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C: N RATIO OF VERMICOMPOST OF *EISENIA FOETIDA* TREATED WITH NITROGENOUS FERTILIZER UREA

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Abstract: Soil organic and inorganic fertilizers are important for agricultural sustainability because of their possible beneficial effects on soil properties and long-term soil productivity. The chemical fertilizers, no doubt are the important sources, which can meet the nutrient requirements but their unbalanced and continuous use lead to environmental pollution and deterioration of soil physiochemical properties. The temperature, pH value and C: N ratio of organic wastes used in vermicomposting is also important factors influencing the growth and survival of earthworms (Hou et al., 2003). The C: N ratio is the critical factor that limits earthworm population. When the C: N ratio of the feed material increases, it becomes difficult to extract enough nitrogen for tissue production.
Keywords: Vermicompost, Earthworms, Eisenia Foetida, Urea, Chemical Fertilizer, Soil.

INTRODUCTION

Soil is an essential element of agriculture and the soil fauna, its intrinsic component, obviously affects its agricultural value [1, 2 & 3]. Most soils are naturally quite fertile, but to maintain this sometimes fertilizers are needed. Organic and inorganic fertilizers contain a range of nutrients in different proportion. On most soils the nutrient that need to be added regularly are nitrogen - for vigorous growth, phosphates - to encourage flowering and fruiting and potassium - for strong roots. Organic is popular alternative to synthetic fertilizers primarily because it is natural, adds nutrient- rich matter to the soil, and improves the structure of soil. Intensive agriculture with the use of chemical fertilizer in large amount has no doubt resulted in manifold increase in the productivity of farm commodities but the adverse effect of these chemicals are clearly visible on the soil environment including soil physiochemical properties and soil organisms as well as on the quality of food and fodder [4, 5 & 6]. The manufacturing of chemical fertilizer is heavily dependent on energy derived from fossil fuel which is getting depleted at a very fast rate. Agricultural activities have become the dominant ecological force over nearly one third of the land areas of the earth. The fertilizers have become an integral part of agricultural economy as they increase the plant nutrient levels and enable them to support high yields. Soil organic and inorganic fertilizers are

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important for agricultural sustainability because of their possible beneficial effects on soil properties and long-term soil productivity. The chemical fertilizers, no doubt are the important sources, which can meet the nutrient requirements but their unbalanced and continuous use lead to environmental pollution and deterioration of soil physiochemical properties. Residual effects of applied organic and inorganic soil fertilizers on soil properties vary based on different factors, including type, rate and timing of application and soil characteristics. Among the most important factors influencing the properties of soil are the type of soil management and fertilization. The changes in soil quality are closely related to soil physical, chemical and biological fertility [7, 8]. Nitrogen fertilization is the most influential in terms of increasing crop production. The ratio of carbon content (%C) and nitrogen content (%N) of a substance is termed carbon to nitrogen ratio which is expressed as C: N ratio. It expresses the relative amounts of the two elements. If the C: N ratio is wide, the amount of C is much higher over the amount of nitrogen whereas, if the C: N ratio is narrow, the amount of C is slightly higher over the amount of nitrogen. This C: N ratio influences the nitrification process.

Another important attribute of earthworm in soil conditioning is their ability to lower the C/N ratio of the litter, by combustion of carbon during respiration. This is very important because plants cannot assimilate mineral N_2 unless C/N ratio is around 20:1 [9].

MATERIALS AND METHOD

***Eisenia foetida*:** Earthworms (*E. foetida*) were procured from the vermicomposting unit of Rajasthan College of Agriculture, Udaipur. They were maintained under laboratory conditions and acclimatized for 15 days prior to the experimental set up. Mature worms with well-developed clitellum were used in the experiment.

Preparations of Worm bed: Plastic tubs were used for preparation of soil bed. Dried soil (from nearby farmland) was crushed and filtered through a fine mesh sieve. Worm beds were prepared with 1: 1 ratio of soil and cow dung (to avoid starvation of the worms) in which 20 mature worms of *Eisenia foetida* were introduced.

UREA (46% N): The inorganic fertilizer used in the experiment was Urea which was purchased from the local market.

Addition of Urea: The Urea dose being practically applied in the local agricultural lands for the Kharif crop was found to be 174 kg/ hectare of land area. Here, in our experimental set up the soil bed contained 1 kg of soil and cow dung mixture made in the ratio of 1:1. Therefore, the calculated value of Urea for the soil bed was 3.48gm/ kg of soil. In addition to the dose

being practiced by the farmers i.e. 3.48gm/ kg, three more doses of Urea were set viz. 0.75gm/ kg, 1.5gm/ kg, and 2.25gm/ kg.

OBSERVATIONS

The observation of our study has been presented in Table 1.0. In this, chemical analysis of the final vermicompost in all the experimental set has been shown.

Table 1.0 Chemical analysis of Vermicompost

S.No.	Initial Soil	Control Set	Urea 0.75 gm/kg	Urea 1.5 gm/kg	Urea 2.25 gm/kg
OC	1.300 ± 0.100	4.200 ± 0.173	5.600 ± 0.200	4.700 ± 0.100	4.230 ± 0.026
OM	2.237 ± 0.175	7.237 ± 0.300	9.650 ± 0.105	8.330 ± 0.265	7.287 ± 0.047
Total N	0.125 ± 0.006	0.314 ± 0.004	0.360 ± 0.005	0.403 ± 0.006	0.464 ± 0.005
Avl N	0.026 ± 0.004	0.085 ± 0.004	0.087 ± 0.006	0.102 ± 0.009	0.126 ± 0.006
C:N	10.380 ± 0.828	13.333 ± 0.379	15.533 ± 0.351	11.600 ± 0.346	9.103 ± 0.155

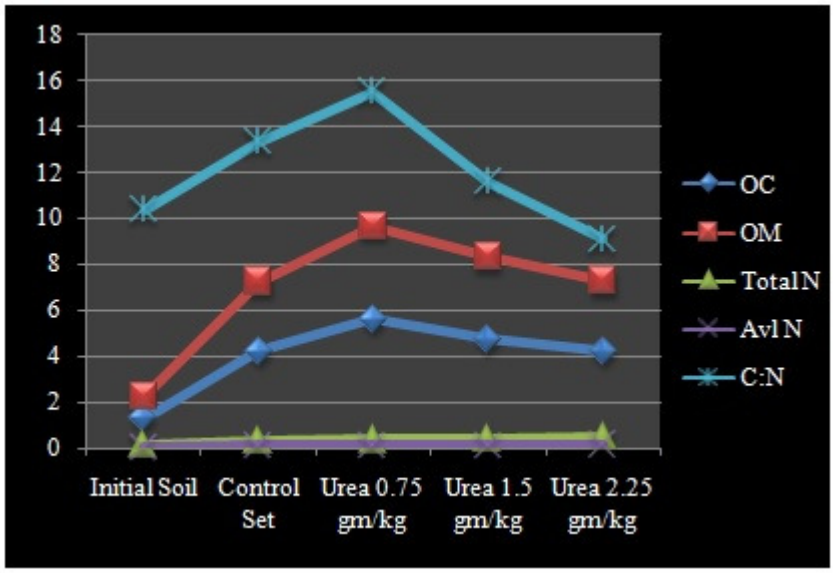

Fig 1 (a)

RESULT & DISCUSSION

The initial feed of worms of *Eisenia foetida* had an organic carbon with value of 1.300 ± 0.100 % which implies towards low carbon content. The soil analysis done at the end of experiment for determining OC of the end product showed an increased value for this parameter in all the sets including the control. The OC of soil in control set was found to have

4.200 ± 0.173 %. Similarly, OC for the chemical fertilizer Urea in 0.75gm, 1.5gm, 2.25gm ranged to be 5.600 ± 0.200 %, 4.700 ± 0.100 % and 4.230 ± 0.026 % respectively. The OM content in the initial soil was 2.237 ± 0.175 %. The OM in all the treated sets and the control set found to increase when calculated at the end of experiment. OM in the control set was 7.237 ± 0.300 %, In Urea 0.75gm, 1.5gm, 2.25gm it ranged to 9.650 ± 0.105 %, 8.330 ± 0.265 % and 7.287 ± 0.047 % respectively. The total nitrogen content of the initial soil was found to be 0.125 ± 0.006 %. Analysis of soil in all the sets at the end of 60 days revealed that there was seen variation in TN values. The control soil had TN of 0.314 ± 0.004 %. In the chemical fertilizer Urea, with treatment of 0.75gm, 1.5gm and 2.25gm, the soil showed TN content of 0.360 ± 0.005 %, 0.403 ± 0.006 % and 0.464 ± 0.005 % respective to the doses. In the initial soil, the available soil nitrogen was 0.026 ± 0.004 %. By the end of our experiment, the soil in control set without any treatment, recorded with 0.085 ± 0.004 % available N. AN under Urea dose 0.75gm, 1.5gm and 2.25gm calculated as 0.087 ± 0.006 %, 0.102 ± 0.009 % & 0.126 ± 0.006 % respectively. The ratio of C: N in control set as recorded to be 13.333 ± 0.379 which increased from the initial soil C: N of 10.380 ± 0.828. In Urea Exp. set 0.75gm, 1.5gm, 2.25gm, value for this ratio was found as 15.533 ± 0.351, 11.600 ± 0.346 and 9.103 ± 0.155, which showed decreasing trend with increasing dose of Urea.

The C: N ratio is the critical factor that limits earthworm population. When the C: N ratio of the feed material increases, it becomes difficult to extract enough nitrogen for tissue production. [10] found that when C/N ratio of material is 25 [11], earthworm can grow better. Some other researchers reported that 20 is the suitable C/N ratio [12]. [13] have recorded reduction in C/N ratio during composting process. The reduction in carbon and lowering of C/N ratio in the vermicomposting could be achieved either by the respiratory activity of earthworms and microorganisms or by increase in nitrogen by microbial mineralization of organic matter in combination with the addition of the worm's nitrogenous wastes through their excretion [14].

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