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Compost made by worms from livestock manure yields benefits when applied to maize

Vermicomposting livestock manure with maize can increase agricultural benefit by 304%, shows a new study. The combination of increased crop yield and the additional earthworms produced as a result of the process led to a substantial increase in output compared to a traditional composting system.

As intensive agriculture and livestock production both increase, unique problems emerge. Heavy use of chemical fertilisers, pesticides and herbicides can affect soil and water quality, and harm wildlife. Large amounts of manure are produced by the livestock industry, which can cause problems such as nutrient overload in water, contamination of ground, and offensive odours. One solution to these problems is to use livestock manure as a form of organic fertiliser. However, this method can be labour-intensive, as manure is traditionally prepared through a process of decomposition and stirring. Furthermore, valuable nutrients can go unutilised, such as through substantial gaseous nitrogen losses from manure.

Some research has indicated that vermicomposting, the practice of using worms to make compost, can be a quick and effective way to process livestock manure. Earthworms quickly break down organic matter and convert nutrients into forms that plants can use. To compare the effects of vermicomposting and traditional composting on nutrient levels, crop yield, and economic benefit, researchers performed a field experiment.

The fieldwork took place in eastern China on experimental plots. The researchers processed cattle manure using two systems: the vermicomposting system and the traditional compost system. The vermicomposting system introduced 309 kg earthworms (*Eiseniafetida*) into 30 tonnes of livestock manure and allowed them to consume it for 60 days. The traditional system covered another 30 tonnes of manure with plastic for 60 days, stirring it every 20 days. The researchers then analysed the nutrient content of each type of compost, and applied them to 1 hectare fields of maize. The maize was planted in late June and harvested in late September.

The scientists found significant differences in the compost produced by the two systems. Total quantities of organic matter, nitrogen, and available phosphorus and potassium were significantly greater in compost produced by the traditional system. This difference was likely caused by earthworms and microbes consuming a proportion of carbon and nitrogen during the vermicomposting process. During this process, the earthworms also reproduced and greatly increased in number, from an initial volume of 309 kg to a final volume of 2 172 kg of worms.

Significant differences were also found in the above ground biomass of the crops and their yield. Maize plots fertilised with traditional compost had 7.1% higher biomass at the crops' flowering stage. However, by the harvest stage the vermicomposted plots showed 7.7% higher biomass. The maize grain yield was significantly higher in the vermicomposted plots at approximately 9 900 kg per hectare, when compared to the approximately 8 400 kg per hectare collected from the plots treated with traditional compost.

The researchers believe this is due to the vermicompost being more favourable for the plants. It may contain fewer pathogens, have a more optimal salinity, or contain compounds that help plants to take up nutrients more efficiently. Furthermore, other research has shown that vermicompost has higher porosity, better drainage, and higher levels of beneficial microbial activity.

Based on the increased yield and number of earthworms generated by the vermicomposting, the researchers calculated a 304.1% increase in the net output of the vermicomposting system — which was $3 956, compared to the $979 output of the traditional system. The overall ratio of output to input was 1.9/1 for vermicomposting, and 1.5/1 for the traditional system, indicating that treating livestock manure by vermicomposting and applying it to maize resulted in greater economic benefits. The researchers say their results indicate an environmentally sustainable way to produce organic fertiliser that both increases agricultural yield and improves soil conditions.

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