# Response of Vermicompost and Zinc Application on Yield and Nutrient uptake by Gram (*Cicer arietinum*)


**Abstract**

A field experiment was conducted at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan) during Rabi season of 2023-24 to effect of vermicompost and zinc on yield and nutrient content and uptake by gram Rapeseed variety "RSG-44" was used in this study. The required quantities of fertilizers as per treatments were applied. The experiment was laid out in randomized block design with three replications consisting of tan treatments. The data recorded maximum yield parameter such as number of pods per plant (68.48), number of seed per pod (2.14), seed yield (2289.12 kg/ha), stover yield (2790.12 kg/ha), biological yield (5079.24 kg/ha) and NPK content in grain and straw (3.432; 0.822, 0.395; 0.165 and 0.712; 1.452%) and uptake (78.56; 22.93, 9.04; 4.60 and 16.30; 40.51 kg/ha), respectively with $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$). The minimum yield, nutrient content and uptake obtained with control treatment. Therefore, conclude be application of Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) are indigenous sources of enhance productivity and nutrient uptake by chickpea.


**Key words**: - Vermicompost; Zinc; Productivity, Gram; Uptake




## 1. Introduction

Since pulses are the main source of protein in our nation, pulse crops are especially important to the vegetarian community. The world's biggest producer and consumer of pulses is India. Among all grain legumes, gram comes in third place worldwide. India is the largest chickpea producer as well as consumer in the world and ranks first in terms of area (10.56 million hectare) and production (11.23 million tonnes) with productivity of 1063 kg $ha^{-1}$ In Madhya Pradesh it is cultivated on an area of 3.59 million hectare with production of 4.59 million tonnes and productivity of 1278 kg $ha^{-1}$ (Anonymous, 2020).

Vermicompost has a higher N, P, and K content than typical heap manure, making it an excellent alternative to commercial fertilizers. Vermicompost typically contains 0.40–0.75%, 0.13–0.22% P, and 0.6–1.2% N. The usage of synthetic fertilizers has been shown to have a negative influence on the environment, and their cost has been rising over time. Farmers are becoming more aware of the benefits of raising crops organically, which will save expenses and lessen adverse environmental effects (Dhyani *et al.* 2011). Furthermore, organic farming will lessen the additional environmental contamination that results from the source-side manufacturing of these synthetic fertilizers. Vermicompost is a fully stabilized organic soil amendment with a low C:N ratio that is created through the mesophilic breakdown of organic materials by earthworms and microorganisms (Lyngdoh *et al.* 2017)

Zinc (Zn) plays a variety of roles in cellular functions and is a micronutrient that is vital to plants and other living things. A zinc deficit is characterized by inadequate zinc availability for ideal growth, which can cause a precipitous drop in crop output and quality. The ratio of grain yield or above-ground dry matter yield to the total amount of zinc absorbed in both zinc-sufficient and zinc-deficient environments is known as zinc efficiency (Shukla *et al.* 2021).

## 2. Materials and Methods

A field experiment was conducted during Rabi season of 2022-23 at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient inavailable zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in randomized block design with three replications consisting of tan treatments *viz.* $T_1$-Control, $T_2$-Vermicompost (1.5 tons $ha^{-1}$) + 0.5 % Zn foliar spray at 30 DAS, $T_3$-Vermicompost (1.5 tons $ha^{-1}$) + Zn (2.5 kg $ha^{-1}$), $T_4$-Vermicompost (1.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$), $T_5$-Vermicompost (3.0 tons $ha^{-1}$) + 0.5 % Zn foliar spray at 30 DAS, $T_6$-Vermicompost (3.0 tons $ha^{-1}$) + Zn (2.5 kg $ha^{-1}$), $T_7$-Vermicompost (3.0 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$), $T_8$-Vermicompost (4.5 tons $ha^{-1}$) + 0.5 % Zn foliar spray at 30 DAS, $T_9$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (2.5 kg $ha^{-1}$) and $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$). The required quantities of fertilizers as per treatments were applied. The doses of NPK were applied in the form of urea, diammonium phosphate, murate of potash respectively. The half dose of nitrogen gives basal dose and remain two split doses after irrigation and full dose of phosphorus and potassium at basal dose. Vermicompost apply in field at field preparation before sowing.

## 3. Results and Discussion

The data presented in Table 1.0 and Figure 1.0 has showed the variation in the yield attributes with application of vermicompost and zinc found significantly to the treatments. The data presented in Table 1.0 that the highest number of pods/plant was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (68.48). The minimum number of pods/plant was recorded with control treatment (32.55). The data state that the highest number of seeds per pod was obtained with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (2.14). The minimum number of seeds per pod was recorded with control treatment (1.62). The data furnished that the maximum seed yield was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (2289.12 kg/ha). The minimum seed yield was recorded with control treatment (1232.02 kg/ha). The maximum straw yield ex was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (2790.12 kg/ha). The minimum straw yield was recorded with control treatment (1830.25 kg/ha). The maximum biological yield was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (5079.24 kg/ha). The minimum biological yield was recorded with control treatment (3062.27 kg/ha). These findings also supported by Jakhar (2006), Fuller *et al.* (2008), Bameri *et al.* (2012), Singh *et al.* (2014) and Krishana *et al.* (2022).

The data presented in Table 2.0 has showed the variation in the nutrient content with application of vermicompost and zinc found significantly to the treatments. The data revealed that the maximum nitrogen content in grain was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (3.432 %). The minimum nitrogen content in grain was recorded with control treatment (3.075 %). The maximum nitrogen content in straw was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (0.822%). The minimum nitrogen content in straw was recorded with control treatment (0.670 %). The maximum phosphorous content in grain was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (0.395 %). The minimum phosphorus content in grain was recorded with control treatment (0.345 %). The maximum phosphorus content in straw was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (0.165 %). The minimum phosphorus content in straw was recorded with control treatment (0.151%). The maximum potassium content in grain was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (0.712 %). The minimum potassium content in grain was recorded with control treatment (0.612 %). The maximum potassium content in straw was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (1.452 %). The minimum potassium content in straw was recorded with control treatment (1.142 %). Similar result also reported by Ramesh *et al.* (2006), Shivran *et al.* (2015), Mohammadi *et al.* (2017) and Joshi *et al.* (2023).

The data presented in Table 3.0 has showed the variation in the nutrient uptake with application of vermicompost and zinc found significantly to the treatments. The maximum nitrogen uptake in grain was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (78.56 kg/ha). The minimum nitrogen uptake in grain was recorded with control treatment (37.87 kg/ha). The maximum nitrogen uptake in straw was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (22.93 kg/ha). The minimum nitrogen uptake in straw was recorded with control treatment (12.26 kg/ha). The maximum phosphorous uptake in grain was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (9.04 kg/ha). The minimum phosphorus uptake in grain was recorded with control treatment (4.25 kg/ha). The maximum phosphorus uptake in straw was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (4.60 kg/ha). The minimum phosphorus uptake in straw was recorded with control treatment (2.76 kg/ha). The maximum potassium uptake in grain was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (16.30 kg/ha). The minimum potassium uptake in grain was recorded with control treatment (7.54 kg/ha). The maximum potassium uptake in straw was recorded with treatment $T_{10}$-Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) (40.51 kg/ha). The minimum potassium uptake in straw was recorded with control treatment (20.90 kg/ha). Similar concluded by Shivay *et al* (2008)**,** Tripathi *et al.* (2011), Kansotia *et al*. (2013) and Meena *et al.* (2022).

**Conclusion**

On the basis of experimental result of the present investigation conducted application of Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) showed significant effect with respect to yield, nutrient content and uptake as compared to control. Therefore, conclude be application of Vermicompost (4.5 tons $ha^{-1}$) + Zn (5.0 kg $ha^{-1}$) are indigenous sources of enhance productivity and nutrient uptake by chickpea.

**Table.1.0 Effect of vermicompost and zinc application on yield attributes and yield of gram**

| Treatments | Number of pods/plant at harvest | Number of seeds/pod at harvest | Seed yield (kg/ha) | Straw yield (kg/ha) | Biological yield (kg/ha) |
|---|---|---|---|---|---|
| $T_1$ | 32.55 | 1.62 | 1232.02 | 1830.25 | 3062.27 |
| $T_2$ | 42.65 | 1.72 | 1632.45 | 2128.25 | 3760.7 |
| $T_3$ | 45.98 | 1.78 | 1685.36 | 2198.66 | 3884.02 |
| $T_4$ | 46.25 | 1.84 | 1745.78 | 2235.45 | 3981.23 |
| $T_5$ | 50.32 | 1.88 | 1832.65 | 2342.58 | 4175.23 |
| $T_6$ | 54.12 | 1.95 | 1868.44 | 2385.47 | 4253.91 |
| $T_7$ | 56.45 | 2.00 | 1965.25 | 2460.77 | 4426.02 |
| $T_8$ | 60.45 | 2.05 | 2078.58 | 2530.58 | 4612.16 |
| $T_9$ | 65.12 | 2.08 | 2085.36 | 2602.47 | 4687.83 |
| $T_{10}$ | 68.48 | 2.14 | 2289.12 | 2790.12 | 5079.24 |
| S. Em. (±) | 3.24 | 0.03 | 70.25 | 88.45 | 155.85 |
| C.D. at 5% | 9.75 | 0.09 | 210.92 | 264.25 | 468.05 |

**Table.2.0 Effect of vermicompost and zinc application on nutrient content and uptake by gram**

| Treatments | Nitrogen content (%) | | Phosphorus content (%) | | Potassium content (%) | | Nitrogen uptake (kg/ha) | | Phosphorus uptake (kg/ha) | | Potassium uptake (kg/ha) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grain | Straw | Grain | Straw | Grain | Straw | Grain | Straw | Grain | Straw | Grain | Straw |
| $T_1$ | 3.075 | 0.670 | 0.345 | 0.151 | 0.612 | 1.142 | 37.88 | 12.26 | 4.25 | 2.76 | 7.54 | 20.90 |
| $T_2$ | 3.125 | 0.762 | 0.355 | 0.153 | 0.635 | 1.255 | 51.01 | 16.22 | 5.80 | 3.26 | 10.37 | 26.71 |
| $T_3$ | 3.138 | 0.785 | 0.362 | 0.155 | 0.642 | 1.275 | 52.89 | 17.26 | 6.10 | 3.41 | 10.82 | 28.03 |
| $T_4$ | 3.145 | 0.788 | 0.365 | 0.155 | 0.652 | 1.285 | 54.90 | 17.62 | 6.37 | 3.46 | 11.38 | 28.73 |
| $T_5$ | 3.245 | 0.793 | 0.372 | 0.157 | 0.662 | 1.305 | 59.47 | 18.58 | 6.82 | 3.68 | 12.13 | 30.57 |
| $T_6$ | 3.285 | 0.798 | 0.378 | 0.158 | 0.668 | 1.345 | 61.38 | 19.04 | 7.06 | 3.77 | 12.48 | 32.08 |
| $T_7$ | 3.302 | 0.802 | 0.382 | 0.158 | 0.678 | 1.374 | 64.89 | 19.74 | 7.51 | 3.89 | 13.32 | 33.81 |
| $T_8$ | 3.375 | 0.810 | 0.385 | 0.160 | 0.685 | 1.402 | 70.15 | 20.50 | 8.00 | 4.05 | 14.24 | 35.48 |
| $T_9$ | 3.415 | 0.815 | 0.389 | 0.162 | 0.695 | 1.425 | 71.22 | 21.21 | 8.11 | 4.22 | 14.49 | 37.09 |
| $T_{10}$ | 3.432 | 0.822 | 0.395 | 0.165 | 0.712 | 1.452 | 78.56 | 22.93 | 9.04 | 4.60 | 16.30 | 40.51 |
| S. Em. (±) | 0.012 | 0.005 | 0.004 | 0.002 | 0.009 | 0.017 | 2.75 | 0.83 | 0.35 | 0.22 | 0.72 | 1.78 |
| C.D. at 5% | 0.036 | 0.015 | 0.012 | 0.006 | 0.027 | 0.051 | 8.28 | 2.50 | 1.04 | 0.65 | 2.18 | 5.30 |

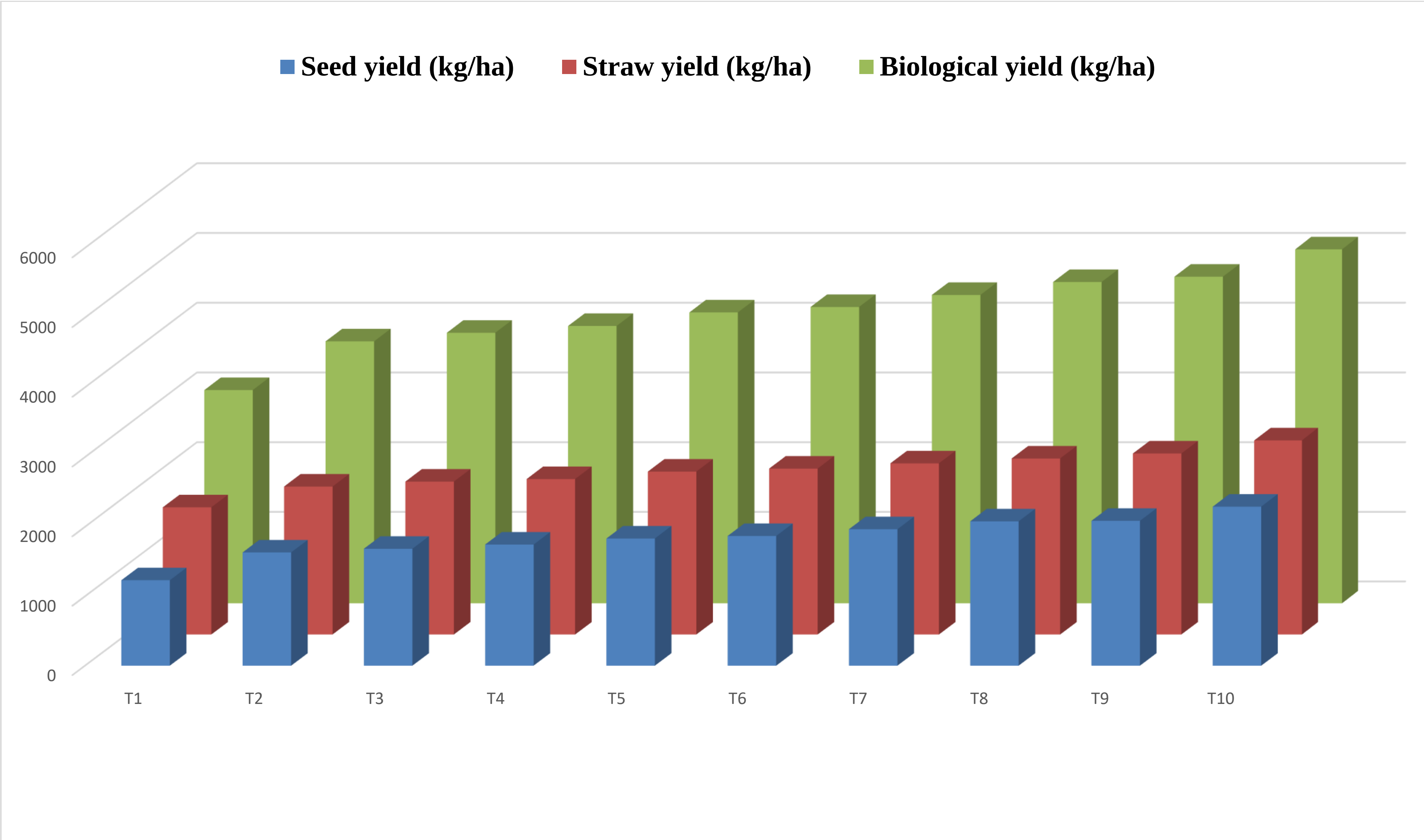


**Figure 1.0 Effect of vermicompost and zinc application on yield of gram**

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