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Efficacy of groundnut haulm compost on the growth and yield of blackgram (*Vigna mungo* L.) var. Vamban 1

P. Indira[1], M. Lenin[2] and T. Ravi Mycin[2]

1 Department of Plant Science and Plant Biotechnology, Quaide Millet College, Chennai 2

2 Division of Environmental Science, Department of Botany, Annamalai University, Annamalai Nagar – 608 002

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CORRESPONDENCE

T. Ravi Mycin, Division of Environmental Science, Department of Botany, Annamalai University, Annamalai Nagar – 608 002

E-mail: mycin_environ@yahoo.co.in

EDITOR

M. Lenin

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ABSTRACT

Crop residues are the non-economic plant parts that are left in the field after harvest. The harvest refuses include straws, stubble, Stover and haulms of different crops. Crop remains are also from thrashing sheds or that are discarded during processing this includes process wastes like groundnut shell. The greatest potential as a biomass resource appears to be from the field residues of some crop plants in Tamil Nadu. The present study was undertaken to the groundnut haulm, was to evaluate the effects of organic compost on growth and yield of blackgram. The morphological parameters such as root length, shoot length, fresh weight, dry weight, number of leaves, number of root nodules and yield parameters were increased in all the haulm compost treated soil when compared to control. Among the sources the groundnut haulm compost applied plants for higher growth and yield than in others.

INTRODUCTION

Organic matter content is usually used as an index of soil health, since it influences the soil in three ways, such as physically, chemically and biologically. The fibrous portion of organic matter plays an important role in improving soil physical properties. It promotes soil aggregations and improves permeability and aeration of clay soils. Its high moisture-absorbing capacity and high carbon for growth of microbial mycelia may help in the granulation of sandy soils to improve the nutrient and water holding capacity. Organic matter accounts for at least half the cation exchange capacity (CEC) of soils. Thus, it is very important not only in retaining nutrients capacity of soils, besides enabling crops to better crop with the such stresses like soil acidity and nutrient excess etc. It helps increase availability of many nutrient elements. By itself, organic matter is a source of nitrogen (N), phosphors (P), potassium (K), sulfur (S) and other secondary and micronutrients (Mahimairaja *et al.,* 2008).

The organic means is generally seen as a key role of soil health and sustainability in cropping systems; both in terms of maintaining the amount and quality of soil organic matter and supplying important micronutrients (Timsina and Conner, 2001). The composting the biological oxidation of organic matter is an important process, however, traditional methods of composting results in losses of about 55% organic matter and from 30 to 50% nitrogen (Kumaraswamy, 2001 and Ravindran 2007). The vermicompost are finely-divided mature peat-like materials with a high porosity, aeration, drainage, and water holding capacity and microbial activity which are stabilized by interactions between earthworms and microorganisms in a non-thermophilic process (Arancon *et al.,* 2004). The vermicompost contains most nutrients in plant available forms such as nitrates, phosphate and exchangeable calcium and soluble potassium (Pramanik, 2009). Vermicompost have large particular surface areas that provide many microsites for microbial activity and for the strong retention of nutrients (Kumar *et al.,* 2010). The vermicompost are rich in microbial populations and diversity such as fungi, bacteria and actinomycetes (Tomati *et al.,* 1987). The vermicompost contain plant growth regulators and other plant growth influencing materials produced by microorganisms and other substances like cytokinins, auxins, were production of earthworms (Atiyeh *et al.,* 2002) vermicompost also contains large amount of humic substances and plant growth regulators (Muscolo *et al.,* 1999). The aim of this study was to determine the effects of different rates of haulm compost on the growth and yield of blackgram.

Materials and Methods

The earthworms was provided by Department of Zoology (DDE), Annamalai University and consisted of dry groundnut haulm, and some minerals processed by earthworms *Eisenia foetida* in indoor beds. The haulm compost was thoroughly mixed with soils at different ratios 10, 20, 30, 40 and 50% v/v. Soil without haulm compost was treated as control. The haulm compost and each mixture of both were analyzed for available Nitrogen (N), by the Kjeldahl method (Subbiah and Asija, 1956), P by the ascorbic acid reductant method (Watanabe and Olsen, 1965), Potassium (K) with a flame photometer and sulphur with N spectrophotometer (Chesnin and Yien, 1950) and Zinc (Zn), magnesium (Mn) and iron (Fe) were determined by atomic absorption, spectrophotometry (Lindsay and Norvell, 1978). The plant growth parameters such as The plant shoot length, root length, fresh weight, dry weight, root nodules, number of leaves, total leaf area was determined by using the standard methods.

Results and Discussion

The analysis of haulm compost consists of higher amount of micro and macronutrients. The nutrients are enhance the plant growth and yield. Results obtained from this experiments revealed that growth and yield parameters such as leaf area, fresh and dry weight of plants were significantly enhanced by applying the vermicompost than in control plants Arancon *et al.* (2006) reported that positive effects of vermicompost on the growth and yield in strawberry especially increase of leaf area,

shoot fresh and dry weight in field conditions. The vermicompost with a relatively high content of humus-like compounds active microorganisms and enzymes, greatly contribute to the enhancement of the biochemical fertility of soil. When the compost was added to the soil in adequate quantity there was increase in soil nutrient status, which resulted in better growth of crops, and culminated in higher yields (Sahni *et al.,* 2008).

The maximum number of leaves observed the haulm compost applied field than in control. The vermicompost are high in nitrogen which is responsible for responsible for rapid plant growth (Ansari, 2008). Therefore, it is reasonable that vermicompost consisting of an amalgamate of humified earthworm faces and organic matter can also stimulate plant growth (Zaller, 2006).

The microbial activity in soils has been suggested by many authors as probably responsible for improving soil structure and influencing the root environment and plant growth indirectly. The by products of microbial activities may include polysaccharides that are involved directly in the aggregation of soil particles which could also have some influence on plant growth (Arancon *et al.,* 2004) and plant growth regulating substances such as plant hormones are other known products of microbial activity, bacteria, fungi, yeasts, actinomycetes and algae are capable of producing the plant hormones, or plant growth regulating substances such as auxins, gibberlins, cytokinins, ethylene and abscisic acid in appreciable quantities. The humic acids increased the growth of tomato and cucumber plants significantly, independent of nutrients availability and the growth increases were correlated directly upto concentration of humic acids that had been incorporated into the container medium. But decreased when the concentrations exceeded 500-1000 mg/kg (Arancon *et al.,* 2005). Earthworms contribute to the biological processes that produce humus or humus like substances (Hartenstein, 1982; Stodut, 1983 and Bachman and Metzger, 2008). Humus or humates are believed to stimulate plant nutrient uptake and metabolism have an influence on protein synthesis and show hormone like activity (Barton and Ruocco, 1981).

Humic substances have been show to increase yields of corn, oats, soybean, peanuts, clover, chicory plants and other tropical crops, (Nardi *et al.* 1988; Valdrighi *et al.* 1996). The plant growth hormones can become absorbed onto the complex structure of humic acids that are produced very rapidly in vermicompost (Canellas *et al.,* 2000) and may have acted in conjunction with them to influence plant growth since humates have also been shown to increase plant growth and yields (Arancon *et al.,* 2008).

Table 1. Nutrient chemical composition of groundnut haulm compost

Source of compost	pH	EC	C (%)	N (%)	Ca (mg g^{-1})	Fe (mg g^{-1})	K (mg g^{-1})	Mg (mg g^{-1})	Mn (mg g^{-1})	P (mg g^{-1})	S (mg g^{-1})	Zn (mg g^{-1})
Groundnut haulm	7.15	6.18	11.20	2.60	36.80	4.38	11.20	6.89	0.38	5.80	4.84	0.35

Table 2. Influence of haulm compost on growth and yield of blackgram *Vigna mungo* L. var. Vamban 1

Treatments	Root length (cm)	Shoot length (cm)	Number of leaves	Total leaf area (cm^{-2})	Fresh weight (mg fr. wt.)	Dry weight (mg dr. wt.)	Number of root nodules	Yield pods $plant^{-1}$	Number of seed $plant^{-1}$
Control	16.54 (± 0.825)	29.16 (± 1.458)	38.0 (± 1.900)	30.16 (± 1.508)	17.50 (± 0.875)	6.18 (± 0.309)	104.0 (± 5.20)	68.0 (± 3.40)	476.0 (± 23.80)
5% VC	19.55 (± 0.977)	32.80 (± 1.640)	43.0 (± 2.15)	33.80 (± 1.69)	19.65 (± 0.982)	8.43 (± 0.421)	141.0 (± 7.02)	74.0 (± 3.70)	518.0 (± 25.9)
25% VC	22.63 (± 1.131)	35.84 (± 1.792)	49.0 (± 2.45)	36.46 (± 1.823)	22.46 (± 1.123)	9.60 (± 0.480)	171.0 (± 8.55)	80.0 (± 4.00)	558.0 (± 27.9)
50% VC	25.63 (± 1.281)	40.63 (± 2.031)	55.0 (± 2.75)	39.40 (± 1.970)	26.30 (± 1.315)	10.34 (± 0.517)	193.0 (± 9.65)	91.0 (± 4.55)	596.0 (± 29.8)

± Standard deviation

Nutrient content

The increased N-content in vermicompost may also be due to the release of nitrogenous products of earthworms metabolism through the cost (excreta), urine as well as mucoproteins, because earthworms belongs to the merenephridial species, the casts would be more enriched with N since the urine produced by septal nephridia is voided into the gut and discharged along with the casts (Lee, 1985). The P and K were substantially higher in vermicompost the enhancement of phosphatase activity and physical breakdown of materials result in greater mineralization (Mathur *et al.,* 1980). The selective feeding of earthworms on organically rich substances which breakdown during passage through the gut, biological grinding together with enzymatic influence on finer soil particular were likely responsible for increasing the different forms of (K) (Rao *et al.,* 1996).

Conclusion

The results of this study suggest that it is possible to obtain good quality compost from groundnut haulm. The haulm compost application can improve net production and save cultivable lands from chemical fertilizer and pollution and manure a good environment.

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