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Effect of organic manure and zinc levels on growth, yield and nutrient uptake by wheat (*Triticum aestivum* L.)

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ABSTRACT

A field experiment entitled “Effect of Organic Manure and Zinc Levels on Growth, Yield and Nutrient Uptake by Wheat (*Triticum aestivum* L.)” was conducted on loamy sand soil at Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jaipur during Rabi 2024-25 seasons. The treatments in wheat during rabi seasons comprising 20 combinations having four organic manures FYM @ 10 t/ha, FYM @ 20 t/ha, Vermicompost @ 3 t/ha and Vermicompost @ 6 t/ha and five zinc levels (Control, Foliar spray of ZnSO₄ @ 0.5%, Soil application of ZnSO₄ @ 6 kg/ha, Soil application of ZnSO₄ @ 12 kg/ha and Soil application of ZnSO₄ @ 6 kg/ha + Foliar spray of ZnSO₄ @ 0.5%) treatments was laid out in a split plot with three replications. Wheat was sown at 22.5 cm row spacing using seed rate of 100 kg ha⁻¹.

The application of vermicompost @ 6.0 t/ha significantly increased the seed, stover and biological yield of wheat which was significantly higher than FYM @ 10 t/ha and vermicompost @ 3 t/ha, but remained statistically comparable with FYM @ 20 t/ha. Zinc application significantly improved the growth, yield, nutrient content and economic performance of wheat. Among the treatments, soil application of ZnSO₄ @ 6 kg/ha + foliar spray of ZnSO₄ @ 0.5% significantly increased the grain, straw and biological yields. The highest net return (₹92,737/ha) was obtained with vermicompost @ 6.0 t/ha, followed by vermicompost @ 3 t/ha (₹91,606/ha) and FYM @ 20 t/ha (₹86,000/ha). The maximum net return (₹94,725/ha) was recorded with soil application of ZnSO₄ @ 6 kg/ha + foliar spray of ZnSO₄ @ 0.5%, followed by soil application of ZnSO₄ @ 12 kg/ha (₹91,293/ha), soil application of ZnSO₄ @ 6 kg/ha (₹87,661/ha) and foliar spray of ZnSO₄ @ 0.5% (₹83,444/ha).

Keywords: Effective tiller, Grain, Straw and yield

Introduction

Wheat (*Triticum aestivum* L.) is the most important food grain crop among cereals and stands next only to rice in our country.

India is self-sufficient in catering to the needs of major food staples like rice and wheat. On an average, wheat contributes to around 35% of total food grain production and 21% of cultivated area in the country (Singh *et al.*, 2020) [1]. In India, wheat (*Triticum aestivum* L.) is the second most important cereal crop after rice and pre-dominant winter season crop of north-western plains zone. Wheat is grown on 33.60 million hectares (m ha) lands with total production of 120.65 million tons (m t) contributes 34 per cent of the total food grain production in the country with the productivity of 3591 kg ha⁻¹ (Ministry of Agriculture, GOI 2025-26). Wheat Productivity has to be raised to meet ever increasing food demand in the country. In Rajasthan area under wheat crop is 3.59 m ha with production of 15.05 m t and productivity of 4197 kg ha⁻¹ (Ministry of Agriculture, GOR, 2025-26). The application of FYM and vermicompost in the soil helps in increasing the fertility of the soil as physical condition including its water holding capacity. Organic manures, which were perhaps the main sources of plant nutrients in traditional agriculture, receive less emphasis with the advent of high analysis chemical fertilizers. The decision on the optimum use of fertilizer required knowledge of crop response to applied fertilizer, inherent nutrients by soil and its short or long-term fate effects (Kohli *et al.*, 2025) [2]. Zinc is essential micronutrient and has a number of crucial functions in [plant system](#). Its deficiency in plants results in significant decreases in both productivity and nutrient quality. But 30 to 40% of the total area of the world is reported zinc deficient. Zn fertilizers are used in the bio fortification and to fulfill the Zn deficiency of cereal crop. The concentration of zinc in wheat grain increased by 18.8% and the dry weight of seedling roots and fruits were significantly improved by applying zinc fertilizer (Ali *et al.* 2021).

Method and materials

The experiment was conducted during *rabi* 2025-26 at Agronomy farm, School of Agriculture, Suresh Gyan Vihar University, Jaipur. Geographically, the study area is located at 75°48'84" E longitude and 26°82'47" N latitude and this region falls under agro-climatic zone III A (Semi-arid Eastern Plain Zone) of Rajasthan. The

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treatments in wheat during *rabi* seasons comprising 20 combinations having four organic manures FYM @ 10 t/ha, FYM @ 20 t/ha, Vermicompost @ 3 t/ha and Vermicompost @ 6 t/ha and five zinc levels (Control, Foliar spray of ZnSO₄ @ 0.5%, Soil application of ZnSO₄ @ 6 kg/ha, Soil application of ZnSO₄ @ 12 kg/ha and Soil application of ZnSO₄ @ 6 kg/ha + Foliar spray of ZnSO₄ @ 0.5%) treatments was laid out in a split plot with three replications. Wheat was sown at 22.5 cm row spacing using seed rate of 100 kg ha⁻¹.

Results and discussion

Effect of organic manure

The results revealed that grain, straw and biological yields of wheat were significantly influenced by the application of organic manures. Vermicompost @ 6.0 t/ha recorded the highest grain yield (4978 kg/ha), straw yield (6199 kg/ha) and biological yield (11177 kg/ha), representing increases of 22.58, 5.62 and 9.28 per cent in grain yield and 25.56, 6.51 and 7.66 per cent in straw yield over FYM @ 10 t/ha, FYM @ 20 t/ha and vermicompost @ 3 t/ha, respectively. The greater productivity under higher vermicompost application may be attributed to improved nutrient availability, enhanced microbial activity, better root growth and efficient utilization of nutrients, which promoted greater biomass production and translocation of assimilates towards grain formation (Kaur *et al.*, 2026) [3] and Debebe *et al.* (2026) [4]. The highest net return (₹92,737/ha) was obtained with vermicompost @ 6.0 t/ha, which was 22.46, 7.83 and 1.23 per cent higher than FYM @ 10 t/ha, FYM @ 20 t/ha and vermicompost @ 3 t/ha, respectively. The higher net return under vermicompost application may be attributed to better nutrient availability, improved soil physical and biological properties and consequently greater crop productivity. Vermicompost supplies nutrients in readily available forms and also enhances microbial activity, which can improve nutrient-use efficiency and crop growth. Similar findings were reported by Meena *et al.* (2024) [5] and Niranjana *et al.* (2024) [6]. Thus, vermicompost @ 3 t/ha appeared to be more economical in terms of return generated per rupee invested. Similar economic benefits from vermicompost-based nutrient management in wheat have been reported by Singh *et al.* (2018) [7].

Effect of zinc levels

The highest grain, straw and biological yield was recorded with sowing on 20th November, which was significantly superior to 10th December and remained statistically at par with 30th November. The per cent increased the seed yield by 20th November and 30th November in tune of 9.32 and 4.59 per cent over to 10th December, respectively. The higher yield under timely sowing may be attributed to favourable temperature during vegetative and reproductive phases, longer grain-filling duration and better synchronization of crop growth with available moisture and solar radiation. The present findings are supported by Yadav and Khan (2025).

The highest net return (₹91,006 ha⁻¹) was recorded under the weed-free treatment, which was significantly superior to the weedy check (₹54,979 ha⁻¹), one hand weeding @ 30 DAS (₹83,139 ha⁻¹), metsulfuron methyl @ 4.0 g ha⁻¹ at 30 DAS (₹86,997 ha⁻¹) and carfentrazone ethyl @ 20 g ha⁻¹ at 30 DAS (₹81,458 ha⁻¹). The higher profitability under weed-free conditions was mainly due to greater grain and straw yields resulting from effective suppression of weed competition. Among herbicides, metsulfuron methyl recorded comparatively higher net returns and B:C ratio because of its effective weed control and relatively low application cost (Bhakar *et al.*, 2026) [8].

Table 1. Effect of Organic Manure and Zinc Levels on yield (kg/ha)

Treatments	Grain yield	Straw yield	Biological yield
Organic manure			
FYM @ 10 t/ha	4061	4937	8998
FYM @ 20 t/ha	4713	5820	10533
Vermicompost @ 3 t/ha	4555	5758	10313
Vermicompost @ 6 t/ha	4978	6199	11177
<i>SEm</i> _±	90	110	174
	282	335	523
<i>CD</i> = 0.05%			
Zinc levels			
Control	4222	5194	9415
Foliar spray of ZnSO ₄ @ 0.5%	4479	5558	10037
Soil application of ZnSO ₄ @ 6 kg/ha	4609	5719	10328
Soil application of ZnSO ₄ @ 12 kg/ha	4735	5885	10620
Soil application of ZnSO ₄ @ 6 kg/ha + Foliar spray of ZnSO ₄ @ 0.5%	4840	6038	10878
<i>SEm</i> _±	73	88	159
	209	252	458
<i>CD</i> = 0.05%			

Table 2. Effect of Organic Manure and Zinc Levels on economics (Rs/ha)

Treatments	Gross return	Net return	B : C ratio
Organic manure			
FYM @ 10 t/ha	129670	75730	1.40
FYM @ 20 t/ha	150940	86000	1.32
Vermicompost @ 3 t/ha	146546	91606	1.67
Vermicompost @ 6 t/ha	159677	92737	1.39
<i>SEm</i> _±	2227	2227	0.03
	6706	6706	0.10
<i>CD</i> = 0.05%			
Zinc levels			
Control	135099	75469	1.27
Foliar spray of ZnSO ₄ @ 0.5%	143574	83444	1.40
Soil application of ZnSO ₄ @ 6 kg/ha	147741	87661	1.47
Soil application of ZnSO ₄ @ 12 kg/ha	151823	91293	1.52
Soil application of ZnSO ₄ @ 6 kg/ha + Foliar spray of ZnSO ₄ @ 0.5%	155305	94725	1.57
<i>SEm</i> _±	2305	2305	0.04
	6639	6639	0.11
<i>CD</i> = 0.05%			

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