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Stimulatory Influence of Some Additives on Vermicomposting by Eudrilus Eugeniae

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ABSTRACT: *To know the Stimulatory Influence of some Additives on Vermicomposting by Eudrilus eugeniae, a vast analysis was carried out in the Vermicomposting Center, Charak Udyan of Jiwaji University, Gwalior (MP) India. Eudrilus eugeniae (Giant African worm) is the most competitive earthworm species and it dominates in a mixed culture. It has higher frequency of reproduction and faster rate of growth than t other species. The major aim of the study was to identify suitable additive that can help in enhancing vermicomposting process, particularly involving complicated, hard to degrade type of waste stuffs. . In conclusion of the present study it can be stated that Spirulina and Trichioderma can be used as probiotic and microbial inoculants during pre-decomposition period in order to get qualitative and quantitative improvement vermicomposting. As per study, maximum number of E.eugeniae earthworms proffered the medium that was treated with Spirulina additive followed by Trichioderma treated medium. The next choice of earthworms was found untreated (control) medium, whereas least preference was demonstrated by the medium treated with jaggery +buttermilk. Before treated with additives it was found that 2:1 ratio of dung and leaves showed high degree of decomposition followed by 1:2 ratio of dung and leaves and least degree of composting was found in the 1:1 ratio of dung and leaves. So concentration of dung showed much attraction earthworms like E.eugeniae. More the concentration of dung with the leaves more efficient is the composition of matter with more number of earthworms.*

KEY WORDS: *Eudrilus eugeniae, Vermicomposting, Additives, Earthworms, Epigeic*

I. INTRODUCTION

Environmental degradation is a major threat confronting the world, and the rampant use of chemical fertilizers contributes largely to deterioration of the environment. It also leads to loss of soil fertility due to toxic residues of chemical fertilizers and pesticides causing adverse effect on soil degradation and plant productivity. Now there is a growing realization that the adoption of ecological and sustainable farming practices can only reverse the declining trend in the global food security and environment protection The soils in tropical regions are becoming deficient in necessary plant nutrients and on the other hand large quantities of such nutrients present in domestic wastes and agricultural by products are being mis-managed and become an extra-source of pollution foul odour and un-hygienic atmosphere. It is estimated that in cities and rural areas of India nearly 700 million tons of organic waste is generated annually, most of which is either burned or land filled **(Bhiday, 1994).**

Vermicomposting is compatible process with sound environmental principles, conservation of resources and sustainable practices. Vermicompost is considered to be the world's best organic fertilizer. Vermiculture is done chiefly for production of Vermicompost. Vermiculture means artificial rearing or cultivation of earthworms and the technology is the scientific process of using them for the betterment of agriculture and human beings. Vermiculture technology improves the crop productivity by increasing the soil fertility through ecological methods of farming and agriculture. Vermiculture has been embraced throughout the world right from the developed countries to the developing countries. Vermicomposting is the panacea for solid waste management, it is a simple process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product (Vermicompost). The earthworms accomplish this task with the help of some species of microorganisms. Earthworm serves as "nature's plowman" to facilitate these functions. They form nature's gift to produce good humus, which is the most precious material to fulfill the nutritional needs of crops. The utilization of Vermicompost results in several benefits to farmers, industries, environment and overall national economy. About 2,350 years ago, Aristotle called earthworms as "intestine of earth". This statement holds true even today. Darwin was the other earlier worker to state, "No other creator has contributed to building of earth as earthworm". Such large quantities of organic wastes generated also pose a problem for safe disposal.

In nature's laboratory there are a number of organisms (micro and macro) that have the ability to convert organic waste into valuable resources containing plant nutrients and organic matter, which are critical for maintaining soil productivity. Microorganisms and earthworms are important biological agents that are helpful to maintain nutrient flow from one system to another and also minimize environmental degradation.During vermicomposting, the important plant nutrients such as nitrogen, phosphorus, potassium (NPK) and Ca (calcium), present in the organic waste are released and converted into forms that are more soluble and available to plants. Moreover, the worms themselves provide a protein source for animal feed. Vermicomposting is basically the science of breeding and raising earthworms. It defines the thrilling potential for waste reduction, fertilizer production, as well as assortment of possible uses for future **(Entre Pinoys, 2010).** The term vermicomposting is derived from the Latin vermis, meaning worms. Vermicomposting is essentially the consumption of organic materials by earthworms. This speeds up the process of decomposition and provides a nutrient rich product, which is slightly blackish in colour, called Vermicompost in the form of 'worm castings'. Composting of different organic waste with worms avoids the needless disposal of vegetative food wastes and enjoys the benefits of high quality compost. Vermicast is also believed to contain hormones and enzymes which it acquires during the passage of the organic matter through the earthworm gut. These hormones and enzymes are believed to stimulate plant growth and discourage plant pathogen. Vermicast is believed to be very good organic fertilizer and soil conditioner **(Gajalakshmi et al., 2003).** Vermicomposting is a biological process of decomposition of biodegradable organic wastes and it can be carried out under controlled conditions of ventilation, temperature, moisture, wherein the organisms within the waste can convert them in to humus like material. If carried out effectively, the final product is stable, odourless, doesn't attract flies and is a good soil conditioner while the non compostable wastes can be left for recycling and reuse by concerned authorities. Eudrilus euginae is popularly known as night crawler and it is one of the most important species for vermicomposting. It grows faster than other species accumulating mass at the rate of 12 mg /day. Mature individuals can attain body weight up to 4.3 g / individual. The worms become mature in a period of 40 days and they have a high rate of reproduction with an average of 1 cocoon / day. Their life span is from one to three 3 years. It is native of equatorial West Africa and its low temperature tolerance is lower than E. foetida, but it can be used as vermicomposting worm in tropical and subtropical regions.

Vermicompost consists mainly of worm casts plus some decayed organic matter. In ideal conditions worms may consume their own weight of organic matter each day. One ton of worms may therefore process one ton of organic waste per day. Vermicompost is organic, non- burning and rich in nutrients. Worm casts are suitable for a wide range of horticultural uses. A considerable amount of the municipal wastes can be reduced, leading to increased efficiency in overall management of waste by means of waste management technique at urban household level. Similarly vermicomposting is a viable, simple, economical and efficient process in converting organic solid wastes into organic manure and soil conditioners popularly with farmers (Garg et al., 2006) and the generated product is stable and homogenous, having desirable aesthetics like reduced levels of contaminants **(Ndegwa and Thompson, 2001).**

II. MATERIAL AND METHODS

The present research work, "Stimulatory Influence of some Additives on Vermicomposting by Eudrilus eugeniae" was carried out in the Vermicomposting Center, Charak Udyan of Jiwaji University, Gwalior(MP) India. Three species of epigeic worms namely red wriggler (Eisenia foetida), (Eudrilus eugeniae) and tropical worm (Perionyx excavates) are being used for vermicomposting purpose. It has been noticed that out of these three worms Eudrilus eugeniae (Giant African worm) is the most competitive worm and it dominates in a mixed culture. It has higher frequency of reproduction and faster rate of growth than most others.The major raw material cattle dung, used in the study was obtained from nearby buffalo dairy farm and dried leaves were collected from the campus of Charak Udyan. The other materials (plastic containers, garden net, vermi-tools, jaggery (additive), buttermilk (additive) etc were procured from the local market. Tricha Trichoderma harzianum (additive) 2 % wettable powder was procured from R.L. Balagi crop care pvt. Ltd. Cherlapally-500051. Ranga Raddy District (A.P). Spirulina powder (additive) was a generous gift from Mr. Varun Agrawal of M/S ACME Foods & Nutraceuticals, 12 Millenium Plaza, University Road, Gwalior. Preliminary experimental Method and Free choice experiment are the two methods used to calculate the influence of additives on the vermicompositing by Eudrilus eugeniae.

III. RESULT AND DISCUSSION:

The present study entitled "Stimulatory Influence of some Additives on Vermicomposting by Eudrilus eugeniae" was taken up to demonstrate the influence of some additives, butter milk and Jaggery, Spirulina and Trichoderma harzianum using African giant Eudrilus eugeniae in vermicomposting of dung and dried leaf mixture. In order to begin the study, a separate vermi-tank (6X3X1 feet) was prepared in which the culture

Eudrilus eugeniae in a bedding mixture of cattle dung and dry plant leaves (2:1) was maintained during the course of study (September to February, 2011) in Vermicomposting Centre located in Charak Udyan of Jiwaji University, Gwalior. The culture was constantly monitored with regular watering and mixing of the medium to maintain suitable moisture and aeration respectively. Mature clitellate worms required for the experiments were taken from this stock culture. The results of the study are described under following heads:

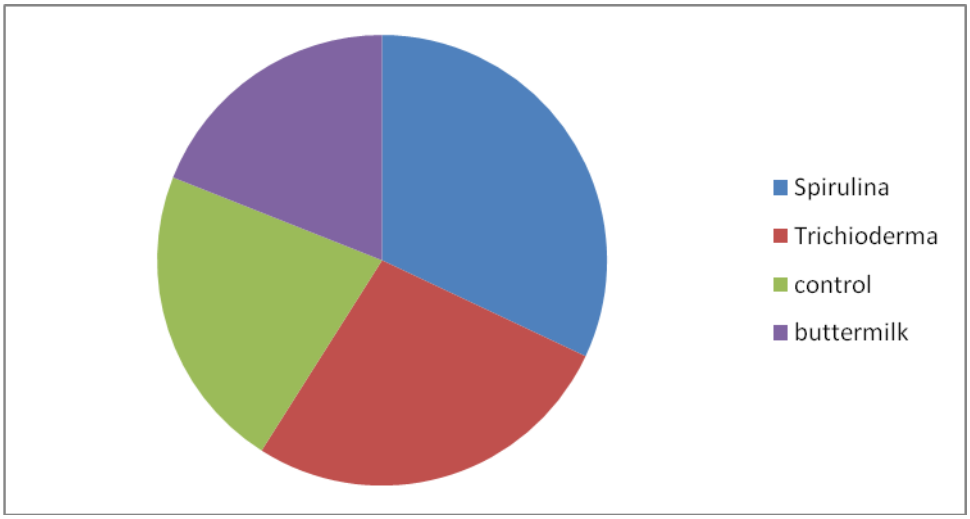
Preliminary experiment:-A preliminary experiment was first conducted to determine suitable ratio of dung and leaf mixture for vermicomposting by E. eugeniae. Three combinations (1:1, 1:2, 2:1) of dung and leaves were tested and the results of the study showed that maximum amount of compost was produced in 2:1 ratio, followed by 1:1 and 1:2 (Table – 2). Thus a mixture of cattle dung and dried leaves (2:1) was selected for further experiments. So results showed that greater percentage of dung with leaves favors growth of more earthworms. Which is the indication of better decomposition of organic matter and so Vermicompost so developed will be efficient that other combination

Table 1 – Showing degree of composting in different combinations of dung + leaves

S.No	Ratio of dung +Leaves	Degree of composting
1.	**1:1**	**48.60%**
2.	**1:2**	**45.95%**
3.	**2:1**	**51.50%**

Free Choice experiment: Free choice experiment was conducted to determine preference or liking of earthworms (Eudrilus eugeniae) towards differentially treated bedding material (2:1 mixture of dung + leaves). The maximum number (32 %) of earthworms (Eudrilus eugeniae) preferred the medium that was treated with Spirulina for their settlement during experimental period of 10 days. Trichioderma treated medium was the next in which 27 % earthworms showed their preference. The next choice (22 %) of earthworms was un-treated (control) medium, whereas least preference (19 %) was demonstrated by the medium treated with jaggery + buttermilk (Fig. 1). It can be concluded that Spirulina and Trichoderma might have selective advantage in enhancing the vermicomposting process in waste biomass.So, upon analysis, it can be calculated that presence of additive like Spirulina in the mixture of dung and leaves favours the growth of more earthworms fallowed by Trichioderma additives which stands at second on efficiency. While medium treated with jaggery additive and buttermilk favours the growth of least percentage of E.euginae earthworms. So least efficient Vermicompost can be produced because of this additive. Untreated medium stands slightly above the medium treated with jaggery and buttermilk as for as percentage of earthworms is concerned.

Fig. 1– Pie diagram to show % preference of earthworms towards differentially treated substrate media



The major aim of the study was to identify suitable additive that can help in enhancing vermicomposting process, particularly involving complicated, hard to degrade type of waste stuffs. In a preliminary experiment it was found that a mixture of dung and dry plant leaves (2:1) with a pre-decomposition time of 15 days followed by vermiculture for 42 days, was suitable for detailed study to demonstrate the influence of three additives, jaggery + buttermilk, Spirulina super food and Trichodera harzianum. In a free choice experiment, conducted for 10 days, it was noticed that maximum number (32 %) of the earthworms settled in Spirulina treated medium, followed by 27 % earthworms in Trichoderma treated medium, 22 % earthworms in untreated (control) substrate. The minimum (19 %) number of earthworms was found in jaggery and buttermilk containing medium. These results indicate that treatment of the substrate mixture with Spirulina and Trichoderma might be beneficial for vermicomposting.

IV. CONCLUSION

The stimulatory effect of Spirulina was more pronounced than the effect Trichioderma treatment. In conclusion of the present study it can be stated that Spirulina and Trichoderma can be used as probiotic and microbial inoculants during pre-decomposition period in order to get qualitative and quantitative improvement vermicomposting. Finally on the basis of present findings it may be concluded that:

[1] Trichioderma harzianum and Spirulina are is ideal inoculants that may be useful in reducing pre-decomposition time of lingo-cellulosic waste and thereby in enhancing vermicomposting process.
[2] Trichioderma harzianum is a microbial (fungal) agent that may be directly acting upon lingo-cellulosic substrates to impart its influence.
[3] Spirulina is nutrient rich food that may be acting as probiotic agent to stimulate growth and multiplication micro-organisms enhance the degradation of lingo-cellulosic waste to impart its influence.
[4] Inclusion of small amount of garden or farm yard soil is believed to increase the amount of cooperative bacteria and provides grit for better mixing –grinding of waste in the alimentary canal of earthworms.

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