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Effect of liquid organic formulations and vermicompost on growth and yield of wheat

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Abstract

An experiment was carried out at experimental farm of Doon (P.G.) College of Agriculture Science and Technology, Rampur, Selaqui during the year 2025-2026. The experimental material for the present study consisted of seven treatments i.e., T₁ (Vermicompost @ 3t/ha + Jivamrit 20% FS at 35 DAS), T₂ (Vermicompost @ 3t/ha + Sanjivak 20% Foliar spray @35 DAS), T₃ (Vermicompost @ 3t/ha + Amrit Pani 20% FS @ 35 DAS), T₄ (Vermicompost @ 3t/ha + Panchgavya 20% FS @ 35 DAS), T₅ (Vermicompost @ 3t/ha + Vermiwash 20% FS @ 35 DAS), T₆ {RDF (100:50:30 kg/ha)} and T₇ (Control). All treatments were planted in a Randomized Complete Block Design with three replications. The results revealed that T₄ - Vermicompost @ 3 t/ha + Panchgavya 20% foliar spray @ 35 DAS found superior plant height, number of tillers per m², dry matter accumulation, number of spikes per plant, spike length, number of grains per spike, test weight, grain yield, straw yield and biological yield. The treatment also produced the highest net return and B:C ratio (2.27).

Keywords: Amrit Pani, Jivamrit, Panchgavya, Vermicompost, wheat

Introduction

Wheat (*Triticum aestivum* L.) is the country's primary crop and the second most important crop after rice, accounting for approximately one-third of total cereal production. It belongs to the grass family Poaceae (Gramineae). Wheat is considered the "king of cereals" and a vital strategic crop for the global population. Globally, around two billion people (35%) rely on wheat as a staple cereal. In terms of cultivation area and productivity, it ranks as India's second most important crop after rice. Wheat is cultivated on 215.5 million hectares globally and 29.6 million hectares in India, yielding 731.4 million metric tonnes and 112.2 million metric tonnes, respectively. The average yield is 3,390 kg and 3,371 kg per acre. India is the second-largest producer of wheat in the world, following China, in terms of both area and production. Wheat is the most important cereal crop of the *Rabi* season grown in our country. It is the most significant cereal grain used for human consumption worldwide. Two billion people (36% of the global population) consume it as a staple food, deriving approximately 55% of their carbohydrates and 20% of their dietary calories from it. Wheat is a valuable source of nutrition for the human body, containing 8.0-15.0% protein, 60-68% starch, 1.5-2.0% fat, 2.0-2.5% cellulose, and 1.5-2.0% minerals and vitamins (B-complex and Vitamin E); it is utilized for both human consumption and animal feed (Rueda-Ayala *et al.*, 2015) ^[1].

Organic fertilizers such as vermicompost, Panchagavya, Jeevamrut, Amritpani, and Sanjeevak are gaining popularity as eco-friendly alternatives to synthetic fertilizers. For instance, vermicompost is a rich source of nutrients and improves soil structure, microbial activity, and water-holding capacity (Arancon *et al.*, 2003) ^[1]. Mixtures like Panchagavya, derived from cow-based products, are reported to promote plant growth and increase yields (Selvaraj *et al.*, 2014) ^[12], while Jeevamrut—another biostimulant based on cow dung and urine—enhances microbial diversity and nutrient availability in the soil (Bhaskar *et al.*, 2016) ^[3]. Amritpani and Sanjeevak are lesser-known yet effective organic solutions. They are believed to enhance soil fertility and promote plant growth by boosting microbial populations in the soil and improving nutrient cycling.

While the use of liquid organic solutions alongside vermicompost has been studied for various crops, there has been limited research on their combined effects on wheat. Evaluating their impact on yield, grain quality, and cost-effectiveness will help formulate better organic nutrient management strategies for sustainable wheat cultivation.

This organic formulation boosts beneficial microorganisms and enhances soil carbon content, thereby improving the physical properties of soil. Various studies have shown that the quality of the wheat grains is excellent after application of this formulation. The objective of this research is to evaluate the impact of the liquid organic formula on various growth and yield characteristics of wheat. It aims to determine the optimal application rate of these formulations to increase crop yield and facilitate the production of high-quality grain sustainably under field conditions.

Materials and methods

Experimental site

The experiment was conducted at experimental farm of Doon (P.G.) College of Agriculture Science and Technology, Rampur, Selaqui during the year 2025-2026. The experimental field was located at North Latitude of 29.58° to 31.20° and East Longitude of 77.34° to 78.18° and an altitude of 1467 feet above the mean sea level in the Tarai-Bhabar agro-climatic zone of Uttarakhand.

Experimental material and design

The current research, entitled "Performance of liquid organic formulation in combination with vermicompost on growth and yield of wheat (*Triticum aestivum* L.) Under Doon Valley," was conducted at Agriculture Research Farm, Doon (P.G.) College of Agriculture Science and Technology, Rampur, Selaqui, Dehradun (UK) during the Rabi season of 2025-2026. The experimental material was consisted of seven treatments i.e., T₁ (Vermicompost @ 3t/ha + *Jivamrit* 20% FS at 35 DAS), T₂ (Vermicompost @ 3t/ha + *Sanjivak* 20% Foliar spray @35 DAS), T₃ (Vermicompost @ 3t/ha + *Amrit Pani* 20% FS @ 35 DAS), T₄ (Vermicompost @ 3t/ha + *Panchgavya* 20% FS @ 35 DAS), T₅ (Vermicompost @ 3t/ha + *Vermiwash* 20% FS @ 35 DAS), T₆ {RDF (100:50:30 kg/ha)} and T₇ (Control) of wheat variety "DBW-327" in randomized block design (RBD) with three replications. Parameters related to growth and yield number of tillers per m², dry matter accumulation, number of spikes per plant, spike length, number of grains per spike, test weight, grain yield, straw yield and biological yield were evaluated using various methods.

Description of variety

DBW-327 is a high-yielding and vigorous wheat variety for the Rabi season. Its grains are bold, lustrous and hard, with an average weight of 48 grams. It is highly suitable for both early and late sowing and possesses strong resistance to brown rust and leaf spot. Its average yield ranges from 23 to 27 quintals per acre.

Data collection

Observations were recorded for various yield and yield-contributing traits viz., days to 50% flowering, days to first fruit harvesting, number of fruits per plant, polar diameter (mm), equatorial diameter (mm), average fruit weight (g), fruit volume (mL) and fruit yield per plant (kg). Data collected from the experiment were statistically analysed to determine significance of differences among the genotypes for various traits and to estimate combining ability and heterosis.

Data analysis

Based on the formula by Gomez and Gomez (1984) [7], an 'Analysis of Variance' (ANOVA) was conducted using O.P. Stat software.

Results and Discussion

The results regarding growth and yield parameters were significantly influenced across all treatments. The data recorded for these parameters is presented in Table 1 and illustrated in Figure 1 & 2. A summary of the results and discussion of various parameters is given below:

Plant height (cm)

The plant height significantly varied from 57.34 cm to 72.17 cm. The significantly longest plant height recorded with T₄ - Vermicompost @ 3t/ha + *Panchgavya* 20% FS @ 35 DAS (72.17 cm). The significantly lowest value of plant height was recorded with T₇ - Control (57.34 cm).

The results indicate that the T₄ treatment yielded the best results in terms of plant height. Organic formulas of this type, used in natural farming, promote plant height. This variation in plant height resulted from the availability of the right organic nutrients and the conversion of carbohydrates into proteins (which subsequently transform into protoplasm). Additionally, there was an increase in cell division. Similarly, Bhadu *et al.* (2021) [2] and Choudhary *et al.* (2024) [5] also recorded longest plant height.

Number of tillers/m²

The value of number of tillers per m² significantly ranged from 123.49 to 155.44. The maximum number of tillers per m² showed in T₄ - Vermicompost @ 3t/ha + *Panchgavya* 20% FS @ 35 DAS (155.44). While, lowest value was recorded with T₇ - Control (123.49).

The highest number of tillers per square meter was observed with the given organic formulation due to the release of nutrients; however, the plants did not receive sufficient nutrients during the critical growth period. The number of tillers is directly correlated with crop yield. In terms of tiller count, the T₄ treatment—vermicompost @ 3 tonnes/ha + *Panchagavya* 20% FS @ 35 DAS—was found to be effective. Similar experimental results were reported by Kumar *et al.* (2021) [9].

Dry matter accumulation (g)

There was a significant variation in plant height, ranging from 57.34 cm to 72.17 cm. The significantly highest value of dry matter accumulation found with T₄ - Vermicompost @ 3t/ha + *Panchgavya* 20% FS @ 35 DAS (9.86 g). The treatment T₇ (Control) showed the lowest value (7.84 g) of dry matter.

Treatments T₄ and T₅ yielded the best results regarding dry matter accumulation in the plants. The mixture of *Panchagavya* and vermicompost releases essential nutrients along with carbon, leading to superior outcomes. Similar results have also been reported by Choudhary *et al.* (2024) [5] and Yadav *et al.* (2025) [16].

Number of spikes per plant

A significant variation in the number of spikes per plant, ranging from 6.64 to 8.36, was observed. The highest number of spikes (8.36) was recorded in treatment T₄ (vermicompost @ 3 tonnes/ha + *Panchagavya* 20% FS @ 35 DAS), whereas the lowest number (6.64) was observed with treatment T₇ (control).

The highest number of spikes was observed due to the supply of essential nutrients through the use of *Panchagavya* and vermicompost; however, the plants did not receive adequate nutrients during critical growth stages. The number of tillers is directly correlated with crop yield. In terms of the number of spikes, the T₄ treatment—vermicompost @ 3 tonnes/ha + *Panchagavya* 20% FS @ 35 DAS—was found to be the best. Similar results align with the findings of Bhadu *et al.* (2021) [2] and Yadav *et al.* (2025) [16].

Spike length (cm)

Spike length varied significantly, ranging from 7.10 cm to 8.94 cm. The longest spike length was observed with T₄ - Vermicompost @ 3 t/ha + Panchagavya 20% FS @ 35 DAS (8.94 cm). The shortest length was recorded with T₇ - Control (7.10 cm). Spike length is a trait directly associated with maximizing yield.

The best combination of organic formulations was observed in T₄, resulting in superior spike length. Organic formulations promote elongation by influencing cell division and the process of converting carbohydrates into proteins. The results are consistent with the findings of Dastmozd *et al.* (2015)^[6] and Yadav *et al.* (2025)^[16].

Number of grains per spike

The number of grains per spike, significantly ranged from 38.13 to 48.00. The significantly maximum number of grains per spike (48.00) was found in T₄ (Vermicompost @ 3t/ha + Panchgavya 20% FS @ 35 DAS). While, the treatment T₇ (Control) showed the significantly lowest value (38.13) of number of grains per spike.

The number of grains per spike in wheat is influenced by several factors—such as the number of tillers, spike length and the overall health of the plant, which are indeed very important. The number of grains per spike is also affected by biotic and abiotic factors. Similar results were also reported by Choudhary *et al.* (2024)^[5], and Sharma *et al.* (2025)^[13].

Test weight (g)

The value of test weight significantly varied from 38.01 g to 47.84 g. The significantly superior value of test weight (47.84 g) showed in T₄ - Vermicompost @ 3t/ha + Panchgavya 20% FS @ 35 DAS. The significantly lowest value (7.10 g) was recorded with T₇ - Control.

The results also indicate that the use of *Jeevamrut*, *Sanjeevak*, *Amrit Pani*, *Panchagavya*, and *Vermiwash* is beneficial for plants, as they are rich in nutrients. In contrast, when only the control treatment was used without any additives, the seed weight was found to be lower. The same results of experiment were also supported by Nagar *et al.* (2023)^[10] and Joddar *et al.* (2025)^[8].

Grain yield (q/ha)

The data of grains yield, significantly ranged from 34.81 q/ha to 43.81 q/ha. The significantly maximum grains yield (43.81 q/ha) was found in T₄ (Vermicompost @ 3t/ha + Panchgavya 20% FS @ 35 DAS). While, the treatment T₇ (Control) showed the significantly lowest value (34.81 q/ha) of grains yield.

Organic formulations such as *Jeevamrut*, *Sanjeevak*, *Amrit Pani*, *Panchagavya*, and *vermiwash* (along with vermicompost) boost beneficial microorganisms in the soil. This improves the soil's physical properties and increases crop yield. Yield is a complex trait; therefore, it depends on various factors associated with growth and productivity. Some subsequent researchers, such as Joddar *et al.* (2025)^[8] and Vaja and Krishnamurthy (2025)^[15], also reached similar results.

Table 1: Effect of liquid organic formulations and vermicompost on growth and yield parameters

Treatments	Plant height (cm)	Number of tillers/m ²	Dry matter accumulation (g)	Number of spikes per plant	Spike length (cm)	Number of grains per spike	Test weight (g)	Grain yield (q/ha)
T ₁	68.34	147.17	9.34	7.92	8.46	45.45	45.29	41.48
T ₂	65.24	140.49	8.91	7.55	8.07	43.39	43.24	39.61
T ₃	65.83	141.76	8.99	7.62	8.15	43.78	43.63	39.96
T ₄	72.17	155.44	9.86	8.36	8.94	48.00	47.84	43.81
T ₅	69.63	149.95	9.51	8.06	8.62	46.30	46.15	42.27
T ₆	63.91	137.63	8.73	7.40	7.91	42.50	42.36	38.80
T ₇	57.34	123.49	7.84	6.64	7.10	38.13	38.01	34.81
SEm ±	1.21	1.83	0.11	0.09	0.10	0.65	0.55	0.50
CD (5%)	3.79	5.70	0.36	0.30	0.32	2.59	2.19	1.58

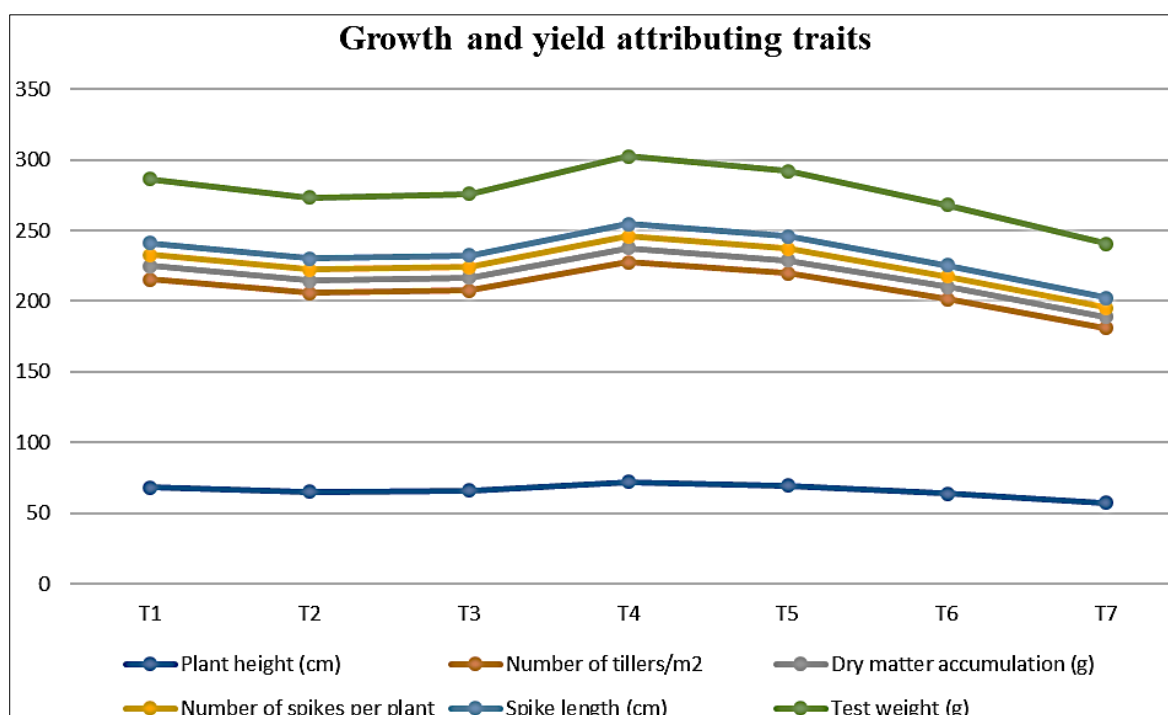


Fig 1: Effect of liquid organic formulations and vermicompost on growth and yield attributing traits

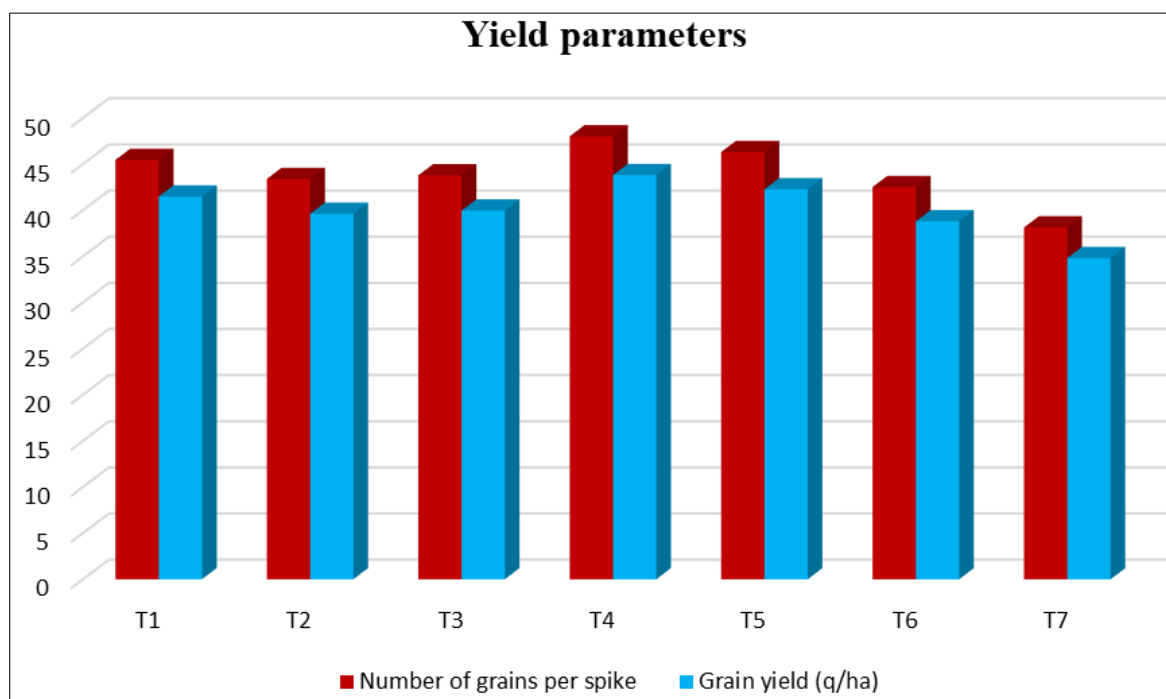


Fig 2: Effect of liquid organic formulations and vermicompost on growth and yield parameters

Conclusion

A mixture of organic formulations and vermicompost is essential for the growth and development of wheat plants, without the harmful effects associated with the use of chemicals. Different nutrient combinations on quantitative trait showed clear differences among the treatments. The results concluded that T₄ (Vermicompost @ 3 t/ha + *Panchgavya* 20% foliar spray @ 35 DAS) found superior for all parameters. The treatment T₄ also produced the B:C ratio (2.27). Furthermore, following trials at several locations, these can be recommended for commercial cultivation in Dehradun and the mid-hill regions.

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