Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 5, Issue, 12, pp. 3662-3665, December, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFECT OF MIXED LEAF LITTER VERMICOMPOST ON THE GROWTH AND PRODUCTIVITY OF *Vigna mungo* UNDER FIELD CONDITIONS

Mohmad Ishaq Bhat, *Prabakaran, S. and Prakash, V. K.

Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu, India – 608 002

ARTICLE INFO

Article History:
Received 20th September, 2013
Received in revised form
30th October, 2013
Accepted 09th November, 2013
Published online 02nd December, 2013

Key words:
Leaf litter vermicompost,
Vigna mungo, Plant growth,
Disease free, Earthworms.

ABSTRACT

The study was aimed at understanding the effect of mixed leaf litter (*Polyalthia longifolia* and *Samanea saman*) vermicompost on the growth and productivity of *Vigna mungo* plant. The vermicompost of leaf litter was used with *Vigna mungo* plants under field conditions. The different treatments affected the seed germination of the test crop significantly. Plant height, number of leaves per plant, number of days for flowering, number of fruits per plant, fruit length and 100 seed weight were significantly greater in the leaf litter vermicompost treated *Vigna mungo* plants as compared to control and no disease incidence was observed in the fruits of vermicompost treated *Vigna mungo* plants. The study revealed that vermicompost amendments affected *Vigna mungo* plants differently and we recommend that the safe and soil enriching plant leaf litter vermicompost should be used by farmers while the cultivation of *Vigna mungo* plants and synthetic fertilizers should be avoided instead to decrease the soil pollution by these synthetic fertilizers.

INTRODUCTION

In recent days, the use of organic inputs like vermicompost, biofertilizers and biopesticides is becoming popular in the world. There is a need of effective technology to deal with disposal of wastes which continues to be a challenge as population increases. Vermicomposting has been identified as one of the potential processes in managing waste, since it is a natural process, cost effective and required only shorter duration. The application of vermicompost helps in increasing the organic matter content of the soil, in maintaining soil productivity (Anil Kumar *et al*., 2011). The use of organic matter such as animal manures, human waste, food wastes, yard wastes, sewage sludges and leaf litter composts has long been recognized in agriculture as beneficial for plant growth and yield and the maintenance of soil fertility. The new approaches to the use of organic amendments in farming have proven to be effective means of improving soil structure, enhancing soil fertility and increasing crop yields. Organic matter is an excellent source of plant-available nutrients and its addition to soil could maintain high microbial population activities with increased values of plant biomass. Amongst the solid organic wastes, plant residue produced as a result of different horticultural and agricultural practices, has posed a significant level of problem of environmental degradation. These wastes alter physico - chemical and biological factors of the soil components at a very slow and steady pace affecting the diversity of soil organisms and its fertility status. The use of synthetic fertilizers causes a great impact on the environment and the cost of these fertilizers is increasing over the years. The farmers need to raise the crops by organic farming that will reduce the costs and will decrease the impact on the environment. In addition, organic farming will reduce the additional burden of environmental pollution that is caused while manufacturing these synthetic fertilizers at the source (Rathier and Frink, 1989). Vermiculture biotechnology is a dynamic process brought about by the earthworms with the aid of mixed microbial population with specific function. The worms maintain aerobic conditions in the mixture ingest solids, convert portion of the organic into worm biomass and to respiration products and they expel the remaining partially stabilized matter as discrete material (Castings). The need of increased food production in most developing countries becomes an ultimate goal, to meet the dramatic expansion of their population (EI-Shaikh and Mohammed, 2009). Among the major food items, crops are the most important one by cultivation and consumption in Tamilnadu, India. In recent years the use of different organic fertilizers and biofertilizers are being recommended not only to minimize the use of hazardous chemical inputs but also for sustainable crop production.

Now it is a well established fact that organic fertilizers provide enough requirements for proper growth of the crop plant and may enhance the uptake of nutrients, increase the assimilation capacity and will stimulate the hormonal activity as well (Tomati *et al*., 1990; Grapelli *et al*., 1985). Vermicompost is also useful as it increases soil porosity, aeration and water holding capacity. It has been found that soil amended with vermicompost had significantly greater soil bulk density and the soil does not become compacted (Lunt and Jacobson, 1994;

***Corresponding author: Prabakaran, S.** Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu, India – 608 002.*

Martin, 1976). Humic acids isolated from vermicompost enhanced root elongation and formation of lateral roots in maize vermicompost enhance the nutrient uptake by the plants by increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of root hairs (Pramanik *et al*., 2007). The use of vermicompost appears to affect plant growth in ways that cannot be directly linked to physical or chemical properties (Dash and Petra, 1979).Hence in the present study we conducted field experiment that included the effects of vermicompost in the growth and production of leaves of *Vigna mungo* plants that were inoculated with vermicompost as compared to the plant that was not inoculated with vermicompost. The objective of this work was to evaluate the impact of vermicompost on germination percentage, plant height, number of leaves, number of days for flowering, number of fruits per plant, fruit length and 100 seed weight of *Vigna mungo* plant.

MATERIALS AND METHODS

We conducted two separate field studies to compare how vermicompost affect plant growth and the vegetation when added to the soil. The vermicompost was produced by using an epigeic earthworm *E. foetida* under shade with appropriate conditions at Botanical Garden, Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu, India. In these experiments, we compared the germination percentage, number of leaves per plant, number of days for flowering, number of fruits per plant, fruit length and 100 seed weight of *Vigna mungo* plants substituted with leaf litter vermicomposts. We germinated and grew *Vigna mungo* plants in the garden with one field inoculated with vermicompost and the other without vermicompost. The seeds were bought from Tamil Nadu Agricultural University, (TNAU) Coimbatore and were sowed at the same time in both fields. At regular intervals the fields were watered depending upon the requirements.

A random sampling technique was used to select the plants for evaluation of germination percentage, plant height, number of leaves per plant, number of days for flowering, number of fruits per plant, fruit length and 100 seed weight of leaves. The soil samples were taken from two points from each field (Site I and Site II). The pH of the soil samples was determined by using digital pH meter MKVI- 8611 (Systronics) and the moisture content and humus of the soil was determined following the standards of Thorex *et al.,* 2008. Phosphate, nitrogen, potassium and organic carbon in the soil samples were analyzed by using a soil testing kit (Jyoti Scientific, India).

RESULT

The pH of the field without vermicompost was 6.3 and 6.2 at site I and site II and the pH of the field amended with vermicompost shows a pH of 7.7 and 8.1 at site I and site II respectively (Table. 1). The moisture content of the soil sample was 12.17% and 10.33% at site I and site II respectively and the moisture content of the soil sample amended with vermicompost was 56.82% and 52.36% at site I and site II respectively. The Organic carbon content of the soil sample was 0.6-0.80% (medium) and below 0.6% (low) at the site I and site II respectively, and organic carbon content of the soil amended with vermicompost was above 0.80% (high) at both the sites. The nitrogen (nitrate) content of the soil sample was 19Lbs (medium) and 11Lbs (low) at the site I and site II respectively and the soil sample amended with vermicompost was having high nitrate content of above 47Lbs on both the sites. The Phosphate content of the soil sample was 25-45Lbs at site I and above 25-45Lbs at site II and the soil sample amended with vermicompost was having high phosphate content above 66 and 67Lbs on site I and site II respectively. The potassium content of the soil sample was low, below 99Lbs at both the sites and the soil sample amended with

Table 1. Macronutrient content in field samples without vermicompost and in vermicompost amended field

Parameters	Without leaf litter vermicompost		With leaf litter vermicompost	
	Site I	Site II	Site I	Site II
pH	6.3	6.2	7.7	8.1
Moisture content	12.17%	10.33%	56.82%	52.36%
Organic carbon	Medium (0.6 – 0.80%)	Low (below 0.6%)	High (above 0.80%)	High (above 0.78%)
Nitrogen (nitrate)	Medium (19 Lbs)	Low (11 Lbs)	High (above 47 Lbs)	High (above 48 Lbs)
Phosphate	Medium (25-45 Lbs)	Medium (22-47 Lbs)	High (above 67 Lbs)	High (above 66 Lbs)
Potasium	Low (below 99 Lbs)	Low (below 100 Lbs)	High (260-350 Lbs)	High (255-345 Lbs)
Nitrogen (ammonical)	Low (12)	Low (11)	High (above 178)	High (above 181)
Humus	14.08%	12.56%	47.33%	46.16%

Table 2. Plant growth and yield characteristics of field samples of *Vigna mungo* without vermicompost and in vermicompost amended field

Plant characteristics	Without leaf litter vermicompost	With leaf litter vermicompost
Germination (%)	90-95	96-100
Height of the plant (60^{th} day)	0.9-1ft	1-1.7 ft
No. of leaves per plant (60th day)	22-29	37-42
No. of days for flowering	2-3.2cm	3-4.5cm
No. of fruits per plant	2-5	6-8
Fruit length	3.5-5 cm	4-5.5 cm
100 seed weight	4.12 gm	5.45 gm

vermicompost was having high potassium content of 260-350 Lbs at site I and 255-345 Lbs at site II. The ammonical nitrogen content of the soil sample at both the sites was 12Lbs which is very low and the soil sample amended with vermicompost was having high ammonical nitrogen content above 178Lbs on both the sites. The humus content of the soil sample was 14.08% and 12.56% at site I and site II respectively and the humus content of the soil sample amended with vermicompost was 47.33% and 46.16% at site I and site II respectively. (Table 1).

DISCUSSION

Organic amendment to soil affects the plant growth and soil fertility positively which varied quantitatively depending on the quality of organic residues added to the soil. Mulching had different effects on the seed germination of different plant species. Vermicompost has considerable potential for improving plant growth significantly, when used as a component of horticultural soil or container media (Edwards & Burrows 1988). Nevertheless, there appear to be major differences between the effects of the vermicompost that were used in our study, in terms of their influence on *Vigna mungo* plant growth, production of leaves and weight of fruits as compared to the *Vigna mungo* that were raised without vermicompost. These differences in growth responses could be due to fundamental differences between the leaf litter vermicomposting and without leaf litter vermicomposting processes. Vermicompost has been reported to have 47.33–46.16% higher levels of humic compounds than conventional composts (Dominguez *et al.*, 1997). It has been observed that growth of tomato and cucumber was enhanced when treated with up to 500 mg/kg humic acids derived from vermicompost (Atiyeh *et al.*, 2002). David *et al.*, 1994 found that humic acid in conditions of limited nutrient availability increase nutrient accumulation. The higher degree of decomposition and mineralization in vermicompost may partially account for the higher N-content (Syres and Springett, 1984; Bano *et al.*, 1987; Shuxin *et al.*, 1991). The increased N-content in vermicompost (48% higher than that of conventional compost) may also be due to the release of nitrogenous products of earthworm metabolism through the cast (excreta), urine as well as mucoproteins. The contents of Phosphorus (P) and Potassium (K) were substantially higher in the vermicompost soil sample than the normal soil sample. The P content of soil sample ranged between low to medium (25-45 Lbs) and of soil sample containing vermicompost is high (66 Lbs). The K content of the soil sample is low (99 Lbs) and higher in the vermicompost soil sample (255-345 Lbs). Greater mineralization is a result of phosphate activity and physical breakdown of minerals. The biological grinding of matter together with the enzymatic influence after passing through the gut of earthworms is responsible for increasing the different forms of potassium (Sharpley and Syres, 1977; Mathur *et al.*, 1980; Rao *et al.*, 1996).

In our field experiments the germination percentage, plant height, number of leaves per plant, number of days for flowering, number of fruits per plant, fruit length and 100 seed weight were significantly higher in the *Vigna mungo* plants that were amended with leaf litter vermicompost as compared to that plants grown in soil without leaf litter vermicompost. This may be due to the increase in soil fertility level in the amended soil as vermicompost is rich in nitrogen. However, we also observed that *Vigna mungo* plant that were taken from the field with vermicompost did not show any signs of disease as it was observed in the control field. This may be attributed to the pesticide action of vermicompost that aids in protecting crop plants against pests and diseases by suppressing, repelling or by inducing biological resistance in plants to fight them or by killing them (Al-Dahmani *et al*., 2003; Atiyeh *et al.*, 2000). It was also observed that vermicompost have the potential for improving plant growth when added to the greenhouse container or soil and in some cases it is superior to compost. From the findings, it can be concluded that the organic amendments of soil increase the height of *Vigna mungo* plants, number of leaves and fruit weight and also decreased the disease incidence of *Vigna mungo* plants. Different forms of organic amendment to soil could be useful for different crops; however, use of vermicompost could be a better option in general. This practice will give boost to the *Vigna mungo* production in the south of India and thus we recommend that farmers should be educated about the importance of vermicomposting. This will also reduce the additional burden of synthetic fertilizers in our vegetable gardens that in turn will decrease the pollution load on our environment.

Acknowledgements

The authors wish to express their warm gratitude to the, Annamalai University Tamil Nadu, India especially the department of Botany- Annamalai University for their cooperation. Special thanks are due to the students who helped in collecting the leaf litter as well as wastes from different sites.

REFERENCES

Al-Dahmani JH, Abbasi PA, Miller SA, Hoitink HAJ. (2003). Suppression of bacterial spot of tomato with foliar sprays of compost extracts under greenhouse and field conditions. Pl Dis, 87: 913-919.

Anil Kumar Gupta, Biswas Ray, Mahendra pratap Singh, Vibha upadhyaya and Chandran Kumar Singh, (2011). Effect of fertilizers and vermicompost on growth, yield and biochemical changes in *Abelmoschus esculentus.* Plant Archieves Vol.11, pp.285-287.

Atiyeh RM, Lee S, Edwards CA, Arancon NQ, Metzger JD. (2002). The influence of humic acids derived from earthworm-processed organic wastes on plant growth. Biores Tech 84: 7–14.

Bano K. Kale RD, Ganjan GN. (1987). Culturing of earthworm *Eudrillus eugineae* for cast production and assessment of worm cast as biofertilizer. J Soil Bio Eco 7 (2): 98–104.

Dash MC, Petra UC. (1979). Wormcast production and nitrogen contribution to soil by tropical earthworm population from a grass land site in Orissa, India, Rev Eco Biol Sol 16: 79-83.

Dominguez J, Edwards CA, Subler S. (1997). A comparison of vermicomposting and composting. Bio Cycle 38 (4): 57–59.

Edwards CA, Burrows I. (1988). The potential of earthworm composts as plant growth media. In: Edwards, C.A., Neuhauser, E. (Eds.), Earthworms in Waste and Environmental Management. SPB Academic Press, The Hague, The Netherlands, pp. 21–32.

El-Shaikh,K.A.A. and Mohammed, M.S. (2009). Enhancing Fresh and Seed Yield of Okra and reducing chemical phosphorus Fertilizer via using VA Mycorrhizal inoculants. World Journal of Agricultural Sciences 5(s): 810-818, 2009. ISSN 1817-3047.

Grapelli A, Tomati U, Galli E, Vergari B. (1985). Earthworm casting in plant propagation. Hort Sc.20: 874 876.

Lunt H A and Jacobson HG. (1994). The chemical composition of earthworm casts. Soil Sc 58: 367-75.

Martin JP. (1976). Darwin on Earthworms: The Formation of Vegetable Moulds; Bookworm Publishing, ISBN 0-916302-06-7.

Mathur BS, Sarkar AK, Mishra B. (1980). Release of N and P from compost charged with rock phosphate. J Ind Soil Sc Soc. 28: 206–207.

Pramanik P, Ghosh GK, Ghosal PK, Banik P. (2007). Changes in organic-C, N, P and K and enzyme activities in vermicompost of biodegradable organic wastes under liming and microbial inoculants. J Biores Tech 98: 2485-2494.

Rao S, Subba Rao A, Takkar PN. (1996). Changes in different forms of K under earthworm activity. National Seminar on Organic Farming and Sustainable Agriculture, India, October pp 9– 11.

Rathier TM, Frink CR. (1989). Nitrate in runoff water from container grown juniper and alberta spruce under different irrigation and N fertilization regimes. J Environ Horticul 7 (1): 32–35.

Sharpley AN, Syres JK. (1977). Seasonal variations in casting activity and in the amounts and release to solution of phosphorous forms in earthworm casts. Soil Bio Biochem 9: 227–231.

Shuxin L, Xiong D, Debing W. (1991). Studies on the effect of earthworms on the fertility of red arid soil. In: Advances in management and conservation of soil fauna, pp. 543–545.

Syres JK, Springett JA. (1984). Earthworms and soil fertility. Plant Soil 76: 93–104.

Tomati U, Galli E, Grappelli A, DiLena G. (1990). Effect of earthworm casts on protein synthesis in radish (*Raphanus sativum*) and lettuce (*Lactuca sativa*) seedlings. Bio Fert Soils, 9:288-289.

****