ORIGINAL RESEARCH PAPER | Science | Volume - 7 | Issue - 4 | April-2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Vermiculture and Vermicomposting During Evaluation Of Physicochemical Properties of Eudrilus eugenae.

KEYWORDS: Physicochemical Properties, Eudrilus eugenae, Vermiculture, Vermicomposting.

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ABSTRACT In present investigation attempt has been made to study the Physicochemical Properties like PH, Temperature, Moisture, Salinity, Electrical conductivity, Nitrate, Phosphate, Chemical oxygen demand (COD) and Biological oxygen demand (BOD) from Eudrilus eugenae During Vermicomposting. Vermicomposting is the process by which worms are used to convert organic materials into a humus like material known as Vermicompost & the goal is to process the material as quickly & efficiently as possible. The Vermicompost has more available nutrients per kg weight than the organic substrate from which it is produced. The biological activity of earthworms provides nutrients rich Vermicompost for plant growth thus facilitating the transfer of nutrients to plants.

Introduction:-

Vermiculture is the culture of earthworms. The goal is to continually increase the number of worms in order to obtain a sustainable harvest. The worms are either used to expand a vermicomposting operation or sold to customers who use them for the same or other purposes (see "On-Farm Vermiculture" later in this manual).

Vermicomposting is the process by which worms are used to convert organic materials (usually wastes) into a humus-like material known as Vermicompost. The goal is to process the material as quickly and efficiently as possible.

These two processes are similar but different. If your goal is to produce Vermicompost, you will want to have your maximum worm population density all of the time. If your goal is to produce worms, you will want to keep the population density low enough that reproductive rates are optimized. Both of these processes will be described in some detail in this manual.

Chemical fertilizers which ushered the 'green revolution' in the 1950-60's came as a 'mixed blessing' for mankind. It boosted food productivity, but at the cost of environment & society. It dramatically increased the 'quantity' of the food produced but decreased its 'nutritional quality' and also the 'soil fertility' over the years. It killed the beneficial soil organisms which help in renewing natural fertility. It also impaired the power of 'biological resistance' in crops making them more susceptible to pests & diseases. Over the years it has worked like a 'slow poison' for the soil with a serious 'withdrawal symptoms'. To reduce all those toxic effects of chemical fertilizers, the world has again moved for the more conventional approach of using Vermicompost for the agriculture practice. Vermicompost is a nutritive 'organic fertilizer' rich in NKP (nitrogen 2-3%, potassium 1.85-2.25% and phosphorus 1.55-2.25%), micronutrients, and beneficial soil microbes like 'nitrogen-fixing bacteria' and 'mycorrhizal fungi' and are scientifically proving as 'miracle growth promoters & protectors' (Shina et al 2009). Kale and Bano report as high as 7.37% nitrogen (N) and 19.58% phosphorus as P_2O_5 in worms' Vermicast. Suhane, 2007 showed that exchangeable potassium (K) was over 95% higher in Vermicompost.

Vermicomposting is the process by which worms are used to convert organic materials (usually wastes) into a humus-like material known as Vermicompost. The goal is to process the material as quickly and efficiently as possible. These two processes are similar but different. If your goal is to produce Vermicompost, you will want to have your maximum worm population density all of the time. If your goal is to produce worms, you will want to keep the population density low enough that reproductive rates are optimized. Both of these processes will be described in some detail in this manual.

There are an estimated 1800 species of earthworm worldwide (Edwards & Lofty, 1972). the "compost worm", "manure worm", "red worm", and "red wiggler" .This extremely tough and adaptable worm is indigenous to most parts of the world and can be found on most Canadian farms wherever piles of manure have been left to age for more than a few months. (Greek for "upon the earth") – these worms live in the surface litter and feed on decaying organic matter. They do not have permanent burrows. These "decomposers" are the type of worm used in vermicomposting. The dry matter of an earthworm's body consists of 60-70% protein, 7-10% fat, 8-20% carbohydrate, 2-3% minerals, and a variety of vitamins (Edwards 1985).they can be used as a feed additive for fish, pigs, and poultry. We can fairly say that Vermicompost along with the earthworms are used to increase the plant and animal productivity respectively. So, vermicomposting has enormous possibilities that can be exploited in Nepal. It is the most important technology to be adopted by the agriculture in the 21st century. Anti-pyretic components were found in the earthworms Lumbricus spp and Perichaeta spp by Hori et al. Bhavnagar and Palta (2002) have reported that earthworms when ingested into our body system increase body heat and are of value in curing neural disorders, bronchitis and tuberculosis and in curing rheumatism. Mihara et. al (1991) have reported Lumbricus rubellus to be potentially very useful in treating thrombosis and in fact, orally administrated earthworm powder was found capable of digesting intravascular fibrin clots.

Over the last few years, as regulations for field application and disposal of animal manure has become more rigorous, the interest in using earthworms as an ecologically sound system for manure management has increased tremendously. Various researchers have examined the potential utilization of earthworm-processed wastes, commonly referred to as Vermicompost, in the horticultural and agricultural industries. Whether used as soil additives or as components of horticultural media, Vermicompost usually enhanced seedling growth and development, and increased productivity of a wide variety of crops (Edwards & Burrows 1988; Wilson & Carlyle 1989; Mba 1996; Bucker field & Webster 1998; Edwards 1998; Subtler et al. 1998; Atiyeh et al. 1999). Enhancement in plant growth and productivity has been attributed to the physical and chemical characteristics of the processed materials. Vermicompost are finely- divided peat-like materials with high porosity, aeration, drainage, and water-holding capacity (Edwards & Burrows 1988). They have a large surface area, providing strong absorption capability and retention of nutrients (Shi-wei & Fu-zhen 1991). They contain nutrients in forms that are readily taken up by the

Volume - 7 | Issue - 4 | April-2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

plants such as nitrates, exchangeable phosphorus, and soluble potassium, calcium, and magnesium (Orozco et al. 1996). Most of the research on utilization of earthworms in waste management has focused on the final product, i.e. the Vermicompost.

There are only few literature references that have looked into the process, by the action of earthworms as they fragment the organic matter, resulting in the formation of a Vermicompost with physicochemical and biological properties which seem to be superior for plant growth to those of the parent material. It has been reported that the storage of organic wastes over a period of time could alter the biochemistry of the organic matter and could eventually lead to the stabilization of the organic waste (Levi-Minzi et al. 1986). Nevertheless, we hypothesize that adding earthworms to the organic wastes would accelerate the stabilization of these wastes in terms of decomposition and mineralization of the organic matter, leading to a more suitable medium for plant growth. Changes of manure during processing by earthworms.

The main objective of this experiment was to estimate the primary changes in the Physicochemical properties of cow manure during processing by earthworms (vermicomposting) under controlled environmental conditions. To be compatible with agricultural uses and to avoid possible adverse effects on plant growth, organic wastes should be transformed into a humus-like material and be sufficiently stabilized for plant growth (Saviozzi et al. 1988).

Statement of the problem:-

Under the present condition of environ-mental degradation vermicomposting technology offers recovery of valuable resources like manure from such biodegradable waste. Even when the Vermicompost has all the good properties, it is still risky if the substrates used are rich in toxic chemicals .So, there are risks of vermicomposting hazardous wastes using earthworms. That means, if the earthworms are grown in organic wastes contaminated soil, they could be used to alleviate the metal concentration from the soil. This will have a direct impact on the productivity of that land and the soil could be again used for the agricultural purposes. Although earthworms can transfer hazardous organic wastes into stabilized value-added Vermicompost, it accumulates a certain amount of toxic metals in their tissues. The accumulation of chemicals in the tissues by these detritivorous organisms can, in principle, damage soil processes and local biodiversity indirectly if their activities and demographics are compromised, and directly if the residues are transferred via earthworms to organisms occupying different trophic levels (Morgan et al., 2001).

Objectives of the study:-

- Carry out vermicomposting using Eudrilus eugenae earthworm species
- Analyze the Physicochemical properties in Vermibed, Vermicompost, and the earthworms
- Determine the Physicochemical properties in Vermicompost and earthworms collected.

Materials and methodology:-

The earthworm species of Eudrilus eugenae, weighing 105–155 mg live weight were randomly picked from several stock cultures containing 500–1200 earthworms in each, maintained in the laboratory with cow dung as culturing material. Fresh waste of mammalian animals, viz., cow were collected from different animal farms of Rahuri taluka. The dung consisted of a mixture of fasces and urine without any bedding material. The main characteristics of animal waste. the samples were used on dry weight basis for biological studies and chemical analysis that was obtained by oven drying the known quantities of material at 110 °C. All the samples were analyzed in triplicate and results were averaged.

The plastic containers (diameter 16 cm, depth 14 cm) were filled with 100 g (DW) of each dung material. The moisture content of wastes was adjusted to 65– 75% during the study period by spraying adequate quantities of water. The wastes were turned over manually everyday for 15 days in order to eliminate volatile toxic gases. After 15 days, 5 clitellated hatchlings, each weighing 155–257 mg (live weight), were introduced in each container. Three replicates for each waste were maintained. All containers were kept in dark at temperature 25±1 °C. Biomass gain, clitella development and cocoon production were recorded weekly for 15 weeks. The feed in the container was turned out, and earthworms and cocoons were separated from the feed by hand sorting, after which they were counted, examined for clitella development and weighed after washing with water and drying them by paper towels. The worms were weighed without voiding their gut content. Corrections for gut content were not applied to any data in this study. Then all earthworms and feed (but no cocoons) were returned to the respective container. No additional feed was added at any stage during the study period. All experiments were carried out in twice and results were averaged. PH, Temperature, Moisture, Salinity, Electrical Conductivity, Nitrate, Phosphate, from Eudrilus eugenae during Vermicomposting.

a) Vermicomposting Bed.

Bedding is any material that provides the worms with a relatively stable habitat. This habitat must have the following characteristics:

I. High absorbency. Worms breathe through their skins and therefore must have a moist environment in which to live. If a worm's skin dries out, it dies. The bedding must be able to absorb and retain water fairly well if the worms are to thrive.

II. Good bulking potential. If the material is too dense to begin with, or packs too tightly, then the flow of air is reduced or eliminated. Worms require oxygen to live, just as we do. Different materials affect the overall porosity of the bedding through a variety of factors, including the range of particle size and shape, the texture, and the strength and rigidity of its structure. The overall effect is referred to in this document as the material's bulking potential.

III. Low protein and/or nitrogen content (high Carbon: Nitrogen ratio). Although the worms do consume their bedding as it breaks down, it is very important that this be a slow process. High protein/nitrogen levels can result in rapid degradation and its associated heating, creating inhospitable, often fatal, conditions. Heating can occur safely in the food layers of the Vermiculture or vermicomposting system, but not in the bedding.

Some materials make good beddings all by themselves, while others lack one or more of the above characteristics and need to be used in various combinations. Table 1 provides a list of some of the most commonly used beddings and provides some input regarding each material's absorbency, bulking potential, and carbon to nitrogen (C:N) ratios. OACC tested the first two materials in Table 1 – horse manure and peat moss – in a separate experiment within the EcoAction-funded pilot project in 2003-2004. Both materials performed well, with the horse manure having the edge. Since horse manure was available free of charge and is a renewable resource, it was used in the balance of the trial (See Appendix C for a full description of this experiment). If available, it is generally considered to be an ideal bedding. Its high C:N ratio (for a manure), good bulking characteristics (because of the high straw content), and relatively good moisture retention make it an excellent environment for E. fotida. It can be improved somewhat i

b) Earthworm culture and vermicomposting

About 4 week old 5oo adult earthworms were inoculated in each bin in triplicate. Eudrilus eugenae were used for the purpose. These worms were obtained from a local vermicomposting unit. Earthworms were cultured for 70 days until the bedding material was fully converted into Vermicompost. Earthworms were kept at 15-20OC. Humidity was maintained at 70-75% throughout the

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experiment.

Result and Discussion:-

At the end of the research, the earthworms were found to be active and burrowed at the base Eudrilus eugenae are widespread throughout tropical Asia, feeding on litter and humus and burrowing deep in the soil (Wall work 1983). After the experiment period, the worms, substrate, and the Vermicompost were analyze for the Physicochemical properties. The results obtained were that the Eudrilus eugenae , show in Table no.1.

Generally, earthworms need to consume great amount of soil to achieve their daily nutrition, during which the digestive process liberates heavy metals in their free forms in the gut lumen (Suther 2007). These freely available metals are then absorbed by the gut epithelial lining. This way, earthworms tend to accumulate considerable amount of the heavy metals within the cells in alimentary canal (Suther 2008).Among the worms,

Table No:-1. Physicochemical Parameter of Eudrilus eugenae During Vermicomposting

Sr. No.	Physicochemical Parameter	Vermicompost Sample
1.	Moisture(%)	46.07
2.	PH	7.2
3.	Temperature	36
4.	Electrical conductity(EC)	0.15
5.	Nitrate	1.9
6.	Phosphate	0.7
7.	Cu ppm	14
8.	Zn ppm	45

Conclusion:-

Form the research, we can safely conclude that the Vermicompost carried out by these worms was safe for agriculture use and could be very beneficial for increasing the productivity of our crops by using natural fertilizers rather than chemical fertilizers which we have to import from India. The worm tissue can also be safely used as feed for the animals such as poultry. The worm tissue is rich in amino acids and vitamins which can be given to animals as a food supplement. In Nepal's context, vermicomposting is the most promising technology that can have severe impact on Nepalese living standards.

Vermicomposting is set to become increasingly popular in the next century as it yields rich organic fertilizers, recover energy rich resources, safety disposes organic wastes and helps tackle environment problem such as landfill and expense of collecting and transporting this waste. Vermicomposting waste will produce no pollution or unusable residue making it a very effective form of recycling. It is an ideal example as the worm composting process resemble closely to the nature. The environment is being damaged by human activities and we are also keen for saving the environment. Earthworms are perhaps nature's most ingenuous solution for a cleaner environment. Vermicompost technology is very new for Nepalese farmers; therefore they need training on Vermicomposting and vermi culturing. Therefore, Ministry of Agriculture and Cooperative and Department of Agriculture should make policy on Vermicomposting and launch the program through DADO Offices. The cost of chemical fertilizer is increasing day by day and farmers cannot buy needed fertilizers, in this contest Vermicomposting technology is very necessary for our poor farmers.

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