Integrated Application Of Groundnut Haulm Compost With Different Biofertilizers Enhancing Soil Health And Microbial Population

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ABSTRACT: The field experiment to study the “Comparative efficiency of groundnut haulm compost and biofertilizers on soil physicochemical properties and microbial population of soil was conducted in Arunagirimangalam village, Thiruvanamalai District. Treatments were groundnut haulm compost single, combined application of different Biofertilizers FYM, Azotobacter, Azospirillum, Phosphobacteria, Rhizobium and control. The obtained results on physicochemical properties of soil and microbial properties revealed the response of groundnut haulm compost, groundnut haulm compost mixed with different biofertilizers a treatment was better compared to control in 15, 30, 60 and 90 DAS observation. Physical properties such as pH and EC increased after groundnut haulm compost mixed with Rhizobium application. Bulk density was reduced after treatment indicating increased soil organic carbon, NPK content, macronutrients (Fe (Iron), Mn (Manganese), Cu (Copper) and Zn (Zinc)) and microbial population. The minimum physiochemical and microbial properties were observed in control. In general, the groundnut haulm compost and mixed with Rhizobium treatment a good performance could be achieved in better growth of groundnut.

Keywords: Biofertilizers, Helianthus annuus, Groundnut, Micronutrients, Rhizobium, Microbial population.

I. INTRODUCTION

Groundnut as well as peanut (Arachis hypogaea L.) is an important oilseed crop belonging to the family Leguminosae. It is mainly grown as oilseed, cash crop and animal feed and fourth-largest oilseed crop into the humanity. The characteristic of the Leguminosae plant is able to form nodules. Nodule is a small bulge in the root portion formed by nitrogen fixing bacterial infection mutuality symbiosis with legume plants. Nodules capable of N fixation from the air, so that the soil is able to meet most of the needs of the fixation of nitrogen from the results. The low productivity in India is mainly due to poor soil fertility, deterioration of soil physical properties, monocropping, irregular rainfall and frequent occurrence of dry spells, imbalanced use of organic and inorganic fertilizers for plant nutrients. On one hand, the production and use of chemicals till different harmful effects on the agricultural ecosystem such as degradation of the soil, loss of crop genetic diversity, reduction in loam microbial diversity, pollution of ground water resources, and pollution of the atmosphere.

The haulm compost application can improve net production and save cultivable lands from chemical fertilizer and pollution and manure a good environment. Now days, the application of organic fertilizers, such as manure, crop residues and compost, has been practiced for a long time in order to increase the amount of microorganisms present in the soil, soil fertility and agricultural productivity. According to Adeniyan et al., (2011) investigated the effects of different organic manures and NPK fertilizer for improvement of soil chemical properties and maize traits in two different soil and concluded that application of organic manures enhanced soil organic carbon, total N, available P and exchangeable K better than NPK fertilizer in both soil, however the application of chemical fertilizer achieved the highest amount of dry mater and yield of maize. It was also noticed that the application of organic manure and FYM improved the soil physico - chemical properties such as soil pH, soil moisture availability, organic carbon and nutrient status of the soil in twenty five years old apple orchards. Keeping this in view, a field experiment was conducted to study the effect of groundnut haulm compost single, groundnut haulm compost combined application of different Biofertilizers FYM, Azotobacter, Azospirillum, Phosphobacteria, Rhizobium on physico-chemical properties and microbial population of soil.

II. MATERIALS AND METHODS

The experiment was laid out in Randomized Block Design with three replications and eleven different treatments. The field was properly leveled and each plot (2.5 x 2.5 m size) was earmarked with raised bunds all around to minimize the movement of nutrient. In each treatment, T1-Control, T2-1 tonne ha-1 haulm compost, T3-1 tonne ha-1 haulm compost + FYM, T4-2 tonnes ha-1 haulm compost, T5-2 tonnes ha-1 haulm compost + Azotobacter, T6-3 tonnes ha-1 haulm compost, T7-3 tonnes ha-1 haulm compost + Azospirillum, T8-4 tonnes ha-1 haulm compost, T9-4 tonnes ha-1 haulm compost + Phosphobacteria, T10-5 tonnes ha-1 haulm compost, T11-5 tonnes ha-1 haulm compost + Rhizobium the soil samples were collected at after harvesting groundnut (Arachis hypogaea L.) and pH, organic carbon, nitrogen, phosphorus and potassium were estimated and their microflora like bacteria were enumerated.

The soil samples were suspended in distilled water in 1:2 ratio (w/v) and the pH was determined using Elico digital pH meter. The organic carbon was determined by the wet digestion method. The available nitrogen was estimated by alkaline permanganate method. The available phosphorous and potassium were estimated by colorimetric method and Flame photometer, respectively.

The microbial population in the soil was enumerated by serial dilution and plating the appropriate dilutions in different agar media. Aliquots of 1 ml of appropriate dilutions were plated in the nutrient agar. The plates were incubated at room temperature (30±2°C) for 3 days. The colonies were counted and expressed as population per gram on oven dry basis.
2.1 Statistical analysis

A one-way analysis of variance (ANOVA) was performed to determine the effect of groundnut haulm compost combined with different fertilizer treatments on soil microbial population and physicochemical properties of soil. The level of significance referred in the results is \( p < 0.05 \).

III. RESULTS AND DISCUSSION

The observation on soil pH as influenced by different combinations of groundnut haulm compost and different biofertilizers was shown in Fig 1. The results revealed that the initial (control) soil pH 6.8 which increased significantly with the addition of groundnut haulm compost mixed with different biofertilizers FYM, Azotobacter, Azospirillum, Phosphobacteria and Rhizobium. A slight increase in soil pH was observed in treatment having combined application of groundnut haulm compost mixed with Rhizobium (7.3) as compared to treatment without inoculation control. The enhancement of pH value under the treatment of organic manures might be due to release of different salts which acts buffering agent to enhance the soil pH towards neutrality accordance with 12. It has been observed in a soil sample study that the highest microbial population was observed in soil sample with the range of pH=7–7.4 and it starts decrease more than 8 or in acidic pH13. Low pH value for FYM is very valuable for calcareous soils14.

![Figure 1](image1.png)

Figure 1: Effect of groundnut haulm compost and different biofertilizers on pH of soil.

Soil organic carbon content was significantly impact by haulm compost mixed with different biofertilizers FYM, Azotobacter, Azospirillum, Phosphobacteria and Rhizobium depicted in Figure 2. With respect to the soil organic carbon ranged from 0.25 to 0.37 compare with control. However, the highest significance was observed in haulm compost mixed with Rhizobium alone (T11) (0.0.37) followed by another haulm compost single and mixed with different biofertilizers, whereas the lowest was observed in control (0.22). Soil organic matter was decreased by chemical fertilizer application but was increased with all types of organic manure application15. An other16 also found that significant increase in organic carbon due to application of FYM may be attributing to excessive microbial activity of soil. Further more17 found that the four years application of FYM at the rate of 10 and 15 kg/ha had improved total N of the soil, organic carbon, available P, K and Mg when compared to the plants lacking FYM application in the 0 – 20 cm soil depth.

![Figure 2](image2.png)

Figure 2: Effect of groundnut haulm compost and different biofertilizers on physical and chemical properties of soil after crop harvest.

Results of post harvest analysis of macronutrients (Nitrogen, Phosphorus and Potassium) of soil are presented in Fig 3. There was significant increase in the soil available Nitrogen, Phosphorus and Potassium in the groundnut haulm compost mixed with different biofertilizers FYM, Azotobacter, Azospirillum, Phosphobacteria and Rhizobium inoculated plots more than the control. The available macronutrients were higher in the haulm compost mixed with Rhizobium at after harvesting groundnut, respectively. The enhanced availability of soil phosphorus due to phosphobacteria inoculation was observed by18. According to 19, the inoculation of organic fertilizer...
increased the N content in soil. Considerable increase was observed in nitrogen up to 30 kg/ha in case of safflower seed treatment with Azotobacter and Azospirillum. Also discovered that the higher available P content was recorded in integrated nutrient management as compared to control.

Significant improvement was observed in soil micronutrients due to application of groundnut haulm compost mixed with different FYM, Azotobacter, Azospirillum, Phosphobacteria and Rhizobium. The availability of soil Fe, Mn and Zn in the groundnut harvested soil was increased due to combined application of haulm compost mixed with Rhizobium, at the same time recommended amount of haulm compost mixed with FYM, Azotobacter which recorded maximum available Fe, Mn and Zn followed by Azospirillum, Phosphobacteria respectively. These results support those of previous studies there was positive and significant correlation among the phosphorus, iron, zinc and chlorophyll content. In other treatments significantly were increased the chlorophyll content, although this effect was not statistically significant. Furthermore, also suggested that the percentage increase of micronutrients (Fe and Zn) in the soil because of cyanobacteria inoculation. The recent finding reported that the application of the cyanobacteria increases the zinc and iron concentration of the soil.

Figure 5 represented the effects of groundnut haulm compost mixed with different biofertilizers FYM, Azotobacter, Azospirillum, Phosphobacteria and Rhizobium inoculation on the soil microorganisms was significant increase at after groundnut harvested soil. The total count of soil microorganisms was found to be maximum in application of haulm compost along with Rhizobium, which was statistically significantly higher than that in the control and other organic fertilizer treatments. This clearly revealed that organic material significantly increases the bacterial population soil microbial biomass has been used as an index of soil fertility which depends on nutrient fluxes. Also demonstrated that animal compost increased bacteria and fungi diversity by increase the carbon pool of the soil, thus improving the living environment for indigenous microbial populations. Furthermore, a positive effect of organic fertilizers on the microbial biomass, nitrogen and the carbon content in the soil was also observed by.
IT is concluded that the application of groundnut haulm compost as a substitute to different bio-fertilizer play a significant role in enhancing the soil fertility in terms of macronutrients, micronutrients and microbial population. Microbial activity of soil was measured in terms of dehydrogenase activity. It was observed that presence of organic and biofertilizers helps in soil helped to improve soil biological properties thereby increasing the availability of nutrients in soil.

REFERENCES


