



Bulbing Attributes of Garlic (*Allium sativum* L.) as Influenced by Varying Levels of Organic Manures

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ABSTRACT

Background: A standard research trial were conducted with the objective to evaluate the influence of variable levels of organic inputs on bulb attributes of garlic cultivars grown under suitable environment of lower hilly region of Uttarakhand.

Methods: A field study were undertaken during successive *rabi* seasons of 2021-2022 and 2022-2023 at Horticulture Experiment Block, School of Agricultural Science, Shri Guru Ram Rai University, Dehradun, Uttarakhand, India to evaluate the influence of varying levels of organic manures on bulb attributes of garlic. The research trials were organised in a factorial randomized block design comprising three replications. Design treatments comprised two factors, Factor 1: includes two Garlic cultivars viz. (V₁) Pahadi local and (V₂) Desi local; Factor 2: comprised of twelve varying levels of organic manures viz. T₁: (Control), T₂: (Farm Yard Manure @ 10 t/ha), T₃: (Vermicompost @ 5 t/ha), T₄: (Vermiwash @ 50%), T₅: (Cow urine @ 20%), T₆: (PSB @ 5 Kg/ha), T₇: (FYM @ 5t/ha + Vermicompost @ 2.5 t/ha + Vermiwash @ 25%), T₈: (FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Cow urine @ 10%), T₉: (FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + PSB @ 2.5 kg/ha), T₁₀: (Vermicompost @ 2.5 t/ha + Vermiwash @ 25% + PSB @ 2.5 Kg/ha), T₁₁: (FYM @ 5 t/ha +Vermicompost @ 2.5 t/ha+Vermiwash @ 25% + Cow urine @ 10% + PSB @ 2.5 kg/ha) and T₁₂: (FYM @ 10 t/ha +Vermicompost @ 5 t/ha + Vermiwash @ 50% + Cow urine @ 20% + PSB @ 5 kg/ha).

Result: The maximum fresh as well as dry mass of bulbs among cultivars was reported in desi local in both the years. Among the treatments, the maximum fresh and dry mass of bulbs was noticed in T₄ in both years. The maximum and minimum bulb length was observed in V₂T₈ (3.76 cm) and V₁T₁ (2.70 cm) in 2022, whereas, in 2023, the maximum and minimum bulb length was observed in V₂T₈ (3.76 cm) and V₁T₁ (2.43 cm). The maximum and minimum bulb diameter was recorded in V₂T₁ (3.50 cm) and V₁T₁ (2.60 cm) in 2022 and V₂T₁ (3.50 cm) and V₁T₂ (2.66 cm), respectively in 2023. The maximum and minimum bulb volume was noticed in V₁T₃,11 (20.00 cm³) and V₁T_{4,6} (13.00 cm³) in 2022, whereas, in 2023, the maximum and minimum volume of bulb was noticed in V₁T₈ (20.00 cm³) and V₁T₃ (12.66 cm³). The maximum bulbing index was observed in V₁T₅ (2.32) in 2022 and V₁T₅ (2.32) in 2023.

Key words: Bulb diameter, Bulbing index, Cow urine, Garlic, Neck thickness, PSB, Vermiwash.

INTRODUCTION

India, often referred to as the “Land of Spices,” is home to a wide diversity of spice crops, among which garlic (*Allium sativum* L.) embraces a prominent position owing to its culinary, medicinal as well as economic importance. Garlic, falls to the family Alliaceae possessing a diploid chromosome number of 2n=16, is considered to be originated from central asia before gradually expanding to diverse agro-ecological regions worldwide. Globally, India ranks as the second highest producer of garlic, following China, contributing substantially to the global supply, with major producing states including Rajasthan, Uttar Pradesh, Gujarat, Punjab and Assam (FAOSTAT, 2024 and NHB, 2024). Garlic plant is an erect, bulbous crop having flat leaves and a flowering stalk that can grow up to 30-100 cm in height. The underground bulb consists of multiple cloves enclosed in a papery sheath, typically white or pinkish in colour. Garlic contains appreciable amounts of carbohydrates, proteins, volatile oils, vitamins and mineral elements, which contribute significantly to its nutritional importance in human diets (Singh *et al.*, 2022 and Kumar *et al.*, 2024). The characteristic aroma and bioactivity of garlic are primarily attributed to allicin, a sulphur containing compound formed enzymatically from alliin upon crushing the

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cloves. Allicin and its derivatives, such as diallyl disulphide are responsible for many of its health promoting effects (Banerjee and Maulik, 2021 and Sharma *et al.*, 2023). In recent years, increasing emphasis has been placed on sustainable agricultural practices, particularly the usage of organic fertilizers to enhance soil fertility and crop productivity (Balmiki *et al.*, 2026 and Goyal *et al.*, 2025). Organic sources of organic nutrients enhance soil physical

properties, stimulate beneficial microbial populations and increase the accessibility of nutrients to crops, thereby influencing bulb development in garlic. Given the rising demand for chemical residue free produce and the need to maintain long term soil health, evaluating the impact of different levels of organic manures on garlic bulb attributes has become a crucial area of research (Patel *et al.*, 2023 and Verma *et al.*, 2025).

MATERIALS AND METHODS

A field investigation was carried out in *rabi* seasons of 2021-22 and 2022-23 at the Horticulture Experiment Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Pathribagh, Dehradun, Uttarakhand, to evaluate bulbs attributes of garlic cultivars under different organic manure sources. The experimental site, located at 640 m above mean sea level (30.31°N, 78.03°E) in the middle of the Yamuna and Ganges rivers in the Himalayan foothills. The region is characterized by a warm temperate climate, marked by hot and comparatively dry summers, along with cold winter conditions that occasionally experience frost.

Methodology of organic treatment application

All inputs were applied to the experimental plots in accordance with the respective treatment combinations. Well decomposed farmyard manure and vermicompost were incorporated into the soil at the rates of 10 and 5 tonnes per hectare, respectively. The required quantities for each 1 m × 1 m plot were calculated and mixed thoroughly into the soil about 3 weeks before planting during field preparation in both years of trial. Phosphate solubilizing bacteria (PSB) was applied @ 5 kg/ha as a basal dose treatment during the final stage land preparation. The biofertilizer inoculum was applied along the rows to enhance phosphorus availability in the root zone. Liquid organic nutrients, namely vermiwash (50%) and cow urine (20%) were applied as diluted solutions (Table 1). The first application was applied during the planting stage through soil drenching and second was applied at 30 days after clove planting as foliar spray.

Soil nutrient status within the experimental field plots

The experimental site was characterized by soil having alluvial, sandy loam to loamy textured. The soils have

Table 1: Treatment combinations.

Treatment Symbols	Treatment
V ₁ T ₁	Pahadi local + Control
V ₂ T ₁	Desi local + Control
V ₁ T ₂	Pahadi local + FYM@ 10 t/ha
V ₂ T ₂	Desi local + FYM@ 10 t/ha
V ₁ T ₃	Pahadi local + Vermicompost@ 5 t/ha
V ₂ T ₃	Desi local + Vermicompost@ 5 t/ha
V ₁ T ₄	Pahadi local + Vermiwash@ 50%
V ₂ T ₄	Desi local + Vermiwash@ 50%
V ₁ T ₅	Pahadi local + Cow urine @ 20%
V ₂ T ₅	Desi local + Cow urine @ 20%
V ₁ T ₆	Pahadi local + PSB@ 5 kg/ha
V ₂ T ₆	Desi local + PSB@ 5 kg/ha
V ₁ T ₇	Pahadi local + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Vermiwash @ 25%
V ₂ T ₇	Desi local + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Vermiwash @ 25%
V ₁ T ₈	Pahadi local + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Cow urine @ 10%
V ₂ T ₈	Desi local + FYM @ 5 t/ha + Vermicompost@ 2.5t/ha + Cow urine@ 10%
V ₁ T ₉	Pahadi local + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + PSB @ 2.5 kg/ha
V ₂ T ₉	Desi local + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + PSB @ 2.5 kg/ha
V ₁ T ₁₀	Pahadi local + Vermicompost @ 2.5 t/ha + Vermiwash@ 25% + PSB @ 2.5 kg/ha
V ₂ T ₁₀	Desi local + Vermicompost @ 2.5 t/ha + Vermiwash @ 25% + PSB @ 2.5 kg/ha
V ₁ T ₁₁	Pahadi local + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha+Vermiwash @ 25% + Cow urine @ 10% +PSB @ 2.5 kg/ha
V ₂ T ₁₁	Desi local + FYM @ 5 t/ha + Vermicompost@ 2.5 t/ha+Vermiwash @ 25% + Cow urine@ 10% + PSB @ 2.5 kg/ha
V ₁ T ₁₂	Pahadi local + FYM @ 10 t/ha + Vermicompost @ 5 t/ha + Vermiwash @ 50% + Cow urine @ 20% + PSB @ 5 kg/ha
V ₂ T ₁₂	Desi local + FYM @ 10 t/ha + Vermicompost @ 5 t/ha + Vermiwash @ 50% + Cow urine @ 20% + PSB @ 5 kg/ha

moderate water holding capacity as well as good aeration. The nutrient availability and productive capacity of the soil is generally moderate, with sufficient levels of NPK status. Details of the physical along with chemical evaluation of the soil have been given in the table below. To determine the soil fertility and soil texture of the research field, prior to garlic planting in both years of experimentation, soil sections were collected randomly from the research plots with the aid of a soil auger. The data of different characteristics of soil has been depicted in Table 2.

The present research was structured in a factorial randomized block design comprising two experimental factors, namely variety and organic input treatments. The first factor consisted of two levels, whereas the second factor included twelve levels, thereby generating 24 treatment combinations. Each treatment was replicated thrice, resulting in overall 72 experimental plots. The details of the factors and their corresponding levels are presented below:

Factor 1: Variety (V)

V₁: Pahadi local.

V₂: Desi local.

Factor 2: Organic Inputs (T)

T₁: Control.

T₂: FYM @ 10 t/ha.

T₃: Vermicompost @ 5 t/ha.

T₄: Vermiwash @ 50%.

T₅: Cow urine @ 20%.

T₆: PSB @ 5 kg/ha.

T₇: FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Vermiwash @ 25%.

T₈: FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Cow urine @ 10%.

T₉: FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + PSB @ 2.5 kg/ha.

T₁₀: Vermicompost @ 2.5 t/ha + Vermiwash @ 25% + PSB @ 2.5 kg/ha.

T₁₁: FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha + Vermiwash @ 25% + Cow urine @ 10% + PSB @ 2.5 kg/ha.

T₁₂: FYM @ 10 t/ha + Vermicompost @ 5 t/ha + Vermiwash @ 50% + Cow urine @ 20% + PSB @ 5 kg/ha.

RESULTS AND DISCUSSION

Fresh and dry weight of bulbs (g)

Significant variation in fresh and dry weight of bulbs was observed among cultivars, treatments and their interactions during both years (Table 3). For fresh weight, Desi local recorded the maximum mean values (29.30 g in 2022 and 29.72 g in 2023), while Pahadi local showed the minimum (27.20 g in 2022 and 27.59 g in 2023). Among treatments, T₄ was superior (30.28 g in 2022 and 31.15 g in 2023), whereas T₂ recorded the minimum (22.38 g in 2022 and 22.81 g in 2023). Interaction effects were significant; V₂T₃ (31.66 g) and V₁T₂ (14.33 g) were the highest and lowest in 2022, while V₁T₅ (32.41 g) and V₁T₂ (15.20 g) were shown in 2023. Similarly, dry weight varied significantly. Desi local recorded higher mean dry weight (13.72 g in 2022 and 13.74 g in 2023) compared to Pahadi local (12.85 g in 2022 and 13.05 g in 2023). T₄ produced the maximum dry weight (14.65 g in 2022 and 14.87 g in 2023), while T₁ (10.68 g) in 2022 and T₂ (10.66 g) in 2023 recorded the minimum. Interaction effects were also significant; V₁T₄ (14.80 g) and V₁T₁ (6.66 g) were highest and lowest in 2022, whereas V₁T₉ (15.62 g) and V₁T₁ (6.83 g) were recorded in 2023. Overall, V₂ and T₄ performed best. The progress in fresh weight may be linked to the growth promoting effect of cow urine, while enhanced dry matter accumulation may be due to vermicompost improving nutrient readiness and soil conditions. Similar findings were reported by Patidar *et al.* (2017); Purohit *et al.* (2015) in onion; Yadav *et al.* (2017); Sachin *et al.* (2017) and Kumawat *et al.* (2024) in garlic.

Bulb size (length and diameter, cm)

Bulb length showed non-significant variation among cultivars in both years (Table 4). In 2022, Pahadi local

Table 2: Mechanical, physical and chemical properties of experimental plot soil.

Properties	Value recorded	
	2021-22	2022-23
Mechanical compositions		
Sand (%)	10.04	10.75
Silt (%)	18.60	17.80
Clay (%)	15.70	15.86
Physical properties		
Soil bulk density (mg/m ³)	1.40	1.40
Soil particle density (mg/m ³)	2.64	2.65
Pore space (%)	43.28	43.26
Chemical properties		
Soil pH	6.08	6.2
Organic carbon (%)	0.47	0.48
Available nitrogen (kg/ha)	338.32	340.56
Available phosphorus (kg/ha)	14.84	15.02
Exchangeable potassium level (kg/ha)	213.26	215.46

Table 3: Effect of cultivars and organic manures on fresh and dry weight (g) of bulb.

Organic Manure	Fresh weight (g) of bulb				Dry weight (g) of bulb			
	V ₁		V ₂		V ₁		V ₂	
	2022	2023	2022	2023	2022	2023	2022	2023
					Mean organic manures (2022)	Mean organic manures (2023)		Mean organic manures (2023)
T ₁	15.00	15.23	30.90	30.90	22.90	23.06	6.66	6.83
T ₂	14.33	15.20	30.43	30.43	22.38	22.81	7.33	7.16
T ₃	28.43	29.13	31.66	31.66	30.05	30.40	14.03	13.71
T ₄	29.96	30.55	30.60	31.75	30.28	31.15	14.80	14.65
T ₅	30.76	32.41	28.26	28.05	29.51	30.23	14.50	14.56
T ₆	28.73	29.37	28.40	28.59	28.56	28.98	12.70	12.74
T ₇	29.16	29.16	30.26	30.80	29.71	29.98	13.56	13.56
T ₈	28.70	28.70	28.93	29.30	28.81	29.00	13.53	14.39
T ₉	31.03	31.03	29.06	29.70	30.05	30.36	14.73	15.62
T ₁₀	30.20	30.20	26.76	27.32	28.48	28.76	13.96	14.88
T ₁₁	31.13	31.13	27.43	27.56	29.28	29.35	14.66	14.66
T ₁₂	29.00	29.00	28.96	30.59	28.98	29.79	13.80	13.80
Mean	27.20	27.59	29.30	29.72			12.85	13.05

cultivars

CD_{0.05} 2022: V= 0.72; T= 1.77; V×T= 2.50;
2023: V= 0.93; T= 2.30; V×T= 3.25

S.Em.± 2022: V= 0.25; T= 0.62; V×T= 0.87;
2023: V= 0.32; T= 0.80; V×T= 1.13

2022: V= 0.56; T=1.38; V×T= 1.96;
2023: V= 0.55; T= 1.36; V×T= 1.93
2022: V= 0.19; T= 0.48; V×T= 0.68;
2023: V= 0.19; T= 0.47; V×T= 0.67

recorded the maximum mean length (3.40 cm) and Desi local the minimum (3.33 cm); a similar trend was observed in 2023 with V_1 (3.36 cm) and V_2 (3.33 cm). In contrast, treatments differed significantly, with T_8 producing the highest mean length (3.65 cm in both years) and T_1 the lowest (2.90 cm in 2022 and 2.76 cm in 2023). Interaction effects were significant; V_2T_1 recorded the maximum bulb length (3.76 cm) in both years, while V_1T_1 showed the minimum (2.70 cm in 2022 and 2.43 cm in 2023). Overall, Pahadi local and T_8 performed better. The superiority of vermicompost may be due to its higher and readily available nutrient content compared to FYM. This confirms the results of Kumar *et al.* (2017) in onion; Mohammad (2022); Haiguipung *et al.* (2025); Jadhav *et al.* (2023) and Akpan *et al.* (2025) in garlic. Bulb diameter exhibited non-significant differences among cultivars and treatments in both years. In 2022, Pahadi local recorded the highest mean bulb diameter (3.02 cm) and desi local the lowest value (2.99 cm); in 2023, Pahadi local (3.03 cm) again exceeded desi local (3.00 cm). Among treatments, T_6 (3.20 cm) and T_2 (2.76 cm) were maximum and minimum in 2022, while T_7 (3.16 cm) and T_2 (2.75 cm) were maximum and minimum in 2023. However, interaction effects were significant; V_2T_1 recorded the highest bulb diameter (3.50 cm) in both years, whereas V_1T_1 (2.60 cm) in 2022 and V_1T_2 (2.66 cm) in 2023 were recorded the lowest value. Pahadi local showed comparatively higher diameter overall. This might be attributed to organic manures supplying macro and micronutrients, enhancing photosynthesis, nitrogen metabolism and auxin activity,

thereby promoting bulb enlargement. These observations were comparable with those reported by Murmu *et al.* (2018); Acharya *et al.* (2018); Ibrahim *et al.* (2018) and Sharma *et al.* (2021) in garlic.

Bulb volume (cm³) and bulbing index

Bulb volume indicated non-significant variation among cultivars and treatments in both years (Table 5). In 2022, Desi local recorded higher mean bulb volume (16.69 cm³) than Pahadi local (16.38 cm³); a similar trend was observed in 2023 with V_2 (16.86 cm³) and V_1 (16.38 cm³). Among treatments, T_3 (18.50 cm³) and T_9 (15.00 cm³) recorded the maximum and minimum values in 2022, whereas T_8 (19.16 cm³) and T_1 (15.00 cm³) did so in 2023. Interaction properties were non-significant; however, the maximum volume (20.00 cm³) was observed in V_1T_3 and V_1T_{11} (2022) and V_1T_8 (2023), while the lowest was recorded in V_1T_4 and V_1T_6 (13.00 cm³) in 2022 and V_1T_3 (12.66 cm³) in 2023. Overall, Desi local performed better among cultivars and T_3 (2022) and T_8 (2023) were superior treatments. This might be attributed to FYM enhancing soil physico-chemical as well as biological characteristics. These results are in conformity with the findings of Bhushan *et al.* (2020); Prakash and Prasad (2023); Abrham *et al.* (2024) and Begum *et al.* (2025). In contrast, the bulbing index showed significant variation among cultivars in 2022 but non-significant differences in 2023. Pahadi local recorded higher values in both years (2.01 in 2022 and 1.95 in 2023) compared to desi local (1.88 in 2022 and 1.94 in 2023). Treatments differed

Table 4: Effect of cultivars and organic manures on bulb length and diameter (cm).

Organic manures	Bulb length (cm)						Bulb diameter (cm)					
	V_1		V_2		Mean organic manures (2022)	Mean organic manures (2023)	V_1		V_2		Mean organic manures (2022)	Mean organic manures (2023)
	2022	2023	2022	2023			2022	2023	2022	2023		
T_1	2.70	2.43	3.10	3.10	2.90	2.76	2.60	2.70	3.50	3.50	3.05	3.10
T_2	3.00	3.00	3.66	3.66	3.33	3.33	2.70	2.66	2.83	2.83	2.76	2.75
T_3	3.50	3.50	3.33	3.13	3.41	3.31	3.03	3.03	3.10	3.10	3.06	3.06
T_4	3.67	3.66	3.50	3.16	3.58	3.41	3.20	3.20	2.70	2.70	2.95	2.95
T_5	3.40	3.33	3.30	3.53	3.35	3.43	3.43	3.26	2.83	2.83	3.13	3.05
T_6	3.56	3.46	3.13	3.13	3.35	3.30	3.23	2.96	3.16	3.16	3.20	3.06
T_7	3.60	3.60	2.96	2.96	3.28	3.28	3.00	3.16	3.16	3.16	3.08	3.16
T_8	3.53	3.53	3.76	3.76	3.65	3.65	3.30	3.30	2.73	2.83	3.01	3.06
T_9	3.33	3.40	3.46	3.46	3.40	3.43	2.90	3.16	3.06	2.86	2.98	3.01
T_{10}	3.73	3.66	3.10	3.30	3.41	3.48	2.86	2.93	3.03	3.13	2.95	3.03
T_{11}	3.46	3.46	3.16	3.50	3.31	3.48	2.93	2.93	2.76	2.80	2.85	2.86
T_{12}	3.30	3.30	3.53	3.30	3.41	3.30	3.06	3.06	3.00	3.16	3.03	3.11
Mean	3.40	3.36	3.33	3.33			3.02	3.03	2.99	3.00		
cultivars												
CD _{0.05}	2022: V= NS; T= 0.31; V×T= 0.44; 2023: V= NS; T= 0.33; V×T= 0.47						2022: V= NA; T= NA; V×T= 0.43; 2023: V= NA; T= NA; V×T= 0.46					
S.Em.±	2022: V= 0.04; T= 0.11; V×T= 0.15; 2023: V= 0.04; T= 0.11; V×T= 0.16						2022: V= 0.04; T= 0.10; V×T= 0.15; 2023: V= 0.04; T= 0.11; V×T= 0.16					

Table 5: Effect of cultivars and organic manures on bulb volume (cm³) and bulbing index.

Organic manure	Bulb volume (cm ³)						Bulbing index					
	V ₁		V ₂		Mean	Mean	V ₁		V ₂		Mean	Mean
	2022	2023	2022	2023	organic manures (2022)	organic manures (2023)	2022	2023	2022	2023	Organic manures (2022)	Organic manures (2023)
T ₁	14.66	13.00	17.00	17.00	15.83	15.00	1.77	1.55	1.26	1.26	1.51	1.41
T ₂	14.00	19.00	17.33	17.33	15.66	18.16	2.00	2.21	1.45	1.70	1.73	1.95
T ₃	20.00	12.66	17.00	17.00	18.50	14.83	2.30	2.29	1.21	1.72	1.76	2.00
T ₄	13.00	13.66	18.33	18.33	15.66	16.00	2.29	2.20	1.67	1.61	1.98	1.91
T ₅	19.00	19.00	15.66	14.66	17.33	16.83	2.32	2.32	2.04	2.04	2.18	2.18
T ₆	13.00	16.33	17.66	17.00	15.33	16.66	1.88	2.18	2.24	2.21	2.06	2.20
T ₇	14.66	14.66	16.00	16.00	15.33	15.33	1.75	1.73	2.19	2.03	1.97	1.88
T ₈	19.33	21.00	17.33	17.33	18.33	19.16	2.25	1.99	2.02	2.04	2.13	2.01
T ₉	16.00	16.66	14.00	14.00	15.00	15.33	2.14	2.23	2.17	2.17	2.16	2.20
T ₁₀	17.33	17.33	16.66	18.33	17.00	17.83	2.26	2.01	2.26	2.26	2.26	2.14
T ₁₁	20.00	19.33	16.66	17.00	18.33	18.16	1.72	1.21	1.97	2.17	1.84	1.69
T ₁₂	15.66	14.00	16.66	18.33	16.16	16.16	1.39	1.45	2.08	2.06	1.74	1.75
Mean	16.38	16.38	16.69	16.86			2.01	1.95	1.88	1.94		
cultivars												
CD _{0.05}	2022: V=NS; T=NS; V×T=NS; 2023: V=NS; T=NS; V×T=NS						2022: V=0.10; T=0.25; V×T=0.36; 2023: V=NS; T=0.29; V×T= 0.41					
S.Em.±	2022: V=0.52; T=1.28; V×T=1.81; 2023: V=0.49; T=1.22; V×T=1.73						2022: V=0.03; T=0.09; V×T=0.12; 2023: V=0.04; T=0.10; V×T= 0.14					

significantly in both years, with T₁₀ (2.26) and T₁ (1.51) recording maximum and minimum values in 2022, while T₉ (2.20) and T₁ (1.41) ensured therefore in 2023. Interaction effects were significant; V₁T₅ recorded the highest value (2.32) in both years, whereas the lowest was observed in V₂T₃ (1.21) in 2022 and V₁T₁₁ (1.21) in 2023. Overall, V₁, T₁₀ (2022), T₉ (2023) and V₁T₅ showed superior performance. These findings are in concurrent with Islah (2010); Cuinan *et al.* (2016) and Chauhan *et al.* (2022) in garlic.

CONCLUSION

Present study shows that garlic bulbs attributes were significantly influenced by cultivar and organic input treatments over two years. Desi local recorded higher fresh and dry bulb weight, while Pahadi local performed better for bulb length, diameter and bulbing index under specific treatments. Among organic manures, T₄ consistently improved fresh and dry weight and T₈ enhanced bulb length. The significant interaction effects focus the need for cultivar specific organic management.

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Disclaimer

The results presented in this manuscript are merely express the views of the authors alone and may not essentially signify those of their corresponding affiliated institutions. Every work has been made to ensure the accuracy and trustworthiness of the data; however, the authors accept no responsibility for any errors or concerns arising from its use. As the research was performed under particular agro-climatic and management conditions, the results may not be universally applicable and should be adopted with appropriate validation under local conditions.

Conflict of interest

Authors state that no conflicts of interest occur in relation to present research work.

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