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# Effect of Different Organic Nutrient Management Practices on Soil Properties after the Harvest of Pearl Millet

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## ABSTRACT

A field experiment was conducted at College of Agriculture, Vijayapur during *kharif* 2021 to study the "Effect of different organic nutrient management practices on growth attributes of pearl millet". The experiment was laid out in Complete Randomized Block Design with 12 treatments and replicated thrice comprasing of different levels of FYM (2.25, 2.5 and 5.0 t ha$^{-1}$), vermicompost (1.25 and 2.5) and foliar spray of jeevamrutha @ 10% and 20% compared with recommended package of practices (50:25:10 NPK kg ha$^{-1}$ + 2.5 t FYM ha$^{-1}$). The results revealed that the soil application of FYM @ 5 t ha$^{-1}$ + foliar spray of 20% jeevamrutha at 45 DAS recorded significantly higher soil organic carbon (5.38 g kg$^{-1}$), EC (0.28 dS m$^{-1}$ ), available potassium status (422.2 kg ha$^{-1}$) and available micro nutrient status (iron and zinc) (3.90 and 0.53 ppm) in soil. However, higher available nitrogen status (183.0 kg ha$^{-1}$) of soil was recorded in treatment that received nutrients through recommended dose of fertilizers and higher available phosphorus status (36.40 kg ha$^{-1}$) of soil was recorded in treatment ($T_3$) with soil application of vermicompost @ 2.5 t ha$^{-1}$+ foliar application of 20% jeevamrutha at 45 DAS.

**Keywords** Pearl millet, FYM, Organics, Jeevamrutha, Vermicompost.

## INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) belongs to the grass family Graminaceae. The world's tropics and subtropics are home to the plant genus Pennisetum. Pearl millet has an extremely high photosynthetic efficiency since it is a $C_4$ plant. The primary reason for pearl millet's widespread cultivation in arid and semi-arid locations is its greater adaptability to water

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stress and nutrient-depleted soils than other cereal crops. India is the largest producer of pearl millet in the world covering an area of 7.65 million hectares with an annual production of 10.86 million tonnes with average productivity of 1420 kg $ha^{-1}$, and is mainly cultivated in the states of Rajasthan, Gujarat, Maharashtra, Haryana, Uttar Pradesh and Karnataka (Anon 2021).

The use of organics, among the various agronomic management approaches, is of immense important in rainfed areas in order to produce healthy plants. It is critical to build and maintain an active and rich soil type, despite the fact that they have a lower concentration of nutrients and need more labor to handle, they have seen a significant growth in their use as a nutrition source over inorganic fertilizer (Kannan *et al.* 2005). Organic liquid manures such as jeevamrutha aid in the rapid development of soil fertility by increasing the activity of soil microflora and fauna (Devakumar *et al*. 2014). These functions both as fertilizer and a biopesticide and they serve an important function in encouraging the plant growth and providing immunity to the plant system.

Nutrient mining is currently a major threat to agricultural productivity as there is a larger gap between the amount of nutrient applied and the amount of nutrient used by the crop. One of the major reasons for lower production is farmers' blanket use of fertilizers without knowing the soil fertility status and poor nutrient management. Several studies have shown that nitrogen fertilization can improve millet production efficiency and that an adequate nitrogen supply is linked to vigorous vegetative development. It also responds well to the applied phosphorus. Farmyard manure improves the crop's nitrogen usage efficiency, as well as the status of organic carbon, accessible nitrogen, $P_2O_5$ and trace elements in the soil, while reducing the negative effects of soil acidity, salinity, and alkalinity. Vermicompost lowers the C:N ratio, increases humus content and feeds plants with a wide range of easily available nutrients like nitrate, phosphorus, potassium, calcium and magnesium (Talashikar *et al*. 1999).

## MATERIALS AND METHODS

A field experiment was conducted during *kharif* 2021 at College of Agriculture farm, Vijayapur, Karnataka on vertisol having pH 8.32 and EC 0.22 dS $m^{-1}$. The soil was medium in organic carbon content (0.47 %) and available $P_2O_5$ (31 kg $ha^{-1}$), and low in available N (168 kg $ha^{-1}$) with high available $K_2O$ content (410 kg $ha^{-1}$). The experimental site was located at a latitude of 16˚ 77' North, longitude of 75˚ 74' East and an altitude of 516.29 meters above mean sea level in Northern Dry Zone of Karnataka (Zone 3).

### Experimental design and treatment combination

The experiment was laid out in a Complete Randomized Block Design with three replications.The experiment consisted of 12 treatments involving different combinations of organic manures viz., FYM, vermicompost and foliar spray of jeevamrutha to compare with recommended package of practices.

### Crop management

The land was ploughed once after the harvest of the previous crop, followed by two harrowing. At the time of sowing, the land was prepared to a fine seedbed and the plots were laid out. The variety VPMV-9 was used and fertilizers were applied according to the treatments. The crop was sown on 26th July 2021 with a spacing of 45 × 10 cm. Harvesting was done on 25th October 2021, when crop had attained milky dough stage and were picked from five randomly selected and tagged plants from each treatment, separately for recording various observations. The Bajra heads from the net plot were cut, sundried and threshing was done with threshing machine, grains per plot thus collected were winnowed, cleaned and weighed. Intercultivation was done to remove all weeds from the field in order to check crop weed competition.

### Statistical analysis

The data collected from the experiment at different growth stages and at harvest were subjected to statistical analysis as described by Gomez and Gomez (1984). The level of significance used for 'F' and 't' tests was p=0.05. Critical difference (CD) values were calculated at 5 % probability level if the F test will found to be significant.

## RESULTS AND DISCUSSION

### Effect of different organic nutrient management practices on soil pH, EC and organic carbon in soil after the harvest of crop

Soil reaction did not vary significantly among the treatments. pH ranged between 8.06 to 8.32 (Table 1).

Significantly higher soil organic carbon of 5.38 g $kg^{-1}$ was recorded with soil application of FYM @ 5 t $ha^{-1}$+ foliar application of 20% jeevamrutha at 45 DAS ($T_5$) compared to all other treatments. This increase in organic carbon content might be due to the combined effect of different levels of FYM and jeevamrutha in increasing the biological activity of soil as these inputs contain abundant beneficial micro flora as well as some useful fungi and actinomycetes which mineralized the soil organic matter and raised the soil organic content (Sreenivasa *et al*. 2009) (Table 1).

There was a significant increase in EC of 0.28 dS $m^{-1}$ with the soil application of FYM @ 5 t $ha^{-1}$+ foliar application of 20% jeevamrutha at 45 DAS ($T_5$) than all other treatments. The proportionate increase in EC might be due to the supply of greater quantity of salts through FYM. These results were similar to the findings of Balaguraviah *et al*. (2005) (Table 1).

### Available nutrient status (nitrogen, phosphorus and potassium) in soil after the harvest of crop

Significant improvement in available nitrogen status

**Table 1.** Soil pH, EC and organic carbon (OC) as influenced by different organic nutrient management practices after harvest of pearl millet.

| Initial values | 8.32 | 0.22 | 4.7 |
|---|---|---|---|
| Treatments | Soil pH | Soil EC (dS $m^{-1}$) | Organic carbon (g $kg^{-1}$) |
| $T_1$: Recommended package of practices | 8.32 | 0.22 | 4.82 |
| $T_2$ Soil application of vermicompost @ 2.5 t $ha^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 8.19 | 0.25 | 5.14 |
| $T_3$ Soil application of vermicompost @ 2.5 t $ha^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 8.17 | 0.25 | 5.17 |
| $T_4$ Soil application of FYM @ 5 t $ha^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 8.07 | 0.27 | 5.33 |
| $T_5$ Soil application of FYM @ 5 t $ha^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 8.06 | 0.28 | 5.38 |
| $T_6$ Soil application of vermicompost @ 1.25 t + FYM @ 2.25 t $ha^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 8.13 | 0.25 | 5.19 |
| $T_7$ Soil application of vermicompost @ 1.25 t + FYM @ 2.25 t $ha^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 8.12 | 0.26 | 5.25 |
| $T_8$ Foliar spray of 10% jeevamrutha at 30 DAS + Foliar spray of 20% jeevamrutha at 50 DAS | 8.31 | 0.23 | 4.85 |
| $T_9$ Soil application of vermicompost @ 1.25 t $ha^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 8.28 | 0.23 | 5.02 |
| $T_{10}$ Soil application of vermicompost @ 1.25 t $ha^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 8.26 | 0.23 | 5.03 |
| $T_{11}$ Soil application of FYM @ 2.5 t $ha^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 8.24 | 0.24 | 5.06 |
| $T_{12}$ Soil application of FYM @ 2.5 t $ha^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 8.21 | 0.24 | 5.14 |
| SEm± | 0.07 | 0.01 | 0.04 |
| CD (p=0.05) | NS | 0.02 | 0.13 |

*NS- Non-significant, *DAS- Days after sowing.

**Table 2.** Soil available nitrogen, phosphorus and potassium as influenced by different organic nutrient management practices after harvest of pearl millet.

| Initial values (kg ha$^{-1}$) | 171 | 31.5 | 415.1 |
|---|---|---|---|
| Treatments | Soil available nutrients | | |
| | N (kg ha$^{-1}$) | $P_2O_5$ (kg ha$^{-1}$) | $K_2O$ (kg ha$^{-1}$) |
| $T_1$ Recommended package of practices | 183.0 | 35.50 | 417.7 |
| $T_2$ Soil application of vermicompost @ 2.5 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 175.9 | 36.20 | 421.0 |
| $T_3$ Soil application of vermicompost @ 2.5 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 177.6 | 36.40 | 421.3 |
| $T_4$ Soil application of FYM @ 5 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 181.8 | 34.02 | 421.6 |
| $T_5$ Soil application of FYM @ 5 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 182.4 | 33.96 | 422.2 |
| $T_6$ Soil application of vermicompost @ 1.25 t + FYM @ 2.25 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 179.2 | 34.15 | 417.7 |
| $T_7$ Soil application of vermicompost @ 1.25 t + FYM @ 2.25 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 180.4 | 35.06 | 418.0 |
| $T_8$ Foliar spray of 10% jeevamrutha at 30 DAS + Foliar spray of 20% jeevamrutha at 50 DAS | 170.7 | 31.58 | 415.2 |
| $T_9$ Soil application of vermicompost @ 1.25 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 173.5 | 34.74 | 416.9 |
| $T_{10}$ Soil application of vermicompost @ 1.25 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 173.8 | 34.47 | 417.1 |
| $T_{11}$ Soil application of FYM @ 2.5 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 174.6 | 33.11 | 416.3 |
| $T_{12}$ Soil application of FYM @ 2.5 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 174.0 | 33.86 | 417.4 |
| SEm± | 0.83 | 0.44 | 1.15 |
| CD (p=0.05) | 2.43 | 1.29 | 3.38 |

*DAS- Days after sowing.

(183.0 kg ha$^{-1}$) of soil after harvest of the crop was recorded in the treatment that received nutrients through recommended dose of fertilizers and FYM compared to all other treatments. Which could be attributed to the application of more basal fertilizer in the form of urea and DAP as a recommended dose of fertilizers (Table 2).

Significant improvement in available phosphorus status (36.40 kg ha$^{-1}$) of soil after harvest of the crop was recorded in the treatment ($T_3$) with soil application of vermicompost @ 2.5 t ha$^{-1}$+ foliar application of 20% jeevamrutha at 45 DAS compared to all other treatments. The increase in available P of the soil resulting from the application of organic manures might be due to the mineralization of organic phosphorus and production of organic acids which have a solubilizing effect on soil phosphorus and retards the fixation of phosphorus in soil (Narwal and Antil 2005) (Table 2).

Significant improvement in available potassium status (422.2 kg ha$^{-1}$) of soil after harvest of the crop was recorded in the treatment ($T_5$) with soil application of FYM @ 5 t ha$^{-1}$ + foliar application of 20% jeevamrutha at 45 DAS compared to all other treatments. The increase in available K content in soil with organic manures application might be due to the higher amounts of K content present in organic manures applied (Table 2).

**Available micro nutrient status (iron and zinc) in soil after the harvest of crop**

Significantly higher available micro nutrient status (iron and zinc) of (3.90 and 0.53 ppm) in soil after

**Table 3.** Soil micro nutrient status as influenced by different organic nutrient management practices after harvest of pearl millet.

| Treatments | Fe (ppm) | B (ppm) | Zn (ppm) |
|---|---|---|---|
| Initial values (ppm) | 3.2 | 0.5 | 0.45 |
| | Soil available nutrients | | |
| $T_1$ Recommended package of practices | 3.38 | 0.49 | 0.46 |
| $T_2$ Soil application of vermicompost @ 2.5 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 3.62 | 0.51 | 0.46 |
| $T_3$ Soil application of vermicompost @ 2.5 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 3.65 | 0.52 | 0.47 |
| $T_4$ Soil application of FYM @ 5 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 3.82 | 0.54 | 0.52 |
| $T_5$ Soil application of FYM @ 5 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 3.9 | 0.55 | 0.53 |
| $T_6$ Soil application of vermicompost @ 1.25 t + FYM @ 2.25 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 3.69 | 0.52 | 0.48 |
| $T_7$ Soil application of vermicompost @ 1.25 t + FYM @ 2.25 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 3.71 | 0.53 | 0.49 |
| $T_8$ Foliar spray of 10% jeevamrutha at 30 DAS + Foliar spray of 20% jeevamrutha at 50 DAS | 3.39 | 0.51 | 0.44 |
| $T_9$ Soil application of vermicompost @ 1.25 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 3.5 | 0.51 | 0.45 |
| $T_{10}$ Soil application of vermicompost @ 1.25 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 3.52 | 0.51 | 0.45 |
| $T_{11}$ Soil application of FYM @ 2.5 t ha$^{-1}$ + Foliar spray of 10% jeevamrutha at 45 DAS | 3.56 | 0.52 | 0.45 |
| $T_{12}$ Soil application of FYM @ 2.5 t ha$^{-1}$ + Foliar spray of 20% jeevamrutha at 45 DAS | 3.59 | 0.52 | 0.45 |
| SEm± | 0.04 | 0.01 | 0.01 |
| CD (p=0.05) | 0.12 | NS | 0.04 |

*NS- Non-significant, *DAS- Days after sowing.

the harvest of crop was recorded in the treatment ($T_5$) with the soil application of FYM @ 5 t ha$^{-1}$ + foliar application of 20% jeevamrutha at 45 DAS compared to all other treatments. This might be because the addition of organic manures may have created the more readily available metal organic complexes (Gupta *et al.* 2000). This might also be due to the incorporation of organic manures improved the availability of native and applied micronutrient cation (Zn, Mn, Fe and Cu) in soil. These elements create stable complexes with organic ligands that reduces their susceptibility to adsorption, fixation and or precipitation in the soil (Table 3).

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## REFERENCES

Anonymous (2021) Area, production and productivity of pearl millet. www.indiastat.com

Balaguraviah D, Adnarayana G, Pratap S, Yellamanda Reddy T (2005) Influence of long-term use of inorganic and organic manures on soil fertility and sustainable productivity of rainfed groundnut in Alfisols. *J Ind Society Soil Sci* 53: 608-611.

Devakumar N, Shubha S, Gouder SB, Rao GGE (2014) Microbial analytical studies of traditional organic preparations beejamrutha and jeevamrutha. *Building Organic Bridges* 2: 639-642.

Gomez KA, Gomez AA (1984) Statistical Procedure for Agricultural Research. Willy Inter Science Publication, New York, USA.

Gupta RK, Arora BR, Sharma KN, Ahluwalia SK (2000) Influence of biogas slurry and farmyard manure application on the changes in soil fertility under rice- wheat sequence. *J Indian Soc Soil Sci* 48: 500-505.

Kannan PA, Saravanan S, Krishnakumar, Natrajan SK (2005) Biological properties of soil as influenced by different organic manures. *Res J Agric Biol Sci* 1: 181-183.

Narwal RP, Antil RS (2005) Integrated nutrient management in pearl millet - wheat cropping system. In: National Symposium on Management of Organic Wastes for Crop Production, CCS Haryana Agricultural University, Hisar, India, pp 205 - 213.

Sreenivasa MN, Nagaraj M, Naik, Bhat SN, Beneficial traits of microbial isolates of organic liquid manures. Paper presented In: First Asian PGPR Congress for sustainable agriculture, June 21-24, 2009, ANGRAU, Hyderabad, India.

Talashikar SC, Bhangarath PP, Mehta VP (1999) Changes in chemical properties during composting of organic residue as influenced by earthworm activity. *J Indian Soc Soil Sci* 47: 50-53.