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# HOLISTIC APPROACH FOR IMPROVING USAR LAND FARMING THROUGH VERMICOMPOSTING TECHNOLOGY

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## Abstract

Effect on the germination of seed, biomass of plant and fruiting behavior of *Lycopersicum esaulentum* was studied in present experiment by application of vermicompost, biocompost and farmyard manure (FYM). Reclamation of usar soil was done by vermicompost, biocompost and farmyard manure (FYM) in different dose levels at various plots. Plots were observed after sowing the seeds of tomato. The germination of seeds was not observed in 100% usar soil plot. In vermicompost treated plots growth of plants from seedlings (78%), biomass production (16.43g.drywt) to fruiting (8/plant) was recorded more than that of FYM and bio compost amended plots. India is an agriculture based country and produce large amount of plant refuses which can be easily produce tons of vermicompost and biocompost. It reduces the use of chemical fertilizers, land stress and increase the rural economy.

***Key words:*** Farm Yard Manure, Vermicompost, Biocompost*, Lycopersicum esculentum*, usar soil.

## Introduction

Vermiculture technology implies a modern technique of harnessing the ecosystem for effective utilization of the organic waste with the help of earthwaorms, which results into generation of useful organic manure. This is ecologically safe, economic and can create more employment opportunities for rural people to upgrade their standard of living (Uma and Suman, 2013). The vermicompost treatment can reclaim the usar soil up to the level of crop production and fulfill the requirement of fertile land (Agarwal *et al*., 2008). Vermiculture technology easily converts the organic wastes into a good quality of vermicompost within 60-90 days. Continued price hike of fertilizers coupled with low-purchasing capacity of farmers and persistent nutrient depletion from soil have revived the interest of recycling along with chemical fertilizers, so as to sustain optimum yield and improve soil physical, chemical and biological properties (Siag and Yadav, 2004).

Vermicompost helps in plant growth and health via stimulating microbial activity besides the additions of available nutrients. The earthworm creates soil condition of available nutrients. The earthworm creates soil conditions that discourage population of insects, nematodes and others that are harmful to plants by passing soil and organic matter through their bodies gradually make acidic soil less acidic and alkaline soil less alkaline. Experiments conducted on the effect on the cultivation of vegetables like tomato, brinjal and okra have yield very valuable results. The organic waste turned into compost/vermicompost and FYM is of paramount significance from the view point of healthy quality of environment. Moreover the conversion of negative waste with earthworms and microbes into a valuable added product is an important aspect of resource recycling and environmental cleaning, besides maintaining good soil health for the agricultural productivity (Senapati and Julka, 1993; Kale, 2000; Bharadwaj, 2009). The Sharma *et al*., (2004) enumerated that vermicompost contain macro and micro nutrients, vitamins, enzymes, antibiotics and micro nutrients, enzymes, antibiotics and growth hormones. Munroc (2006) emphasized that vermicompost provides many more benefits agricultural soil than conventional compost such as FYM. Vermicompost enriched soil exhibited better ability to retain moisture and nutrient holding capacity.

## Materials and Methods

The present experiment includes survey of usar soil of Farrukhabad district of Uttar Pradesh. and collection of soil samples (Kalra and maynard,1991). Soil (Normal) was added with three kind of compost and observed the growth and development parameters of tomato. Experiment was set in treatment combinations and one untreated in pots (3 organic soil additive x 3 doses of each) using tomato seeds as test crop for further study. Uniform cultural practices were applied in control and amended soils for raising plants. Irrigation was given as per requirements throughout the growing period and completely stopped at the maturation stage as evident by yellowing of leaves. FYM was taken by local farmers, biocompost prepared by plant refuses were collected from area. It was subjected to composting for initiate the microbial activity. Adequate moisture status (40-45%) of mixture was maintained. After 3 months, the mixture became dark brown to black and ready for use as soil conditioner. Vermicompost has been taken Braj Gausala Trust, Vrindavan, Mathura (U.P.) for use in study. Composite soil samples were amended with FYM, Bio and Vermicompost. These were kept in different pots for sowing of tomato, growth and development investigations. (Agarwal *et al*., 2008).

Statistical analysis was performed by using the MS-Excel software package. The levels of significance were presented as P (probability values at either 0.05 or 0.01 levels. To the test significance difference among soil amendments in respect to soil properties, plant growth and flowering traits analysis of variance was done. Significant differences were determined at £0.05. Value for least significance difference (LSD05) was determined for comparative assessment of difference among various treatments. Correlations between difference parameters were developed using MS-Excel analysis tool pack.

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## Results and Discussion

Soil of Hawai Patti Muhamdabad, (Farrukhabad) was surveyed and collected for amendments to assess the role of organic additive in the improvement of soil fertility and its productivity status. Three organic enrichers viz. vermicompost, biocompost and farm yard manure (FYM) were used to amend chosen soil in 25%, 50% and 75% dosages (w/w). Various soil physico-chemical characteristics of control and variously amended soils were done to assess the role of organic enrichers in improvement of soil fertility. Presides the different growth characteristic of tomato (*Lycopersicum esculentum*) plants were studied in varying concentrations of different organic enrichers.

The enrichment of usar soil with organic amendment effectively increased the germination percentage of tomato over untreated soil (Table 1 & 2 and Fig 1 & 2). The germination percentage was very poor in untreated control soil (12%) while it ranged from 60% to 82% in vermicompost, 52% to 74% in FYM, 28% to 68% in biocompost amended soils. Maximum increase in germination percentage was recorded in soil amended with 75% dose level of vermicompost (82%) and followed by FYM (74%) and biocompost (68%). As discussed in the physico-chemical characteristic of variously amended soil (illustrated in earlier section) different concentrations of vermicompost, FYM and biocompost have synergistic impact in improving soil fertility, moreover vermicompost resulted into better result. It is directly correlated with the improved in seed germination percentage. Atiyeh *et al.,* (2002) observed the effect of earthworm processed pig manure (vermicompost) on seed germination of tomato (*Lycopersicum esculentum* Mill). Similarly Dubey (2009) also noted better seeds in higher doses germination percentage in moon been plant seeds in higher doses of vermicompost. Further he noted that plants were well established well at all doses, though the lower doses showed slight improvement in germination over the control soil.

Maximum plant seedlings establishment was recorded in vermicompost treated soil while it was minimum in biocompost treated soil. In control soil only 4% plant establishment is recorded which is very poor. Establishment was ranged in between 20% to 78% 75% doses of different organic enrichers exhibits better establishment of seedlings (vermicompost (78%) FYM (66%) and Biocompost (60%). Data on establishment of plants are given in Table 3 & 4 and Fig 3 & 4.

The fresh and dried biomass of young tomato plants varied in varying doses of different organic enrichers. Amended doses of vermicompost, FYM and biocompost yielded better results over control at different time intervals of study. It was noted that vermicompost showed it's overall superiority in terms of biomass production over the FYM and biocompost. The Table-5 showed the observations of biomass production at different days in different samples. Vermicompost amended soil showed maximum output (fresh weight 50.62g, dry weight 16.43g). Moreover,75% dosage of various organic played better role in terms of biomass production. A significant effect was observed in present study particularly at 50-75% does levels compared to FYM and biocompost. Goel and Behl (2002) observed plants grown in soil enriched with different organic amendments showed greater plants spreading.

Fruit characteristic traits viz. average fruit number per plant average weight of fruit (g) and average number of seeds per fruit of tomato plants grown in vermicompost, FYM and biocompost amended soils are presented in Table 6. It is evident from the results that maximum number of fruits per plant (8.0 fruits/plant) was recorded for the plants grown in 75% vermicompost amended soil. Plants grow in exhibited 4 fruits/plants followed by 75% vermicompost amended 75% FYM amended soil. The number of fruits per plant was minimum in 50% FYM amended soil but average weight (g), per fruit was maximum for plant grown in 50% FYM amended soil.

Soil amended with 75% dose level of vermicompost had maximum number of seeds per fruit (166.5 seeds/fruit) minimum number of seeds per fruit was recorded for fruits harvested from 50% vermicompost amended soil (1058 seeds/fruit) 143.5 seeds/fruit and 117.2 seeds/fruit were recorded from 50% and 75% doses of FYM. However biocompost enrichment could not support the development of fruits in plants since no fruiting in different doses of biocompost enrichment observed similar to control. Similarly 25% dose level of all the three organic enrichers (vermicompost, biocompost and FYM) could not support the development of fruits in plants amended soils respectively. 25% dose level of vermicompost as well as FYM was not effective for the growth in fruit characteristics. Plants grown in control soil and biocompost amended soils did not reach to fruiting stage hence, no fruits were harvested from control and biocompost amended soils.

Thus it is concluded from present investigation that farmers could change the conventional cultivation of crops on fertile lands to sub-standard usar soil via adopting organic farming practices. The vermicompost enrichment to degraded usar soil indicated improvement in physico-chemical and soil fertility in turn increase the yield of tomato without any disease on plants. Farmers could cultivate tomato crop in areas of wastelands though vermicompost amended and earn more money; Thus resulted in improvement of economical status of poor farmers and root out the poverty from nation. More over vermicompost technology is novel and is based on the principles of better economy and sustainability of environment.

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**Table 1: Germination of seeds in amended and control soil**

| Doses | Vermicompost | FYM | Biocompost | Control/ 100% usar soil |
|---|---|---|---|---|
| 25% | 30 | 26 | 19 | - |
| 50% | 36 | 32 | 33 | - |
| 75% | 41 | 37 | 34 | 6 |

**Table 2: Percentage of germination of seeds in amended and control soil**

| Doses | Vermicompost | FYM | Biocompost | Control/ 100% usar soil |
|---|---|---|---|---|
| 25% | 60% | 52% | 28% | - |
| 50% | 72% | 64% | 66% | - |
| 75% | 82% | 74% | 68% | 12% |

**Table 3: Establishment of tomato seedling in amended and control soil**

| Doses | Vermicompost | FYM | Biocompost | Control/ 100% usar soil |
|---|---|---|---|---|
| 25% | 25 | 20 | 10 | - |
| 50% | 32 | 28 | 25 | - |
| 75% | 39 | 33 | 30 | 2 |

**Table 4: Percentage of establishment of tomato seedling in amended and control soil**

| Doses | Vermicompost | FYM | Biocompost | Control/ 100% usar soil |
|---|---|---|---|---|
| 25% | 50% | 40% | 20% | - |
| 50% | 64% | 56% | 50% | - |
| 75% | 78% | 66% | 60% | 4% |

**Table 5: Fresh weight (g) Biomass of plants in different does of Vermicompost, FYM and Biocompost at different time intervals**

| No. of days | 25th | 40th | 55th | 160th | Mean | Relative |
|---|---|---|---|---|---|---|
| **Vermicompost** | day | day | day | day | | Increase |
| 25%dose | 0.64 | 3.35 | 15.64 | 225.0 | 61.15 | 480.70 |
| 50%dose | 0.79 | 3.36 | 24.04 | 145.0 | 43.29 | 311.10 |
| 75%dose | 0.81 | | 34.86 | 315.0 | 59.09 | 246.00 |
| **FYM** | | | | | | |
| 25%dose | 0.9 | 3.16 | 12.55 | 160 | 44.15 | 319.2 |
| 50%dose | 0.731 | 4.42 | 16.11 | 155.0 | 44.06 | 318.4 |
| 75%dose | 0.8 | 4.95 | 20.79 | 170.0 | 49.13 | 366.5 |
| **Biocompost** | | | | | | |
| 25%dose | 0.55 | 3.36 | 14.34 | 168 | 46.56 | 342.1 |
| 50%dose | 0.44 | 4.82 | 13.62 | 175 | 48.47 | 360.3 |
| 75%dose | 0.72 | 4.46 | 14 | 190 | 52.29 | 396.5 |
| Control | 0.228 | 1.75 | 3.135 | 37 | 10.53 | |

**Table 6: Number of fruits and weight of fruits per plant of *Lycopersicum esculentum***

| | 25% | | | | | 50% | | | | | 75% | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tot al no of fruits | Wt. of all fruits (gm) | Av. Wt. of fruit | Total seeds count | Av seed count per fruits | Total no of fruits | Wt. of all fruits (gm) | Av. Wt. of fruit | Total seeds count | Av seed count per fruits | Total no of fruits | Wt. of all fruits (gm) | Av. Wt. of fruit | Total seeds count | Av seed count per fruits |
| Vermicompost | 0 | 0 | 0 | 0 | 0 | 7 | 228 | 31.5 | 741 | 105 | 8 | 334 | 41.7 | 1332 | 166 |
| FYM | 0 | 0 | 0 | 0 | 0 | 2 | 89 | 44.5 | 287 | 143.5 | 4 | 168 | 42.0 | 469 | 117 |
| Biocompost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

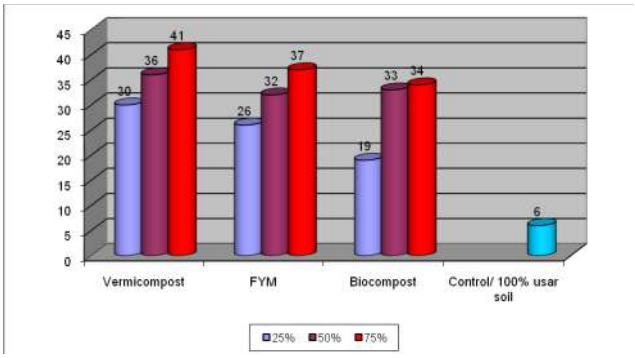


**Fig 1:** Impact of varying doses of different organic enrichers on germination of seeds with respect to control soil

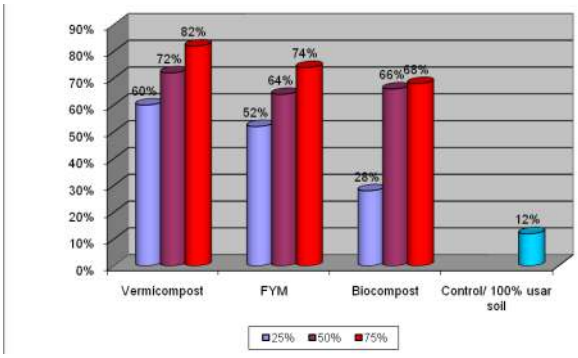


**Fig 2:** Impact of varying doses of different organic enrichers on percentage germination of seeds of tomato plants with respect to control soil

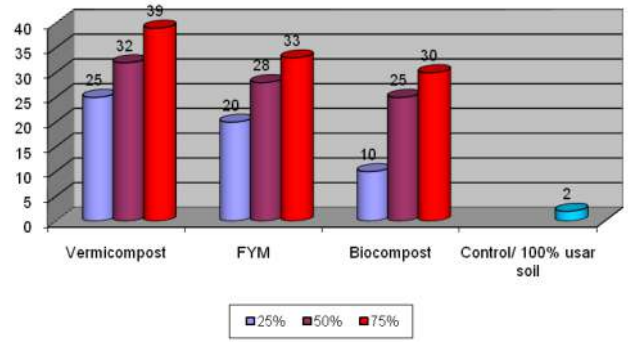


**Fig 3:** Impact of varying doses of different organic enrichers on establishment seeds of tomato plants seedling with respect to control soil

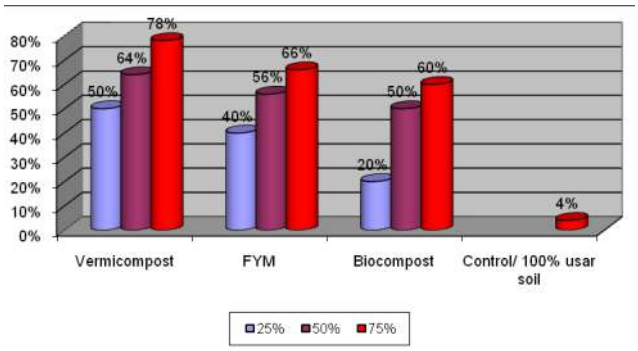


**Fig 4:** Impact of varying doses of different organic enrichers on percentage of establishment of tomato plants seedling with respect to control soil