PRODUCTION OF VERMI-COMPOST

AND

MANUFACTURE OF ANIMAL FEED FROM EARTH WORMS

MINOR PROJECT REPORT

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By

Dr.VALSALA A.D.

Associate Professor

Sacred Heart College

Chalakudy,Kerala

Thrissur-680307

1.1 Introduction:

The importance of earthworms in the breakdown of organic matter and the release of the nutrients that it contains has been known for a long time (Darwin 1881). It has been demonstrated clearly that some species of earthworms are specialized to live in decaying organic matter and can degrade it into fine particulate materials, rich in available nutrients, with considerable commercial potential as plant growth media or soil amendments (Edwards and Bohlen 1996). Vermicomposting is an important component of organic farming which converts rural and urban bio-wastes into nutrient rich organic manures. Exploitation of earthworms for production of various by products is a recent development in biological sciences (Graff, 1981).

Many mammals and birds prey on earthworms in nature. Earthworm has been found to be a good source of protein (Hilton, 1983), it uses as fish bait is well known in fishing. Earthworm contains 60-70% protein and high in essential amino acid (lysine and methionine) compared with meat or fish meal (Sigh *et al*., 1978). Ngyuon and Yang, (2007) reported that earthworm powder-based diet contains 6-11% of fat, 5-12% of carbohydrate and 2-3% of minerals and various types of vitamins. It has been suggested that earthworms contain sufficient high quality protein to be considered as bred animal food, and this potential of earthworms in animal feed has been confirmed by full analyses of the body tissues of earthworms, which show the kinds of amino acids that they contain and the nature of the other chemical body constituents. In addition, earthworm tissues contain preponderance of long-chain fatty acids, many of which cannot be synthesized by non-ruminant animals and also have an adequate mineral content. They contain an excellent range of vitamins and are rich in niacin, which is a valuable component of animal feeds, and they are an unusual source of vitamin B_{12}. The overall nutrient spectrum of earthworm tissues shows them to have an excellent potential as a protein supplement to feed for fish, poultry, pigs, or domestic animals.

Large numbers of earthworms can be bred in a range of organic wastes, with a conversion ratio for waste to earthworm biomass of about 10%. They can be separated from the wastes mechanically and processed into dry or wet animal feed supplements that can be used in the diets of fish, poultry and pigs as 15% protein supplements. Earthworms can outperform other protein sources, such as waste fish or soybeans, in terms of animal weight gain, growth and nitrogen retention by fish, poultry and pigs (Sakthika, 2014).

Research into vermicomposting and commercial projects has been developed in many countries, including England, France, the Netherlands, Germany, Italy, Spain, Poland, the United States, Cuba, Mexico, the Bahamas, China, Japan, the Philippines, India and other parts of Southeast Asia, including Australia, New Zealand, America Samoa, and Hawaii, and many countries in South America .

As the land utilization for agricultural purposes by using chemical fertilizers and nutrients has led to transgression of the production and losing of soil fertility, vermicomposting by vermiculture is an alternative option to increase soil fertility. The dumping of organic waste into a pit and the bio-conversion of waste to vermicompost takes only 3-4 months. Thus there is a tremendous scope to convert the bio-degradable waste into organic manure through vermicomposting.

Earthworm pellets can be substituted for animal feed as it has rich source of nutrients and can be made in a cheaper method. Also vermicomposting technology has promising potential to meet organic manure requirement in both irrigated and rain fed areas. It has tremendous prospects in converting agro-wastes and city garbage into valuable agricultural and animal husbandry inputs. This prompted us to undertake this particular project.

The present study was conducted in the college campus. We have an eco-friendly environment with plenty of plants which provide an ideal environment for the growth of earthworms. Earthworms are identified and cultured in organic waste, from the campus i.e., kitchen waste from canteen, college hostel and food leftovers from the students.

1.2 Objective of the study:

As the land utilization for agricultural purposes by using chemical fertilizers and nutrients has led to transgression of the production and losing of soil fertility, vermicomposting by vermiculture is an alternative option to increase soil fertility. The dumping of organic waste into a pit and the bio-conversion of waste to vermicompost takes only 3-4 months. Thus there is a tremendous scope to convert the bio-degradable waste into organic manure through vermicomposting.Also we know that earthworms are rich in high quality protein (65 %) and is

'complete protein' with all essential amino acids. There is 70-80 % high quality 'lysine' and 'methionine'. Glutamic acid, leucine, lysine & arginine are higher than in fish meals. Tryptophan is 4 times higher than in blood powder and 7 times higher than in cow liver. Worms are also rich in Vitamins A & B. There is 0.25 mg of Vitamin B_1 and 2.3 mg of Vitamin B_2 in each 100 gm of earthworms. Vitamin D accounts for 0.04 – 0.073 % of earthworms wet weight. Thus worms are wonderful pro-biotic feed for fish, cattle and poultry industry (Dynes, 2003). They are being used as 'additives' to produce 'pellet feeds' in the USA, Canada and Japan (Kangmin, 2005). Thus earthworm pellets can be substituted for animal feed as it has rich source of nutrients and can be made in a cheaper method. Also vermicomposting technology has promising potential to meet organic manure requirement in both irrigated and rain fed areas. It has tremendous prospects in converting agro-wastes and city garbage into valuable agricultural and animal husbandry inputs. This prompted us to undertake this particular project.

1.3 Materials and methods:

Materials of the present study include the earth worm, *Eudrilus eugeniae* and *Eisenia foetida*. These particular earthworms were chosen because of its re-existence to extreme condition, voracious feeding nature, high reproductive rate and able to survive handling and efficient in waste processing. These earthworms were procured from the Koodapuzha extension Centre of Kerala Agricultural University, Chalakudy and Periyar EVR Memorial College, Thiruchirapalli.

Production of vermicompost:

Well rings were erected into the earth. The bottom of the pit was sealed by concrete. Each ring has an outlet to remove excess water. At the bottom of the ring broken bricks were placed here and there. Few coconut husks were also spread in one corner of the ring. Finely cut pieces of plantain sheath was spread $^1/_4$ the length of the ring. Cow dung slurry was sprinkled on the finely cut pieces of sheath of plantain. Inoculums of earthworms were introduced into organic debris. Every alternate day other organic wastes like vegetable waste, dried and fallen leaves from the College garden were introduced into the ring and also the diluted cow dung sprinkled on the organic wastes. The organic matter was stirred occasionally for uniform spreading of the earthworms. Moisture content, temperature and P^H were maintained at an optimum level. Vermicomposting set-up was kept moist by sprinkling water whenever necessary. Therefore the beds were neither dry nor soggy. The bed was turned over on every fifth day with the help of a

forked spade. During this, care was taken to avoid injury to the worms. The bed was covered with lid to prevent predators.

Vermiwash is collected through the outlet regularly. It is the coelomic fluid of earthworms and is very useful for the growth and even develops resistance in crops.

The containers were observed and watered regularly. The presence of earthworm castings was detected by the appearance and presence of granular particles. It was harvested from the containers by the following process. The compost was taken out carefully and placed in the form of a cone in bright sunlight in order to force the earthworms to move to the lower layers. The earthworms were removed from the lower layers and dried. Drying in sunlight did not produce the expected results, so an alternative drying method i.e. in a hot air oven was tried and it was very successful. The dried earthworms were made to grind using a grinder. The process repeated to get sufficient quantity of earthworm powder.

The vermicompost was collected by removing the upper layers and spreading out on a flat surface to dry. The compost was then analyzed for their biochemical characteristics.

Production of animal feed from earthworm :

Eisenia foetida was selected for the production of animal feed. As it is tolerant to extreme condition, voracious feeding nature, high reproductive rate and able to survive handling.

Every fortnight after the introduction of inoculums, samples were taken randomly from the ring and observed their growth. After the complete maturation of earthworms, about 100g were taken out every day and dried in an incubator. Then the dried earthworms were made to grind using a grinder. The earthworm powder was mixed with starter (earth worm meal) in the ratio, 2:1.About ten chicks of two months old were taken for the experiment, five chicks for control and five for experiment respectively. Control chicks were given only starter where as experimental group were given earth worm meal regularly for one month. Growth of the chicks was observed and measured their weight.

1.4 Result:

The earthworms were multiplied rapidly within 60 days of introduction of the inoculums. The initial weight of control chicks were doubled when starter was given as poultry

feed. When earthworm powder alone was given to experiment chicks, they didn't accept as such. But they accepted the same when earthworm with starter. The experiment group showed an increase in their weight after one month than control chicks. The growth of control and experiment chicks when fed with two types of poultry feed are shown in table 1 and table 2 respectively.

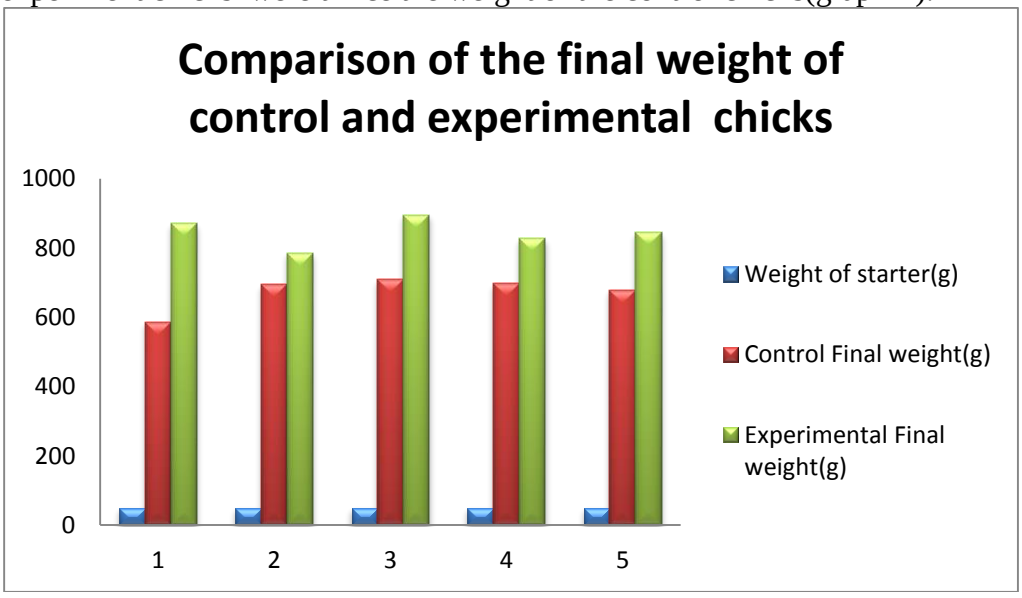
Table 1.The growth of control chicks when fed with starter alone

Weight of starter(g)	Initial weight of chick(g)	Final weight(g)
50	310	586
50	387	695
50	347	708
50	350	698
50	361	678

Table 2.The growth of experimental chicks when fed with earthworm + Starter

Weight of starter(g)	Initial weight of chick(g)	Final weight(g)
50	320	871
50	399	785
50	337	895
50	354	827
50	369	844

When the final weight of control and experiment chicks were compared, the growth of experiment chicks were thrice the weight of the control chicks(graph-1).



Graph- 1,Comparison of the final weight of control and experiment chicks

1.5 Conclusion:

From the present study we could derive that earthworms can be good poultry feed. Earthworm with starter when given, we could observe that an enormous increase in the weight of chicks within one month when compared to starter alone. Our studies go well with the study of other researchers in this field. Ngyuon and Yang, (2007) reported that earthworm powder-based diet contains 6-11% of fat, 5-12% of carbohydrate and 2-3% of minerals and various types of vitamins.

Vermimeal produced from cultured *P.excavatus* and *E. eugeniae* has been found to be an efficient and cost-effective replacement for fishmeal in the diets of the cage-cultured freshwater fish (*Oreochromis niloticus*) and poultry (chicken and quail). Feeding of dried earthworms (*E. eugeniae*) to the freshwater shrimp (*Macrobrachium idella*) also gave better results compared to feeding with dried fish (*Therapon plumbeus*) in ponds. The presence of a blood clot delaying factor, important saturated and unsaturated fatty acids and a fibrinolytic enzyme was demonstrated in the extracts of *E.eugeniae* which could be potential vermiceuticals (pharmaceuticals) for human medicine application.(Rafael D. Guerrero III 2009)

Roghaye Fadaee (2012) has described in their study that Earthworm meal can also be obtained in the production of vermin-compost. In this way that the appropriate volume of earthworms can be placed in a suitable temperature in the oven and after drying use as powder. At this time, significant percentage water is lost through the worm body and can be considered as an appropriate protein source in feed for poultry.

A range of different methods of processing the earthworms into materials suitable for animal feed has been developed (Edwards *et al* 1998). Though the authors spoke of the labour intensive technologies and economically not feasible methods of production of animal feed we found that present method we adopted were economically feasible and not much labour intensive.So the present study is more relevant.