VERMICOMPOST: AN ORGANIC GOLD

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INTRODUCTION

In recent years, the disposal of organic wastes from domestic, agricultural and industrial sources has caused increasing environmental and economic problems and many different technologies to address this problem have been developed. There is a marked trend towards the use of novel technologies, mainly based on biological processes, for recycling and efficient utilization of organic residues. Therefore, it is possible to conserve the available resources and to recover the natural products, and in some cases, to combat the disposal problems and minimize the pollution effects. Vermicomposting has been arising as an innovative biotechnology for the conversion of agro industrial wastes into value added products, which can be utilized for improving the soil structure and fertility in organic farming.

CHARACTERISTICS AND SIGNIFICANCE OF VERMICOMPOST

Vermicompost is a finely divided peat-like material with high porosity, aeration, drainage, and water-holding capacity processed and produced from organic materials by the activity of earthworms. Particle size of vermicompost is much finer than other composts. Due to its much finer structure vermicompost exhibits larger surface area providing strong absorbability and retention of nutrients. Vermicompost has a great potential as plant growth booster in soil and in potting media. It serves as an organic amendment and soil conditioner for low productive soils since it supplies plant available nutrients and organic matter.

Vermicompost possesses a favorable cation exchange capacity, providing a buffering action against nutrient changes in the root zone, which decreases fluctuations in nutrient availability. Promotion of germination, growth, and marketable yield of green beans observed in the vermicompost added potting mix was attributed to property enhancement of the growing media with improved porosity, aeration, water retention, high nitrate content and quick drainage

NUTRIENT SUPPLYING CAPACITY OF VERMICOMPOST

In the production process itself vermicompost is physically, nutritionally and biochemically improved. As an organic substrate vermicompost typically contributes a high level of mineral elements in soil as well as in soilless culture relative to commonly available other composts/ substrates. Readily available forms such as nitrates, exchangeable phosphorus, potassium, calcium, and magnesium are released from vermicompost for the uptake of crops, in addition vermicompost contains organic substances that stimulate and regulate plant growth. During vermicomposting nitrate is being released, and it is most suitable for plant consumption. Other nutrients in vermicompost present in readily available forms for plant uptake are exchangeable phosphorus, potassium, calcium, and magnesium.

Supply of nutrients through mineral fertilizers and combining vermicompost in growing media at 10 and 20 per cent showed a positive effect on plant growth of marigold, tomato, green pepper, and cornflower. A consistent plant growth response was noticed when vermicompost was constituted upto 10-20 percent of total volume in container media mixture along with all needed nutrients, whereas greater proportion of vermicompost in growth medium not always improves growth of plants . Use of vermicompost as a substrate showing a significant encouragement impacts on the growth and yield of sweet paper, snap bean, lettuce, strawberry, celery, salad cabbage and red cabbage have been reported.

Application of vermicompost upto 10–20 per cent in combination with rice husk and sand led to increase in the vegetative and yield characteristics of celery and red cabbage, while 30 percent addition showed a negative impact. Further increasing the rate of vermicompost application increased N, P and K contents of celery and red cabbage compared to the control treatment. Addition of vermicompost into substrate significantly increased number of flowers, panicles and fruits per each plant, with also improved phosphorous and potassium content in aerial parts of plants in tomato. Excluding the addition of fertilizer nutrients and substituting soil from 10 to 50 per cent vermicompost, adequately increased shoot length and shoot dry weight of green beans plants in contrast to those in soil where only inorganic fertilization alone followed.

VERMICOMPOST AS A PROMOTER OF BIOLOGICAL ACTIVITY

Significant amount of addition of vermicompost consistently promotes biological activity which increases germination, enhances seedling growth, and yield of various greenhouse crops when used in container media when compared to other commercial container media. Addition of vermicompost in soils promoting the growth and yield of crops such as tomatoes, strawberries and cluster beans have been observed in field experiments.

Fig.1. Conversion of organic waste into compost and vermicompost and the potential uses of vermicompost

Microorganisms responsible for production of plant growth regulators and other plant growth effecting materials involving humates are present in vermicompost. Increased plant growth and yield was an indirect effect of increased microbial populations resulting from the earthworm activities during the vermicomposting process, leading to the production of growth hormones or humates in the vermicompost, which can promote plant growth. In addition, a large amount of humic substances present in vermicompost behave alike to those of humic substances present in soil in promoting plant growth.

Plant growth substances and humic acids present in vermicompost might be more efficient at lower substitution rates and also aid in supply of readily available nutrients. The complex structure of acids generated by microbial communities in earthworm cast could be released slowly in soil which gradually contribute to plant growth.

Auxins or cytokinins could be produced significantly from the activity of earthworms in organic wastes and these plant hormones are dose specific and very important for plant metabolism. Plant growth hormones considerably make direct positive effect on the growth and development of crops and as well as crop quality when present at low quantity.

Table 1. Chemical composition of vermicompost

Characteristics	Value
Organic carbon, %	9.15 to 17.88
Total Nitrogen, %	0.5 to 0.9
Phosphorus, %	0.1 to 0.26
Potassium %	0.15 to 0.256
Sodium %	0.055 to 0.3
Calcium & magnesium (Meq/100 g)	22.67 to 47.6
Copper; mg kg^{-1}	2.0 to 9.5
Iron, mg kg^{-1}	2.0 to 9.3
Zinc, mg kg^{-1}	5.7 to 9.3
Sulphur, mg kg^{-1}	128.0 to 548.0

CROP RESPONSES TO VERMICOMPOST APPLICATION

Addition of vermicompost in the growing media resulting structural changes would induce changes in water availability. Increased water holding capacities of growing substrates due to the addition of vermicompost, can therefore potentially increase water availability to the plant allowing increased movement of nutrients into the plant. Among the substrates in the soilless cultivation for growing sage plants use of compost and vermicompost recorded greater biometric characteristics and found as a sustainable peat alternative. Vermicompost acts as a nutrient-rich and microbiologically-active natural growing medium for plants and application of vermicompost with or without rock dust improved the growth and flower production in dahlia by improving leaf chlorophyll content, plant height, photosynthetic efficiency.

The use of vermicompost in moderate amounts produces beneficial effects on plant growth due to the enhancing the physical and chemical properties of substrate. Such changes in the physical properties of the substrates might be responsible for the better plant growth with the lower doses of vermicompost as compared to the peat-based substrate. Furthermore, plant growth is enhanced through the addition of vermicompost to a potting substrate. Furthermore, the use of vermicompost in urban horticulture led to conserve the nutrients and offer the organic matter.

CONCLUSION

Vermicomposting has a great potential to process a wide range of wastes produced in agriculture, food processing, sewage treatment, etc., and generate high-quality end products that can have multiple uses. Vermicompost produced by the activity of earth-worms is rich in macro and micronutrients, vitamins, growth hormones, enzymes such as proteases, amylases, lipase, cellulose and chitinase and immobilized microflora. Vermicompost is optimal organic manure for better growth and yield of many plants. Considering that, there are still many unknowns that need to be investigated and optimized in order to use vermicompost products in the context of sustainable agriculture. By answering the current knowledge gaps, it will be possible to increase the understanding of variables and parameters crucial in the process of vermicomposting and will enable wider utilization of vermicompost products.