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The impact of vermicompost application on yield of maize (*Zea mays*)

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Abstract

Pollution of agriculture in ecosystem is due to excessive use of mineral fertilizers and discharge of livestock manure. Therefore, there is a need for disposing manure safely for instance by transforming manure into compost. The traditional composting is, however time consuming with considerable nutrient loss. Vermicomposting is a new and good method, but do far, there are few quantitative evaluations of vermicomposting. There we compared vermicomposting and traditional composting if cattle manure with maize. The result show that the amount of nutrients from vermicomposting is lower than that from traditional composting. Mannuring vermicomposting yield 2172.0kg of earthworms per hectare. Moreover vermicomposting increased aboveground biomass by 7.7% and maize grain yield by 18.35%. The global output of vermicomposting was thus higher 304% due to higher grain yield.

Keywords: Earthworms, microorganisms, organic fertilizers, organic waste

Introduction

The current agriculture is now trying to create the balance between soil and crop with good yield and product. The vermi composting, sustainable and organic farming helps in maintaining a balance between the intake and output of nutrients in the soil. The use of synthetic fertilizers provides a sufficient content of nutrients into soil and influence on yield, on the other hand, it is only has one time effect. With the current development of industrial fertilizers and the decline in production of organic fertilizer due to the reduction in production of livestock numbers, it is necessary to pay attention to other alternatives to improve this negative situation. Reuse of waste i.e. composting has an important position in context. A large scale of reusable materials that are suitable for composting increase the value of some technology, having due regard to the protection of the environment. Composting waste materials, can be regarded as suitable alternative to organic fertilizers. The production of vermicompost is processed by reusing of waste products through new technologies of earthworms *Eisenia foetida*, which mix with the digested organic matter with minerals in digestive tract i.e. with the soil creating relatively water resistant aggregates i.e. casts, which have a positive impact on physical, chemical and biological parameter of soil.

Vermicompost preparation

The vermicompost was made in vermicomposting bin having size of 80*120*30 cm. Material used for making the vermicompost were the mushroom waste, coconut husk sugarcane trash, cow dung, dry leaf litter and vegetable waste. The vegetable wastes are collected from the traditional market, kitchen waste and were cut into the size of vegetable wastes into pieces of 5 cm. the dry leaf litter and sugarcane trash was grinded. The mushroom waste, sugarcane trash, coconut husk were served as bedding material materials. While the mixture of cow dung, leaf litter and vegetable waste were used food for worms. The amount of material used to fill the bin was 40kg of bedding materials and 20kg of worm food. The amount was adapted to the capacity of the worms to decompose organic matter. Vermicomposting process lasted for 28 days by using the earthworm species *Eisenia foetida*. The composting was done for 14 days. The vermicompost is also added with fish meal and eggshell with composition of 5% as additive materials. During the vermicomposting bin is covered with black cloth to avoid the exposure to sun. The vermicompost bins were made in shade to protect it from excess rainfall and from birds.

Advantages of Vermicompost

- Increase soil aeration and nutrient holding capacity.
- Improves soil physical, chemical, biological property.
- Vermicompost contains high amount of humic acids which helps to balance soil pH and increases its microbial activity.
- Vermicompost provides higher amount of macro and micro nutrients to the soil as compared to other compost.
- Increases plant growth and reduces the incidence of disease.
- Better method of waste management as compared to landfills
- Economic and low cost method.

Vermiculture and Vermicomposting

Rogayan *et al.* suggested that vermiculture is defined as rearing of earthworms for the purpose of organic waste management. Vermicomposting is defined as the converting of organic waste with the help of earthworms as the converting of organic waste into the compost with the help of earthworms. From three month experimentation it is revealed that vermiculture and vermicomposting is worthwhile venture. This study reveals that uneconomic biodegradable waste from the various venture can be put into economic product. This venture helps in maintaining the ecological balance on earth by reducing the waste and producing organic fertilizers which helps in maintaining the soil fertility of the soil. The product obtained from the vermicomposting that produced by using plant debris, cattle dung and many other waste is high in nutrient content. Various types of earthworms are used in vermicomposting i.e. *Eisines foetida*, *Eudrilus enginiae* etc. which helps in degradation of waste and converting them into economic product.



Source: <https://link.springer.com/article/10.1007/s13593-015-0307-0>

Fig 1: Earthworms converting the compost to vermicompost

Results and Discussion

The analysis of variance showed the significant effect of nitrogen fertilizer and bio-fertilizer vermicompost effect on all parameters measured include the no. of kernels per row, grain weight and grain yield. In one treatment biological fertilizer the vermicompost has higher no. of kernels per row, grain yield and biological treatment of vermicompost fertilizer i.e. 9 tons per hectare and lowest no. of kernels per row, thousand grain weight, yield related to treatment control (no biological fertilizer vermicompost). Nitrogen is the macro elements from which necessary elements needed for plant growth and development that lack it of for any reason. So biological nitrogen fertilizer plant vermicompost [2:4:14:9:5] of compensate deficiency this

element to crops and with the growth and development of corn and assimilate the vegetative reproduction organs and improved yield. The result of project can be concluded that the advantages of bio-fertilizer (vermicomposting) to reduce nitrogen and can stabilize production and increase production, increase farmers income and reduce the cost of cultivation and use of nitrogen fertilizer in further crops.

Economic Benefits

The grain yield is not the single factor considered by farmers; actually, the economic benefits are greater importance. We found that the net output was higher in vermicomposting system, which is increased by 304.1% compared to traditional system. The inputs for vermicomposting were more than those of traditional composting. Large amount of earthworms were obtained from the former treatment and the application of cattle manure vermicom post harvested greater grain yield which lead to higher output. At the end, the ratio of output/input (1:9:1) was higher in vermicomposting system than (1:5:1) in the traditional system. At the end the above mentioned results powerfully proved that cattle manure treated by vermicomposting application generated more economic benefits. By which now people do more and more livestock process and take full benefits of each and everything i. e. milk, cattle dung, urine etc.

Conclusion

The digestion of cattle manure by earthworms converts useful cattle manure into the more useful and valuable organic fertilizer that is friendly to the environment. Some of the nutrients are used by earthworms, and large amount of earthworms is obtained. The activities of earthworm made the remainder compost product contain some plant growth regulators which leads to the plant to fully consume the agronomic nutrients to generate greater aboveground biomass and higher grain yield. Thanks to the harvest of earthworms and increase grain yield. Both the net output and input ratio is higher in vermicompost system, even its input was simultaneously elevated. These findings may help to sustainably increase food supply by improving soil conditions, protecting environments, and maintaining the crop yields through the application of vermicompost. By the adding of 100 earthworms we can make 1000 of their species and also used it as a vermicompost plant.

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