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Performance of different Vermicomposts on yield and yield components of Mungbean (*Vigna radiata* L.) in major soils of Bundelkhand region, India

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Abstract : *Sustainable agriculture is one in which the goal is permanence, achieved through the utilization of renewable resources. This leads to development of concept of organic natural farming. Vermicomposting is one of the important aspects of organic farming. Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, flower and fruit crops. Present study was carried out in major soil group (black soil and red soil) of Bundelkhand region with addition of different vermicompost and their effects on performances of Vigna radiata L. Gorwth and yield parameters were measured 30 days and 60 days after sowing. Significant performances were found in cowdung based vermicompost in black soil in compare to red soil. The result of our experiment showed the application of vermicompost had significant positive effects on growth performances and yield of plant as compare to control.*

Key Words: *Organic farming, Sustainable agriculture, Vermicompost.*

Introduction

Vermicompost a mixture of beat of earthworm, organic matter, humus, living earthworm, and earthworms egg (cocoon) and other mixture of microorganism and worm casts enriched with macro and micronutrients (N, P, K, Mn, Fe, Mo, B, Cu, Na Z.), some growth regulating substances such as gibberellins and auxins and useful micro flora (*Azospirillum*, *Actinomyces* and *Phosphobacillus*) etc. The nutrient level of Vermicompost (1.5-2.5% N, 0.6-0.8% P and 1.2-1.5% K) is higher than any other compost.

Positive effect of application of various organic wastes and vermicompost on dry matter of wheat and maize was reported by Sharma and Maden (1998). Jai Kumar (1995) got higher fresh and dry matter yield of fodder maize crop by addition of compost prepared by *Eisenia fetida*. Stevonson (1982) listed organic matter as the most influenced factor modulating nutrient availability aeroos diverse soil. Diminishing organic matter led to a significant fall in the availability of zinc, copper, manganese, and iron (Katyal and Sharma, 1991).

Green gram is the third most important pulse crop in India. Mung bean (*Vigna radiata* L.) cover an area of 3 million hectares which is about 12% of the total area under pulses in India with a production of 1.31 million tones and productivity of 425 kg/ha. Increased mung bean production in the country can serve a very useful purpose in this direction.

In Uttar Pradesh, green gram is grown in summer as well as *Kharif* season with an area of 1.11 million hectare with production of 0.66 million tones and average productivity of 592 kg/ha. The yield of green gram in the state is limited chiefly due to plant nutritional problem, which is the ubiquitous shortage of total and available nitrogen to the plants especially during seedling establishment. Yield and quality of mung bean could be improved by managing the properties of organic manures.

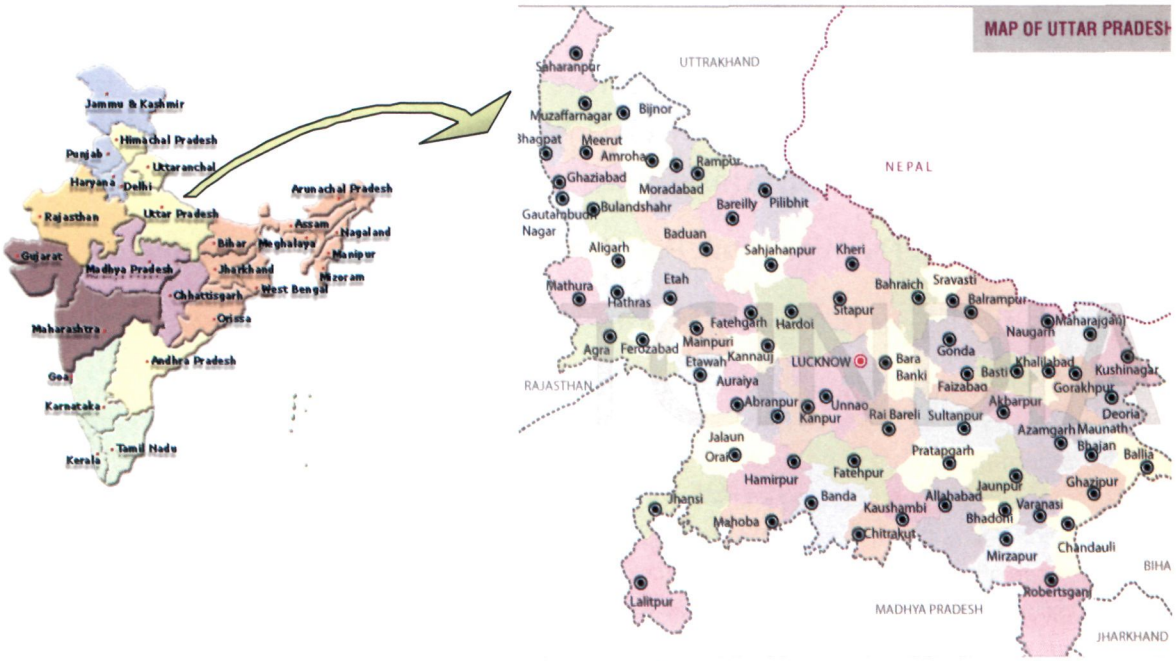
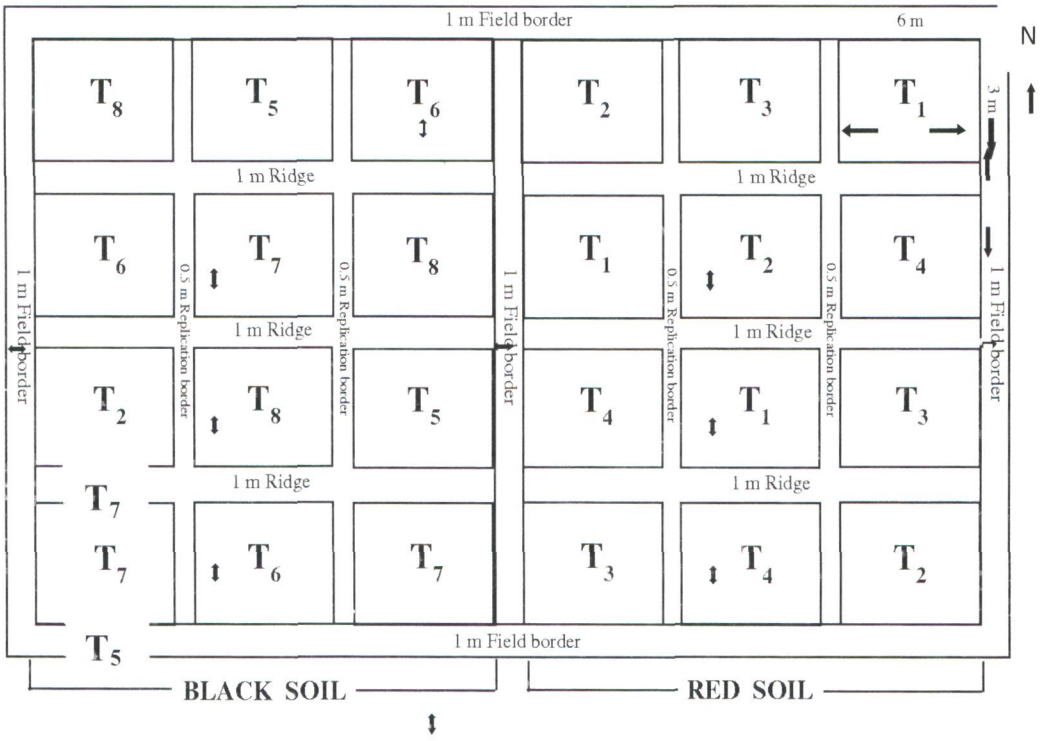


Fig. 1. Lalitpur district experimental siet desinge



The application of vermicompost gave higher germination (93%) of mung bean (*Vigna radiata* L.) compared to the control (84%), further, the growth and yield of mung bean was also significantly higher with vermicompost application (Ghanshyam *et al.*, 2010). Likewise, in another pot experiment, the fresh and dry matter yield of cowpea (*Vigna unguiculata*) was higher when soil was amended with vermicompost than with biodigested slurry (Karmegam *et al.* 1999; Karmegam and Daniel, 2000; Sailaja and Usha, 2002). Similarly, a positive response was obtained with the application of vermicompost to other field crops such as *Phaseolus vulgaris* (Singh and Chauhan, 2009; Manivannan *et al.*, 2009; Fermandez-Luqueno *et al.*, 2010), *Lycopersicum esculentum* (Fedrico *et al.*, 2007; Gutierrez-Miceli *et al.*, 2007; Azarmi *et al.*, 2008), *Zea mays* (Kumar *et al.*, 2007) and strawberry (Arancon *et al.*, 2004). In this work we have also tested the performance of different vermicompost on yield and yield components of Mungbean (*Vigna radiata* L.) in major soils of Bundelkhand.

Materials and Methods

Experimental details : The field experiment was initiated during 2006-07 and 2007-08 at Agriculture Experimental Station, Nehru PG College, Lalitpur (UP), India which is situated at 24°102 N to 25°152 N and 78°102 E to 79°002 E (Fig.1) The climate of the experimental site is sub tropical with high variation between summer and winter temperature. The average annual rainfall is approximately 688mm, most of which is during the monsoons in middle of June to last week of October. There four major soils group of Bundelkhand region are; Rakar, Kabar, Mar and Parwa respectively. Rakar and Kabar selected for our experiment as Red soil and Black soil.

The experiment was conducted on fallow land where two types of soils Red and Black were imported. Red soil is coarse grain and Black soil is heavy soil and is distributed in upland and low lying areas of Lalitpur. In vermicompost, three different biodegradable wastes viz. cow dung, fresh water hyacinth plant (*Eichhornia crassipes*) and straw with various C/N ratios were used as food for epigeic earthworm Eisenia foetida. Fresh cow dung was procured from the adjacent dairy farm, fresh water hyacinth plants were collected from Sumera Talab pond and Straw of local cereal crops were collected from Lalitpur district.

In a set of 8 treatment plots were tried in randomized block design (plot size 6x3 M) with three replications. PDM-139 variety of mung bean was sown with a row spacing of 30 cm and 10 cm plant to plant of sowing in *kharif* season between 10 to 15 July during both experimental years on a well prepared seedbed with the help of desi plough using seed rate of 15 kg ha^{-1} and vermicompost applied at the rate of 5 tones ha^{-1} after first plough in each plots.

Treatment details : T_1- Red soil (S_1) + Control (V_0), T_2- Red soil (S_1) + cow dung based vermicompost (V_1), T_3- Red soil (S_1) + *Eichhornia* based vermicompost (V_2), T_4- Red soil (S_1) + Straw based vermicompost (V_3) and T_5- Black soil (S_2) + Control (V_0), T_6- Black soil (S_2) + cow dung based vermicompost (V_1), T_7- Black soil (S_2) + *Eichhornia* based vermicompost (V_2), T_8- Black soil (S_2) + Straw based vermicompost (V_3).

The crop was grown as a rain fed crop. Since the 688 mm rainfall received in this area during the monsoon season is sufficient for its normal cultivation. No pests were observed in the crop in both years. Every year at 30 and 60 days after sowing 5 random plants were carefully uprooted from each plot and washed out gently and the nodules were separated from the roots. The total number of nodule was counted and then bulked dried in an oven at 75°C and weighed for dry weight of nodules. The Plant height and number of branch per plant was recorded at 30 and 60 days after sowing in every year. Attribute character like number of Pods $plant^{-1}$, number of grain pod^{-1}, test weight (1000 grain weight), grain yield and straw yield were recorded after

Results and Discussions

The different vermicompost significantly influenced the growth, yield and yield attributes of greengram over their respective control. The present study maximum number of nodules plant^{-1} were recorded in treatment T_2 and T_6 (30 and 31, 32 and 32.67 in 30 DAS and 38 and 38.33, 38.33 and 37.67 in 60 DAS) in both soil group. The minimum number of nodules plant^{-1} were recorded in treatment T_1 and T_5 (10 and 10, 11.33 and 10.33 in 30 DAS and 13 and 12.67, 13 and 13 in 60 DAS) in both soil group (Fig. 2).

The maximum nodules dry weight plant^{-1}(mg) were recorded in treatment T_2 and T_6 (64 and 61.66, 73 and 73 in 30 DAS and 123 and 122.66, 139 and 136 in 60 DAS) in both soil group. The minimum nodules dry weight plant^{-1} (mg) were recorded in treatment T_1 and T_5 (32.66 and 46.66, 36 and 48 in 30 DAS and 53.66 and 88.66, 53.66 and 89.66 in 60 DAS) in both soil group (Fig. 3). Similar trends were also showed by *Karmegam et al. (1999) and Ghanshyam et al.*, (2010) in their respective study.

In red soil the number of primary branches plant^{-1} was observed maximum in treatment T_2 (4.22 and 5.22 in 30 DAS and 5.22 and 5.77 in 60 DAS) in both year. The minimum number of primary branches plant^{-1} in treatment T_4 (3.22 and 3.77 in 30 DAS and 3.77 and 3.88 in 60 DAS) in both year. In black soil the number of primary branches plant^{-1} was observed maximum in treatment T_6 (4.77 and 5.88 in 30 DAS and 5.88 and 7.22 in 60 DAS) in both year. The minimum number of primary branches plant^{-1} in treatment T_5 (2.88 and 3.11 in 30 DAS and 3.88 and 4 in 60 DAS) in both year (Fig. 4).

The Maximum plant height (cm) was recorded in 30 and 60 DAS in treatment T_2 (21.67 and 24.50 and 38.17 and 41.50) in red soil of two experimental years and minimum in treatment T_1 (14.50 and 15.58 and 25.83 and 28.50). The Maximum plant height (cm) was increase in 30 and 60 DAS in treatment T_6 in black soil of two experimental years and minimum in treatment T_5 (Fig. 5).

The maximum number of pods plant^{-1} (31.67 and 35) were recorded in treatment T_2 in red soil and in treatment T_6 (36.67 and 38) in black soil. The *minimum number of pods plant^{-1} (15 and 14) was* observed in treatment T_1 in red soil and in treatment T_5 (18.33 and 15) in black soil (Fig. 6).

The maximum number of grain pod^{-1} (11.67 and 11) was found in treatment T_2 in red soil and (12.67 and 12.67) in treatment in black soil. The

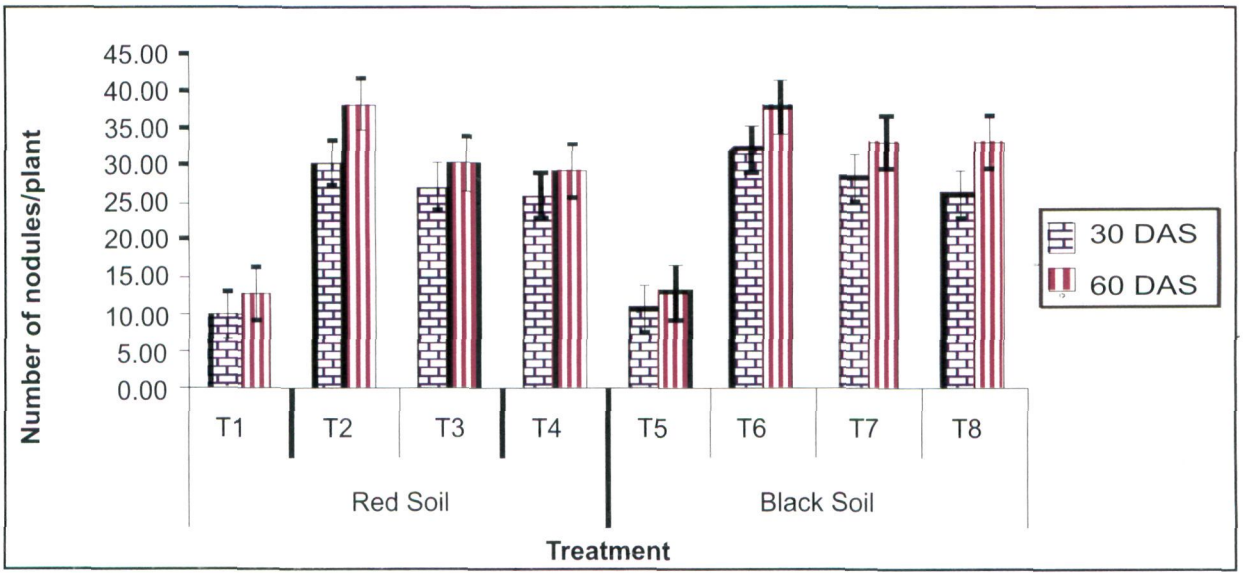


Fig. 2. Effect of vermicompost on number of nodules/plant

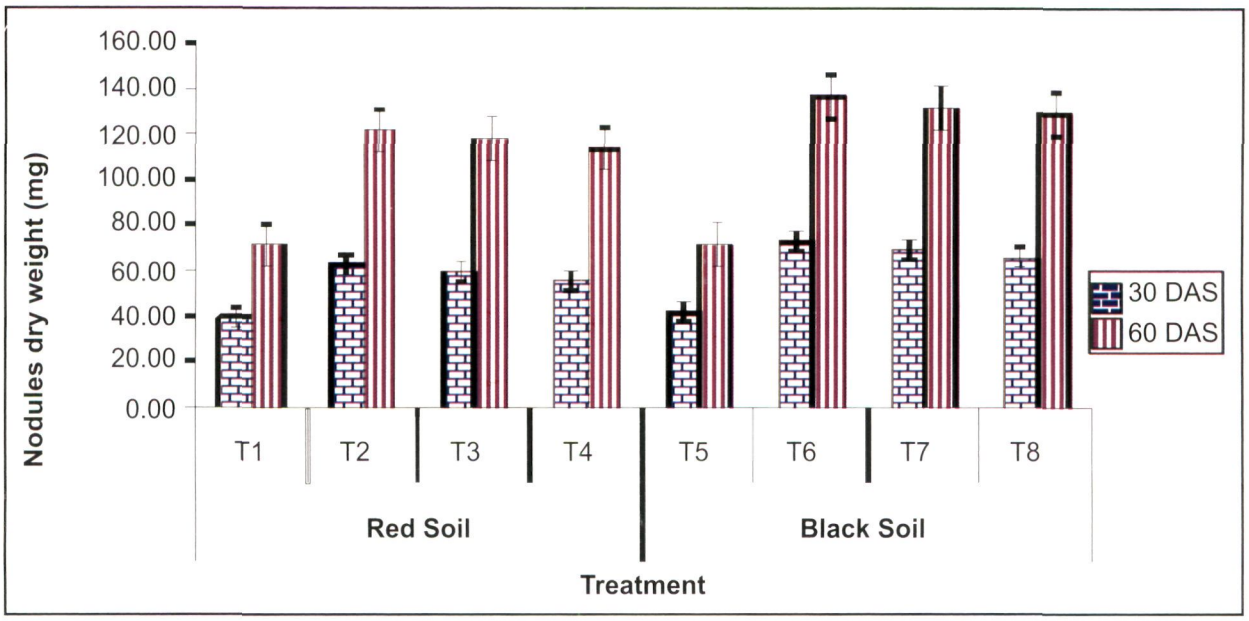


Fig. 3. Effect of vermicompost on Nodules dry weight/plant

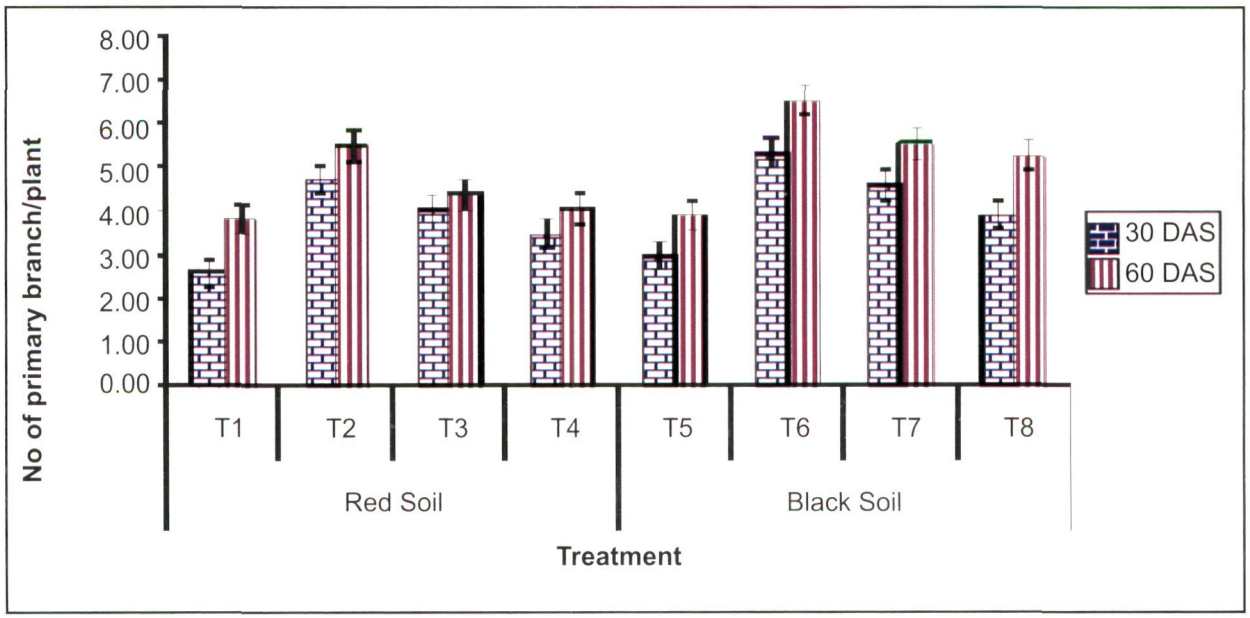


Fig. 4. Effect of vermicompost on no. of primary branch/plant

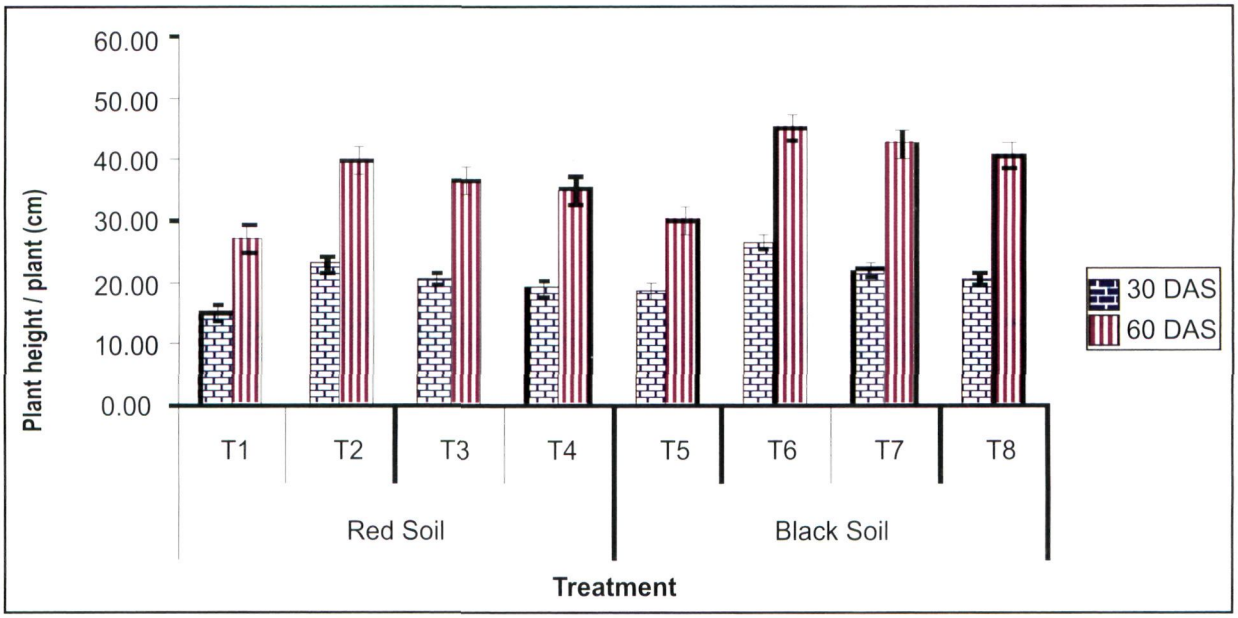


Fig. 5. Effect of vermicompost on plant height/plant (cm)

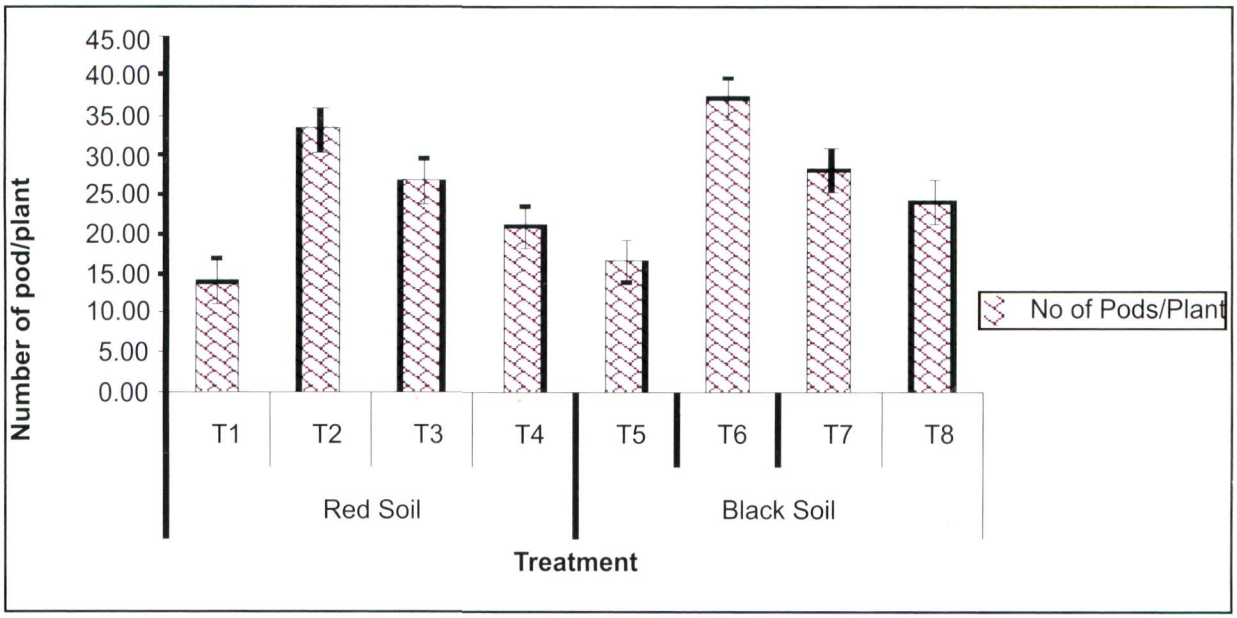


Fig. 6. Effect of vermicompost on number of pods/plant

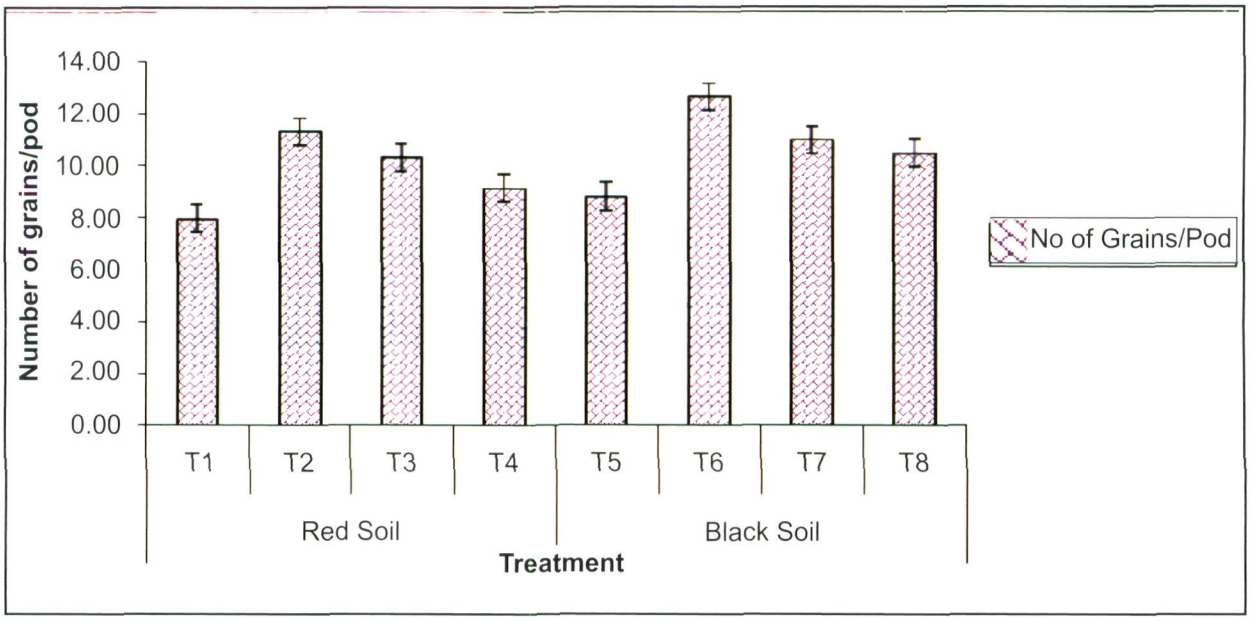


Fig. 7. Effect of vermicompost on plant height/plant (cm)

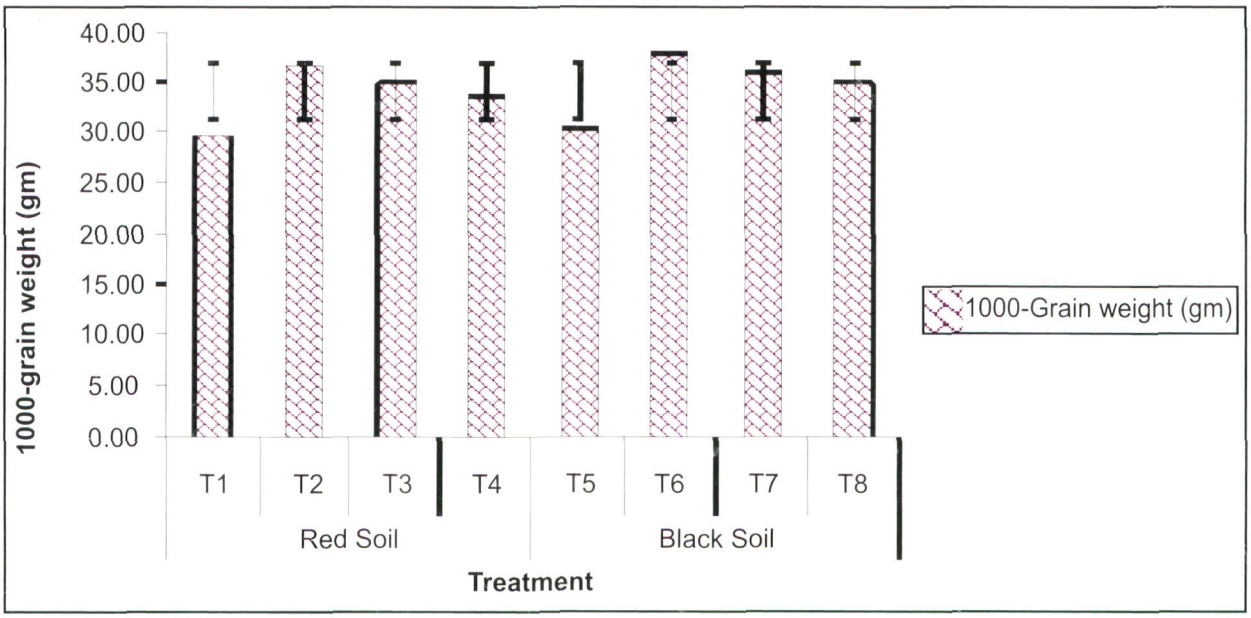


Fig.8. Effect of vermicompost on number of pods/plant

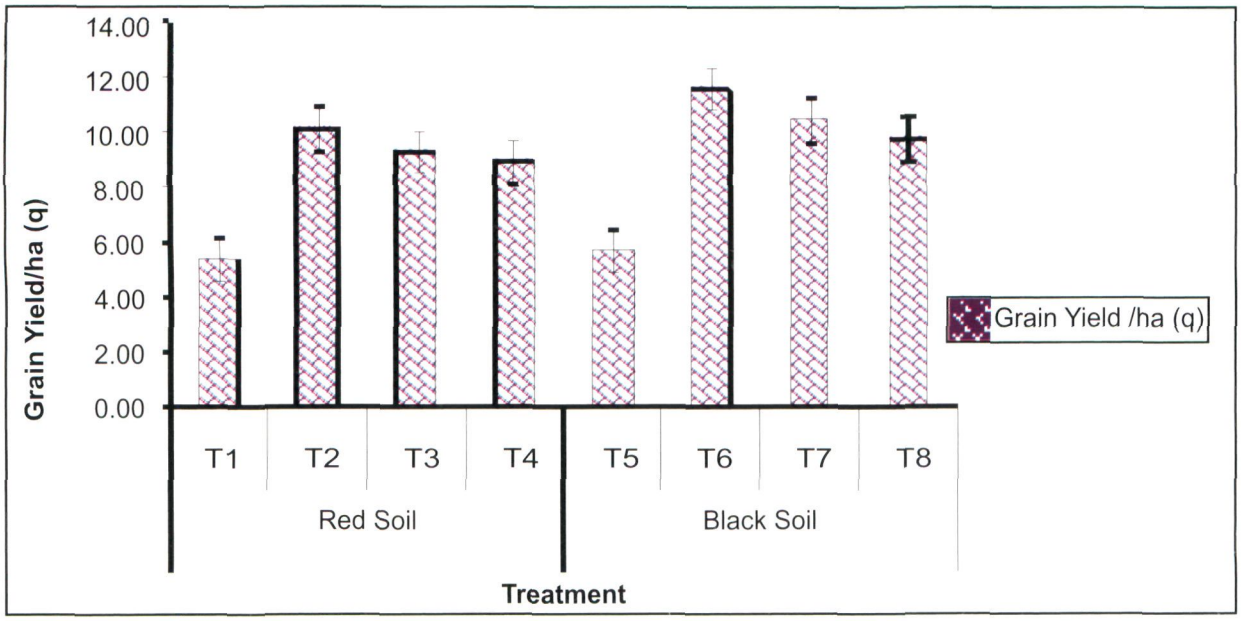


Fig. 9. Effect of vermicompost on number of Grain/Pod

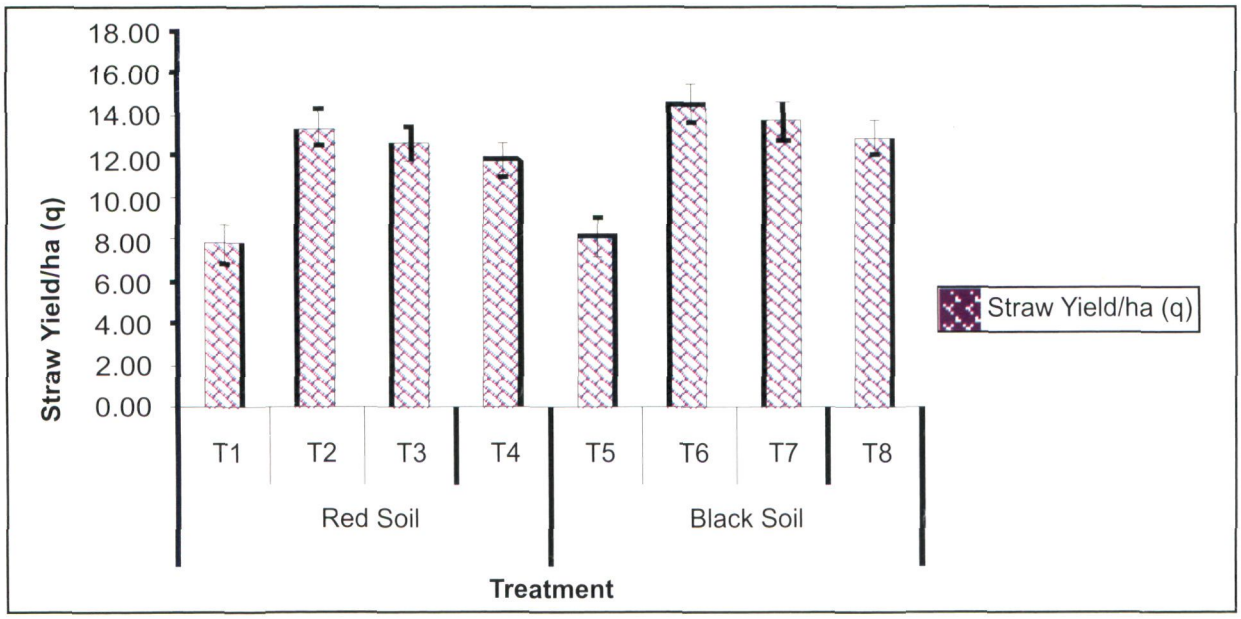


Fig. 10. Effect of vermicompost on Straw yield (q/ha)

T_1- Red soil (S_1) + Control (V_0)
T_2- Red soil (S_1) + cow dung based vermicompost (V_1)
T_3- Red soil (S_1) + Eichhornia based vermicompost (V_2)
T_4- Red soil (S_1) + Straw based vermicompost (V_3)
T_5- Black soil (S_2) + Control (V_0)
T_6- Black soil (S_2) + cow dung based vermicompost (V_1)
T_7- Black soil (S_2) + Eichhornia based vermicompost (V_2)
T_8- Black soil (S_2) + Straw based vermicompost (V_3)
DAS- Day After Sowing

11) was found in treatment T_2 in red soil and (12.67 and 12.67) in treatment in black soil. The minimum number of grains pod^{-1} (8 and 8) was noted in treatment T_1 and (9 and 8.67) in treatment T_5 in black soil (Fig. 7).

The maximum 1000-grain weight (gm) (36.77 and 36.90) was recorded in treatment T_2 in red soil and (37.93 and 37.98) in treatment in black soil. The minimum 1000-grain weight (29.65 and 29.72) was found in treatment T_1 in red soil and (30.31 and 30.32) in treatment T_5 in black soil (Figure 8).

The treatment T_2 produced maximum grain yield (q ha^{-1}) (9.91 and 10.39) in red soil and treatment T_6 (11.43 and 11.77) in black soil. The minimum grain yield (7.01 and 6.74) was noted in treatment T_1 in red soil and (7.84 and 7.68) in treatment T_5 in black soil (Fig. 9).

The maximum straw yield (q ha^{-1}) was recorded in treatment T_2 (13.03 and 13.82) in red soil and in treatment T_6 (11.43 and 11.77) in black soil (Fig.10). The minimum straw yield was observed in treatment T_1 (10.08 and 9.53) in red soil and black soil in treatment T_5 (10.60 and 10.77).

A similar trend of results of growth performances and yield characters of various crops and vegetables had been showed by different workers in their study.

Arancon *et al.* (2004) reported positive effects of vermicompost on the growth and yield in strawberry especially increase the leaf area, soot dry weight and fruit weight in field condition. Mishra *et al.* (2005) showed that vermicompost had beneficial effects on growth and yield of rice, especially causing significant increase of many growth parameters auch as seed germination, chlorophyll concentration and yield. Similar results were noted by Maynard (1995), who reported that tomato yields in field soils amended with compost were significantly greater than those in the untreated plots.

In this study significant performances were found in cowdung based vermicompost (T2 and T6) in both the soil group, although black soil is better in compare to red soil. Overall, our experiment showed that the application of vermicompost had significant positive effects on growth performances and yield of plant as compare to control.

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