₉	29.2
T ₁	28.7
T ₂	22.4
SEm±	0.59
CD (P=0.05)	1.76
CV (%)	7.28

Quality and economics

Vermicompost @ 20 t ha⁻¹ (T₇) recorded the highest TSS (6.8 °Brix), while T₈ gave 6.6 °Brix. Economically, T₈ recorded the highest gross return (₹5, 08,500 ha⁻¹), net

return (₹3, 03,500 ha⁻¹) and benefit-cost ratio (2.48) (Table 7). The superior economic performance was mainly due to higher marketable yield and better curd quality.

Table 4: Effect of different organic manures on economics of cauliflower production (₹ ha⁻¹)

Treatment	Cost of cultivation	Gross return	Net return	B:C ratio
T ₈	2,05,000	5,08,500	3,03,500	2.48
T ₉	2,02,000	4,96,500	2,94,500	2.46
T ₁	1,85,000	4,30,500	2,45,500	2.33

Discussion

Poultry manure applied at 20 t ha⁻¹ (T₈) consistently gave the best results for growth, curd size, weight, volume and marketable yield. This can be attributed to its high nutrient concentration and relatively fast mineralisation rate, which matched the crop's nutrient demand during critical curd formation stages. Vermicompost and goat manure at 20 t ha⁻¹ performed almost equally well due to the presence of humic substances, plant growth regulators and enhanced microbial activity. The RDF treatment showed quicker early growth but could not sustain nutrient supply as effectively as higher organic doses. Lower manure rates, especially FYM at 15 t ha⁻¹, resulted in slower nutrient release and inferior performance. Quality parameters such as TSS, curd

compactness and shelf life were markedly better under higher organic treatments because of balanced and sustained nutrition with reduced nitrate accumulation. The highest economic returns in T₈ resulted from significantly higher marketable yield and premium quality of produce. These observations are in agreement with the findings of Kaur *et al.* (2020) ^[12], Rasool *et al.* (2023), Bopche *et al.* (2024) ^[4] and several other researchers cited in the thesis.

Conclusion

On the basis of the one-year field study, it can be concluded that poultry manure applied at 20 t ha⁻¹ is the most effective treatment for maximising growth, curd yield (29.7 t ha⁻¹), quality and economic returns in cauliflower var. Snowball-

16 under the agro-climatic conditions of Kanpur, Uttar Pradesh. Goat manure @ 20 t ha⁻¹ and vermicompost @ 20 t ha⁻¹ proved to be strong alternatives, offering comparable yields along with additional advantages for long-term soil fertility. Higher doses of organic manures (20 t ha⁻¹) were clearly superior to lower doses (15 t ha⁻¹) and the recommended chemical fertilizer dose in terms of curd size, weight, quality and sustainability. These organic options not only reduce dependence on synthetic inputs but also meet the growing consumer demand for residue-free vegetables while improving soil health.

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