

Original Research Article

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Effect of Different Levels of Vermicompost on Soil Physical Properties of Two Cultivars of Cabbage (*Brassica oleracea* L.) under Eastern UP (India) Conditions

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ABSTRACT

An experimental field trials was conducted during the rabi season of 2016-2017 at the Experimental field of SHUATS, Allahabad to evaluate the “Effect of different levels of vermicompost on soil physical properties of two cultivars of cabbage (*Brassica oleracea* L.) Under Eastern UP conditions”. The field trial was laid out in random block design with three replications. Each replicate consisted of 10 treatment combinations. The treatments consisted of application of vermicompost with different varieties of Cabbage at different rates viz., T1 = 0t verm/ha + v1 (Magic ball), T2 = 0t verm/ha + v2(F1 hybrid king), T3 = 0.8kg(2t/ha) verm + v1 (Magic ball), T4 = 1.6kg(4t/ha)verm + v1 (Magic ball), T5 = 2.4kg(6t/ha) verm + v1 (Magic ball), T6 = 3.2kg(8t/ha) verm + v1 (Magic ball), T7 = 0.8kg(2t/ha) verm + v2 (F1 hybrid king), T8 = 1.6kg(4t/ha) verm + v2 (F1 hybrid king), T9 =2.4kg(6t/ha) verm + v2 (F1 hybrid king), T10 = 3.2kg(8t/ha) verm + v2 (F1 hybrid king) with a control for each replication. Plot dimensions were 2 x 2 m with a buffer zone of 0.5 m between all plots. A spacing of 30 x 50 cm between the plants was maintained with a total of 30 plots. Significant influenced of vermicompost application were observed on the particle density, bulk density, pore space (%), solid space (%) and WHC. The highest and lowest particle densities were observed in T1 and T6, T10, means it decreases with increasing levels of vermicompost. Same trend goes for bulk density and solid space (%). While water holding capacity and pore space (%) increase with increase in levels of vermicompost.

Keywords

Vermicompost, Physical properties, Soil, Cabbage etc.

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Introduction

Cabbage is a highly consumed member of Cole crops. Its popularity may be due to its high yield capacity, good taste, short duration, low cost of production. The word ‘Cole’ means a group of highly differentiated plants originated from a single wild *Brassica oleracea* var. *oleracea* (*sylvestris* L.) commonly known as wild cabbage. Cole crops are among the most widely grown vegetables in the temperate zones. Some of the important Cole crops growing states in the

country are Uttar Pradesh, Karnataka, Maharashtra, Bihar, West Bengal, Punjab and Haryana. The area under cabbage cultivation was reported to be 4 lac ha. With an average productivity of 22.6 MT/ha (Indian Horticultural Database, 2013-14). It is a good source of vitamin A, B &C, contains minerals like P, K, Ca, Na, Fe, fats and proteins. It is cooling in effect and helps to prevent constipation, increase appetite, adds up digestion and is useful for diabetic problems.

Vermicompost (or vermi-compost) is the product of the composting process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and vermicast. This process of producing Vermicompost is called Vermicomposting.

Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner (Coyne, Kelly and Erik Knutzen). It is used in farming and small scale sustainable, organic farming. Vermicompost is made up primarily of C, H and O, and contains nutrients such as NO₃, PO₄, Ca, K, Mg, S and micronutrients which exhibit similar effects on plant growth and yield as inorganic fertilizers applied to soil (Singh *et al.*, 2008).

Materials and Methods

The experiment was carried out on cabbage (*Brassica oleracea L.*) in the experimental farm of SHUATS, Allahabad in 2016-17. The soil texture of the experimental field was Sandy loam soil. Vermicompost was composted thermodynamically for three months with mechanical turn cycles every 10 day. For preparing of Vermicompost were added numbers of 400 mature worms per m² bed. The worms were removed with a pile of fresh materials that placed in side of the Vermicompost which recalled them by attraction of the fresh feed. In this experiment the seedling of Cabbage were planted in the plotted field which each plot had 2 m long and 2 m wide (4 m²) and was separated by 15 cm width from unplanted areas. The Vermicompost was applied at the rate of 0 (control), 2, 6 and 8 t ha⁻¹ for the two varieties and it was incorporated into the top 15 cm of soil in the whole experimental plots. The plots were arranged in a Randomized

Block Design (RBD) with three replications. Seeds were sown in boxes prepared with proper soil mixture and Cabbage seedlings were transplanted into field soil 4 weeks after seed planting when they had 3 true leaves. Seedlings were planted in a distance of 50cm row to row and 30cm plant to plant. Treatments are T1 = 0t verm/ha + v1 (Magic ball), T2 = 0t verm/ha + v2(F1 hybrid king), T3 = 0.8kg(2t/ha)verm + v1 (Magic ball), T4 = 1.6kg(4t/ha)verm + v1 (Magic ball), T5 = 2.4kg(6t/ha)verm + v1 (Magic ball), T6 = 3.2kg(8t/ha)verm + v1 (Magic ball), T7 = 0.8kg(2t/ha)verm + v2 (F1 hybrid king), T8 = 1.6kg(4t/ha)verm + v2 (F1 hybrid king), T9 = 2.4kg(6t/ha)verm + v2 (F1 hybrid king), T10 = 3.2kg(8t/ha)verm + v2 (F1 hybrid king)

To determine soil physical properties, the soil samples were collected 3 months after addition of Vermicompost from depth of 15 cm. The samples were air dried at room temperature. Soil sub-samples before physical analysis was screened through a 2 mm sieve and homogenated. The Water holding Capacity, Bulk density, Particle density, Percentage Pore space and solid space were determined using 100ml Measuring cylinder. Soil texture was determined by the Bouyoucos hydrometer method.

Results and Discussion

The application of Vermicompost significantly influenced the WHC and the WHC for the year 2016-17 was found to be in the range of 54.90% to 63.10% with the highest corresponding to T10 and the lowest corresponding to T1 and T2. The data revealed that the WHC of the soil was significantly affected by the application of Vermicompost. This may be due to the fact that WHC is controlled primarily by number of pores and their pore size distribution and the specific surface area of soils. Because of increased aggregation, total pore space is

typically increased by organic matter addition. These findings are in the line of works done by (Kladivko and Nelson, 1979), (Tiarks *et al.*, 1974). The application of Vermicompost not significantly influenced the Particle density and bulk density which found to be in the range of 2.6 gcm⁻³ to 2.54 gcm⁻³ and 1.21 gcm⁻³ to 1.12 gcm⁻³ respectively and similar results was founded by Maheswarappa *et al.*, (1999). Percentage

Pore space was increased with the increasing level of Vermicompost from range of 51.2 % (T1) to 56.36% (T6). Percentage Solid space was decreased with the increasing level of Vermicompost from range of 48.48% (T1) to 43.64% (T6) and similar results were founded by (Sharma *et al.*, 2002). Soil textural class was found to be sandy loam. The observations regarding the parameters were given in table 1.

Table.1 Effect of different levels of Vermicompost on physical properties of soil of Two cultivar of cabbage after harvesting (2016-17)

Treatments	Particle density(gcm ⁻³)	Bulk density(gcm ⁻³)	Pore space (%)	Solid space (%)	Water holding capacity (%)
T ₁	2.68	1.21	51.52	48.48	54.90
T ₂	2.67	1.21	52.56	47.44	54.90
T ₃	2.65	1.20	53.64	46.36	56.40
T ₄	2.62	1.19	54.20	45.8	59.30
T ₅	2.57	1.17	54.71	45.29	61.05
T ₆	2.54	1.16	56.36	43.64	63.10
T ₇	2.66	1.12	53.22	46.78	57.75
T ₈	2.63	1.19	53.67	46.33	59.21
T ₉	2.57	1.17	55.98	44.02	61.06
T ₁₀	2.54	1.13	56.13	43.87	63.48
Mean	2.61	1.17	54.19	45.80	59.11
F test	NS	NS	NS	NS	S
C.D.	-	-	-	-	4.67

The results showed that soils amended with Vermicompost had significantly ($P \leq 0.05$) lesser soil bulk density in comparison to control plots (Table 1). The increase of the rates of Vermicompost reduced soil bulk density. Compost addition caused a significant increase of bulk density due to the more porosity added to the soil (Bazzoffi *et al.*, 1998).

The total porosity was improved by the use of Vermicompost. The greater porosity in the soil treated with Vermicompost was due to an increase in the amount of rounded pores (Marinari *et al.*, 2000). Physical properties like BD, WHC and infiltration rate

numerically but non-significantly increased in organically amended plots when compared with the control or with initial values.

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