Experimental Analysis Of Decomposed Organic Material Excreted From Vermicomposting Technology

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ABSTRACT

Vermicompost is the procedure of fertilizing the soil utilizing different worms, normally red wigglers, white worms, and different night crawlers, to make a heterogeneous blend of disintegrating vegetable or sustenance squander, bedding materials, and Vermicast, additionally called worm castings, worm humus or worm fertilizer, is the finished result of the breakdown of natural matter by a night crawler. These castings have been appeared to contain lessened levels of contaminants and a higher immersion of supplements than do natural materials before vermicomposting. Vermicomposting is a strategy for planning enhanced manure with the utilization of worms. It is one of the least demanding techniques to reuse agrarian squanders and to create quality manure. Night crawlers devour biomass and discharge it in processed shape called worm throws. Worm gives are prominently called a role as Black gold. The throws are rich in supplements, development advancing substances, useful soil small scale vegetation and having properties of restraining pathogenic organisms.

Keywords: Experimental Analysis, Decomposed, Organic Material, Vermicomposting, Technology

1.INTRODUCTION

Vermi is the Latin word for worm. Vermicomposting is essentially fertilizing the soil with worms. Vermicomposting alludes to the technique for changing over natural waste into worm castings.) It is a standout amongst the most cost proficient and ecologically amicable strategies for waste transfer. In a perfect condition night crawlers can devour essentially a wide range of natural matter and they can eat their own body weight every day for instance one kilogram of worms can expend one kilogram of buildups consistently. And yet their casts contain eight times as many microorganisms as their feed. And the casts don't contain any disease pathogens-pathogenic bacteria are reliably killed in the worm's gut. Worm casts also rich in nutrients such as Nitrogen, Phosphorous and Potassium Vermicompost involves aerobic decomposition of organic waste by using microorganisms. Maximizing the waste-processing rate depends on maintaining high earthworm density throughout the vermicomposting process. Composting and vermicomposting are two of the best-known processes for the biological stabilization of solid organic wastes. Fertilizing the soil includes the quickened debasement of natural matter by microorganisms under controlled conditions, in which the natural material experiences a trademark thermophilic organize that permits sterilization of the waste by the end of pathogenic microorganisms (Lung et al., 2001). Two stages can be recognized in fertilizing the soil: (i) the thermophilic arrange, where disintegration happens all the more seriously and which in this way constitutes the dynamic period of treating the soil; and (ii) a developing stage which is set apart by the decline of the temperature to the mesophilic extend and where the staying natural mixes are debased at a slower rate. The term of the dynamic stage relies on upon the attributes of the waste (measure of effectively decomposable substances) and on the administration of the controlling parameters (air circulation and watering). The degree of the development stage is additionally factor and it is ordinarily set apart by the vanishing of the phytotoxical mixes. Fertilizing the soil is settled at the modern scale for strong natural waste treatment, in spite of the fact that the loss of nitrogen through volatilization of NH3 amid the thermophilic phase of the procedure is one of the significant disadvantages of the procedure. Vermicomposting involves the bio-oxidation and stabilization of organic material by the joint action of earthworms and microorganisms. In spite of the fact that the microorganisms biochemically debase the natural matter, night crawlers are the vital drivers of the procedure, as they circulate air through, condition and section the substrate, in this manner definitely changing the microbial movement. Worms go about as mechanical blenders and by comminuting the natural matter they adjust its physical and synthetic status by step by step diminishing the proportion of C:N and expanding the surface zone presented to microorganisms – subsequently making it considerably more ideal for microbial movement and further decay. (Domínguez et al., 1997). Subsequently two stages can likewise be recognized here, (i) a dynamic stage where the night crawlers handle the waste altering its physical state and microbial sythesis (Lores et al., 2006), and (ii) a development like stage set apart by the dislodging of the worms towards fresher layers of undigested waste, where the organisms assume control in the deterioration of the waste. Like in composting, the duration of the active phase is not fixed, and it will depend on the species and density of earthworms, the main drivers of the process, and their ability to ingest the waste

1.1 Objectives

1. Identifying different types and quantity of wastes generated
2. Establishing a suitable vermi bed for bio conversion of organic waste
3. Analyzing the compost generated using different organic waste and different proportions

1.2 Materials

Decomposable natural squanders, for example, creature excreta, kitchen squander, cultivate deposits and backwoods litter are generally utilized as fertilizing the soil materials. When all is said in done, creature waste for the most part bovine fertilizer and dried hacked edit deposits are the key crude materials. Blend of leguminous and non-leguminous yield deposits advances the nature of vermicompost.There are diverse types of night crawlers viz. Eisenia foetida (Red worm), Eudrilus eugeniae (night crawler), Perionyx excavatus and so forth. Red night crawler is favored due to its high augmentation rate and in this manner changes over the natural matter into vermicompost inside 45-50 days. Since it is a surface feeder it changes over natural materials into vermicompost from top. Imperative qualities of red night crawler (Eisenia foetida) Characters Eisenia foetida Body length 3-10cm Body weight 0.4-0.6g Maturity 50-55days Conversion rate 2.0 q/1500worms/2 months Cocoon production 1 in every 3 days Incubation of cocoon 20-23days Types of vermicomposting The types of vermicomposting depend upon the amount of production and composting structures. Little scale vermicomposting is done to meet the individual necessity and rancher can gather 5-10 tons of vermicompost yearly. While, expansive scale vermicomposting is done at business scale by reusing extensive amount of natural waste with the generation of more than 50 – 100 tons every year.

1.3 Process Of Vermicomposting

Following steps are followed for vermicompost preparation

1. Vermicomposting unit ought to be in a cool, wet and shady site
2. Dairy animals manure and slashed dried verdant materials are blended in the extent of 3: 1 and are kept for halfway deterioration for 15 – 20 days.
3. A layer of 15-20cm of slashed dried leaves/grasses ought to be kept as bedding material at the base of the bed.
4. Beds of incompletely decayed material of size 6 x 2 x 2 feet ought to be made5. We have choosing three organic waste (orange waste and musk melon and sapota) with cow dung different ratios like
   a) cow dung 50% and organic waste 50%
   b) cow dung 40% and organic waste 60% c) cow dung 30% and organic waste 70%
5. Each bed should contain 1.5-2.0q of raw material and the number of beds can be increased as per raw material availability and requirement.
6. Red earthworm (1500-2000) should be released on the upper layer of bed.
7. Water ought to be sprinkled with can quickly after the arrival of worms
8. Beds ought to be kept wet by sprinkling of water (every day) and by covering with gunny packs/polythene
9. Bed ought to be turned once following 30 days for keeping up air circulation and for legitimate decay.
10. Compost prepares in 45-50 days
11. The finished product is 3/4th of the raw materials used.

1.4 Possible Effects Of Vermicompost On Plant Growth

Optimum plant growth and development is important for greater final dry matter and yields. In order to achieve this, sufficient amounts of nutrients should be applied to the soil through inorganic and organic sources. Vermicompost for instance, a natural wellspring of plant supplements, contains a higher rate of supplements fundamental for plant development in promptly accessible structures. Accordingly, vermicompost has a potential for enhancing plant development and dry matter yield when added to the dirt. Studies have shown that vermicompost plays a major role in improving growth and yield of different field crops, including vegetables, flowers and fruit crops. For example, the application of vermicompost gave higher germination (93%), growth and yield of mung bean compared with the control (84%). In a study involving a wide range of vegetable and ornamental seedlings, result showed earlier and better germination in a vermicompost compared with control Furthermore, comparing biodigested slurry and vermicompost, Karmegam et al. (1999) and Karmegam and Daniel (2000) showed that the fresh and dry matter yields of cowpea (*Vigna unguiculata* L.) were greater when soil was amended with vermicompost. Furthermore, the yield of pea (P. sativum L.) was also higher when vermicompost was applied at a rate of 10 tha-1 along with recommended N, P and K than with these fertilizers applied alone (Reddy et al., 1998). It was also reported that application of different levels of vermicompost to Chrysanthemum chinensis resulted in increased fresh weight of flowers, number of flowers per plant (26), flower diameter (6 cm) and yield (0.5 tha-1) with the application of 10 tha-1 of vermicompost (Nethra et al., 1999). Vermicompost applied at a rate of 5 tha-1 have also been reported to significantly increase yield of tomato (L. esculentum L.) (5.8 tha-1) in farmers' fields compared with control (3.5 tha-1) (Nagavallemma et al., 2004). Vadiraj et al. (1998) reported that application of vermicompost produced herbage yields of coriander (Coriandrum sativum) cultivars that were comparable to those obtained with chemical fertilizers. Vermicompost and its components has also shown to benefit plant growth in poor light textured soils which was attributed to high rate of N mineralization as a result of high cation exchange capacity (CEC), slow and gradual release of N with minimum losses due to leaching (Harris et al., 1990). For example, in the poorer sandy soils of the Western Cape (South Africa) where root vegetables such as carrots (Daucus carota) are an important agricultural crop, the use of vermicompost could make these soils more productive over a longer period, thus enhancing its potential to support plant growth. Research has revealed that application of vermicompost enhanced plant growth and development, root initiation and root biomass and this was attributed to the organisms essential for maintaining vigorous plant growth capable of withstanding environmental stress (Tomati et al., 1987; Edwards, 1998b; Atiyeh et al., 2002; Bachman and Metzger, 2008).

2. LITERATURE COLLECTION

2.1 Vermicomposting

E. Albanell, J. Plaixats, T. Cabrero,(1988) studied that Vermi is the Latin word for worm. Vermicomposting is basically treating the soil with worms. Vermicomposting alludes to the strategy for changing over natural waste into worm castings It is a standout amongst the most cost proficient and earth agreeable techniques for waste transfer. In a perfect condition night crawlers can devour for all intents and purposes a wide range of natural matter and they can eat their own particular body weight every day for instance one kilogram of worms can expend one kilogram of deposits each day. But then their gives contain eight circumstances a role as numerous microorganisms as their nourish. What's more, the throws don't contain any malady pathogens-pathogenic.

Amid this procedure, the essential plant supplements, for example, nitrogen, potassium, phosphorus and calcium show in the encourage material are changed over through microbial activity into structures that are a great deal more solvent and accessible to the plants than those in the parent substrate (Ndegwa, 2001). Worms are unquenchable feeders on natural waste and keeping in mind that using just a little segment for their body blend they discharge a vast part of these expended squander material in a half processed shape. Since the digestive system of night crawlers harbor extensive variety of microorganisms, chemicals hormones, and so forth., these half processed substrate breaks down quickly and are changed into a type of vermicompost with in a brief timeframe.

2.2 Fruit Waste

Dr.B.Hemalatha **(**2012) concludes that the results from the casting analysis had revealed that the organic waste and the sludge can be converted into usable form with its nutrient release. Though there may not be a great increase in nutrient, the small change in nutrient value and the reduction in C/N ratio make the plant to uptake. The casting which is rich in microorganism enhances the plant growth hormones the result showed the increase in Earthworm population in the case of paper mill sludge than in tannery industry. This is a eco friendly and cost effective methods. It is an ideal method for the Management of solid waste. To conclude hold promise to play a significant role in protecting environment as it uses waste as raw material and in building up of soil fertility and improving soil health for sustainable agriculture. M.Shanmuga priya (2011) studied was focussed to study the changes in various physicochemical parameters like pH, electrical conductivity, moisture content, organic carbon and carbon nitrogen ratio during the vermicomposting of leaf litter by *Lampito mauritti.* Our study, further confirmed *Lampito mauritti* was an efficient degrader of leaf litter. Analysis of various physico chemical parameters during composting by *Lampito mauritti* at different time intervals showed favourable changes in pH, electrical conductivity, moisture content, organic carbon and carbon nitrogen ratio which are proved to be an important criteria for monitoring the efficient and quick degradation of leaf litter into high quality organic manure, thus vermicomposting of leaf litter by *Lampito mauritti* holds promise to play a significant role both in cleaning the environment and building up of soil fertility for sustainable agriculture.

3.METHODS

For this experiment, twenty-four small composting bins made out of 2-liter plastic soda bottles were set up and filled with different organic materials. The partial transparency of the bottles made it possible to observe the changes that occurred during the course of the experiment. Six different compost treatments, labeled A through F, were tested. Each of the six treatments was repeated four times to ensure accuracy through redundancy and to allow an ANOVA (Analysis of Variance) to be conducted once the final data had been gathered. Different combinations of leaves and organic food products were used in the compost treatments. The leaf segment of the manure was made out of an even blend of maple and oak takes off. The subsequent blend was cut into little pieces. The sustenance segment was made out of an uneven blend of lettuce, cabbage, beats, and little measures of other crisp vegetables. What's more, half of the manure medicines got 50 grams of night crawlers. Table 1 shows the quantities of food, leaves, and worms that were added to each of the six compost treatments.

Table 1: Quantities of leaves and food, and worms added to each compost bin:

Treatment I.D.	Leaves (mL)	Food (mL)	Worms (g)
A: Bottles 1-4	1500	0	0
B: Bottles 5-8	750	750	0
C: Bottle 9-12	0	1500	0
D: Bottles 13-16	1500	0	50
E: Bottles 17-20	750	750	50
F: Bottles 21-24	0	1500	50

4.RESULTS

After nine weeks the jugs containing the fertilizer material were purged and their substance were analyzed to figure out which of the treating the soil strategies tried was the best. A few extra inquiries were replied by dissecting the information that had been gathered. Occasional weight estimations showed that the mass of fertilizer material diminished considerably over the span of the test. Table 2 and Figure 1 shows the absolute mass of the contents of each compost treatment at various stages of the experiment.

Table 2: Weight of compost material at certain time intervals: (expressed in grams)

	Start	1 Week	4 Weeks	6 Weeks	9 Weeks
Leaves only	884.88g	595.05g	456.40g	362.40g	232.80g
Leaves & Food	1565.88	944.58	622.19	384.17	203.90
Food Only	1659.66	823.93	276.27	130.75	20.06
Leaves & Worms	1337.06	1020.49	741.77	527.46	303.49
Leaves Food & Worms	1640.76	1083.24	646.68	421.13	204.01
Food & Worms	1989.99	742.01	356.55	248.33	59.56

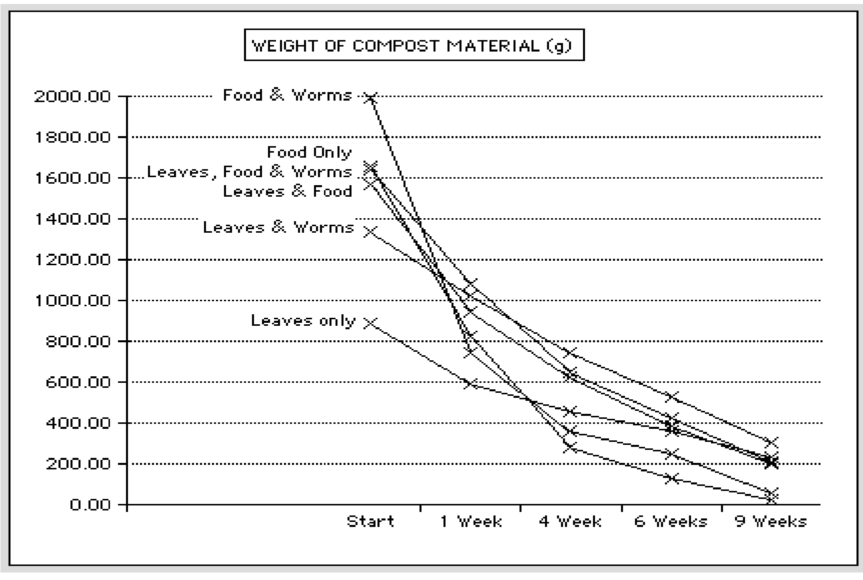

Figure 1: Weight of compost material at certain time intervals: (expressed in grams)

5.DISCUSSION

Several concerns were brought up while this experiment was in the planning stages. Most of these had to do with reducing the variety of unpredictable external forces that could affect the compost treatments differently. The first was that each of the compost treatments had to be aerated equally. The bottles containing food were expected be more dense and more moist than those containing leaves .To space out the sustenance pieces and to keep a satisfactory measure of air moving through the nourishment canisters, Styrofoam bundling peanuts were to be joined with the manure. Nonetheless it was later verified this would have added to an implausible fertilizing the soil environment which would have had no application in this present reality. Compost consolidated with non-biodegradable Styrofoam peanuts would be of no an incentive in a rural setting. Besides, the impact of Styrofoam on worms was obscure. Keeping all compost treatments equally moist was another concern. With a specific end goal to shield the manure from turning out to be excessively wet, little air openings were jabbed in the sides of the pop jugs. The gaps were implied not exclusively to shield the fertilizers from turning out to be excessively clammy, additionally, making it impossible to supply the worms with enough air to survive. It was additionally vital that each of the manure medications was presented to a similar lighting conditions. If some bottles had been in the shade and others in direct sunlight, conditions within them would not have been consistent. A shady counter top in a greenhouse was used to house the compost bottles. Periodically the bottles were randomly rearranged to ensure that no bottle was placed in what could have been an overly shady or bright spot for any longer than any of the other bottles. Similarly, the bottles were rearranged to make sure that no one bottle was exposed to more heat than any of the others. Another element that may have added to the end of the worms was the too much high temperature inside the fertilizer receptacles. The temperature was sufficiently high to soften the worms. Curiously, a portion of the conditions inside the manure bottles appeared to recommend that the temperatures were really not as high as showed by the worms' dissolved bodies. For instance, the volume of every fertilizer was littler than that which is ordinarily required for the development of warmth. In addition, the compost environments were anaerobic early on in the process, meaning that the temperature inside each bottle probably remained fairly low. Furthermore, it is possible that the worms melted because of excess moisture, rather than excess heat.

6.CONCLUSION

Once the collected data was analyzed; it became possible to answer most of the questions posed at the beginning of this paper. The first question asked which of the six compost methods tested is most successful at producing humus (fertile compost.) The contents of compost treatment C, which contained food only, rather closely resembled soil after the nine week / experiment had ended. The following table shows a rundown of the rest of the results.

Table 2: Decomposition Results

Most decomposed	Compost Treatment C (Food only)
Second most decomposed	Compost Treatment F (Food and worms)
Third most decomposed	Compost Treatment B (Leaves and food)
Fourth most decomposed	Compost Treatment E (Leaves, food, and worms)
Fifth most decomposed	Compost Treatment D (Leaves and worms)
Least decomposed	Compost Treatment A (Leaves only)

Although the worms did not thrive under any circumstances, they survived slightly longer in the presence of rotting food than in the presence of rotting leaves. The best environment for the worms, from among the three tried, appeared to be a blend of nourishment and takes off. It is normal that under the correct conditions, the worms would have had an essentially more prominent effect upon the deterioration procedure. The Dakota Blue Worm Farm maintains a Web site that provides valuable information on exactly how to keep worms alive and well. The site provides several rules of thumb that were clearly violated while this experiment was being conducted. First, the site suggests using a sheltered location that gets some sun, but not so much sun that the composts dry out and become too hot. Since the plastic pop jugs utilized as a part of this examination were straightforward and in direct daylight more often than not, they were permitted to wind up distinctly excessively hot and dry. Next the site discloses how to appropriately bolster the worms: The finish of the Bio Cycle ponder likewise clarifies that as the quantity of worms utilized expanded, the net substance of nitrogen in the fertilizer diminished. This conclusion definitively answers one of the questions that this experiment failed to answer: Do worms speed up the decomposition process? The answer is yes. Although the Bio Cycle study does not provide any insight on some of the other questions addressed in this experiment, (chiefly the effects of worms upon weight, depth, and density of compost material) it does provide significant evidence that worms affect the more important aspects of compost: the speed of the decomposition process and the quality of the final product.

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