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A preliminary study on the earthworm castings of *Eisenia fetida* from BT cotton fields of Medak, Telangana

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Abstract

Earthworm castings are organic in nature, they are rich in nutrients. Earthworm castings and soil samples of both Bt and non BT crop fields were collected. In the present study physical and chemical properties of earthworm casts and the soil parameters like pH, electrical conductivity (EC), organic matter, Nitrogen, Phosphorus and Potassium were analyzed. The pH of cast is almost similar in the BT and non BT fields. However, the castings pH was slightly more. There is a significant difference in Nitrogen content of Castings and that of both the crop fields. The phosphorous of cast is almost double to the levels of both BT and non BT fields and there is much significant difference and castings possess greater exchange property for Potassium ions. Potassium levels were more in casts compared to the soil samples. Earthworms play a major role in supplying organic matter to the soil food webs and make it more available to other soil microorganisms.

Keywords: Earthworm castings, nitrogen, phosphorous, potassium, organic matter, pH

Introduction

The planet earth was bestowed with a vast variety of biological diversity. Ecological balance is inevitable for the survival of every living organism. Every organism has their own role and significance in the Nature and the interactions like prey-predator, host-parasite relationship and in the form of food web. Every living organism is interconnected either for food is for shelter in many dimensions. The human population is ever increasing day by day and food grain production has to be amplified multifold in a proportionate manner. Therefore, it necessitated Green Revolution that and it had resulted in dumping of pesticides, application of enormous amount of fertilizers and subsequently resulted in change in the very basic nature of different ecosystems apart from soil health. Detritus organisms maintain the soil health condition.

Microorganisms like bacteria are the most abundant successful group of organisms in the soil followed by fungi. Apart from microorganisms; nematodes, arthropods, and earthworms too inhabit in the soil. Earthworms are one of the decomposing organisms; they are popularly called as soil engineers, they are distributed in all types of soils except in acidic soils and they have significant role in soil fertility^[1]. The role of earthworms in nutrient recycling has widely studied^[2]. They also called as biological drivers.

Earthworms are soil dwelling, make burrows; they increase soil fertility and even strengthen the physical properties such as porosity and improve drainage. Feeding and borrowing behavior of earthworms is of paramount significant and it is advantages to the soil and terrestrial ecosystems too. Decomposition of detritus material results in mineral recycling. They increase mineralization and water infiltration^[3]. They provide incredible ecosystem services^[4] Lavelle, 2016.

More than 450 species of earthworms were reported from India^[5]. Several studies were conducted from tropical parts of India^[6, 7, 8].

Earthworms play important role in the soil ecosystem influencing soil properties regulating underlying ecosystem functions such as soil organic matter decomposition and soil erosion and quantifying their influence on organic matter cycling in tropical ecosystems.

The casts produced enhance microbial activities in soil that promote nutrient cycling and help in aggregate formation and stability in soil. Soil is a prime component of ecosystem in the form of substratum and an important resource to mankind. It contains organic matter, nutrients, water etc. Soil analysis is the most employed accurate method to measure soil fertility.

Litter is the major portion of earthworm's feeding material and most of the material is excreted in the form of castings^[9]. They are rich in humic acid, organic carbon, N, P, K and other micro nutrients apart from the activity of micro-organisms^[10, 11]. They are the repertoires of essential nutrients; they promote fertility, productivity and health of the soil. Castings are excellent soil adjuvant in addition to biofertilizers activity.

pH, electrical conductivity, organic matter (%C) and N, P, K elements are the significant factors that influences the biota on the plant growth. The soil physico-chemical characteristics like pH, organic matter, nitrogen (N), phosphorus (P), Potassium (K) etc. are influenced by earthworms as they associate with soil particles, and mediate organic matter transfer. They enhance N mineralization from organic matter.

Therefore, in view of importance of soil's physical and chemical properties; analysis of soil and the earthworm castings of *Eisenia fetida* from the BT and non BT Cotton crop fields were conducted during 2019-2020 period.

Material and Methods: The study was conducted in BT and non BT Cotton crop fields at Chandanagar, Medak

district of Telangana, a state in peninsular part of southern India to know the impact of Cry protein on the castings and soil fertility. The study site is located between 17.48 latitude and 78.31 longitudes. The annual rainfall is around 1322.4 mm in the year 2020 and it is a semi-arid zone. Telangana receives rain from southwest monsoon. Annual mean maximum temperature of the district is 32.44 °C and minimum is 24.31 °C. The mean minimum temperature is recorded during December (17 °C) and maximum in May (42 °C).

Soils were collected randomly from five different sites by quadrant method. Cast samples were collected in three replicates of 50 g each by fine brush. The collected samples were a dried, grounded and the passed through 2 mm sieve and further analysed for nutrients.

The chemical properties of soil samples were determined by following standard protocols. Soil pH and EC were analyzed by using pH meter and EC meter with 1:2 and 1:2.5 soil water suspensions respectively. Soil organic carbon was determined by using Walkley and Black method^[12]. Available nitrogen was analyzed by alkaline permanganate method^[13].

Available phosphorus was analyzed by using sodium bicarbonate method^[14]. Available potassium was analyzed by using neutral normal ammonium acetate method^[15].

Results and Discussion

Chemical properties of both Bt and non Bt soil samples and castings were presented in Table 1 and Fig 1.

Table 1: Chemical variables of the soil and earth worm castings

Soil characteristics	Bt	Non Bt	Earthworm casting
pH	7.20 ± 0.017	7.21 ± 0.030	7.86 ± 0.097
EC	0.75 ± 0.024	0.75 ± 0.074	0.68 ± 0.147
Organic matter (%C)	0.61 ± 0.057	0.63 ± 0.043	1.24 ± 0.287
N kg/hectare	213 ± 0.576	215 ± 0.243	265 ± 0.026
P kg/hectare	32.61 ± 0.974	31.81 ± 0.574	59.41 ± 0.712
K kg/hectare	396 ± 1.237	391 ± 1.435	507 ± 0.521

The pH of cast is almost similar in the BT and non BT fields. There is no significant difference in the pH of soil samples collected. The castings pH was slightly more and many studies revealed that the pH of earthworm casts is (7.86) more than the soil^[16].

There is a significant difference in Nitrogen content (265) of Castings and that of both the crop fields; castings promote nitrogen availability to plants^[17].

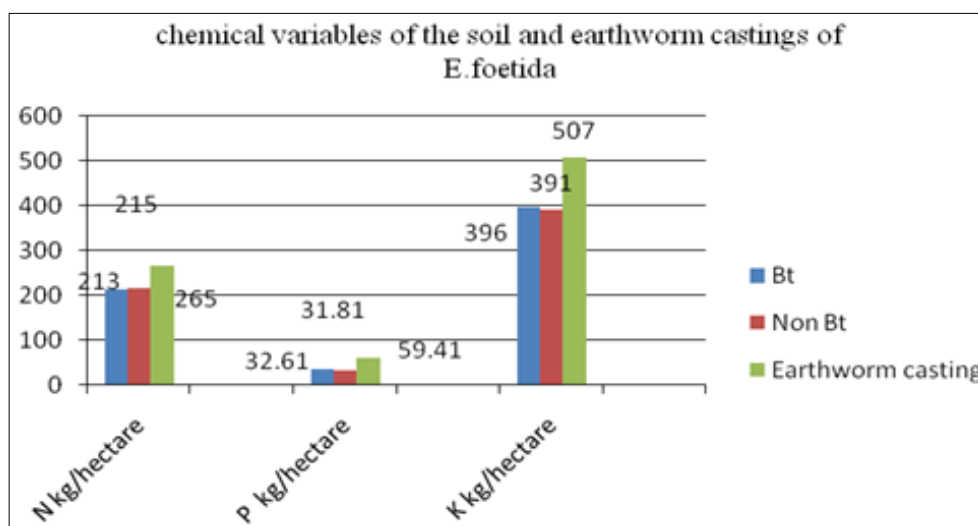


Fig 1: Representing the chemical variables of the soil and earth worm castings

The phosphorous of cast is almost double (59.41) to the levels of both BT and non BT fields. There is much significant difference and castings possess greater exchange property for Potassium ions. The microbial activity and Nitrogen fixation in the soil results in gain of N. the present findings are in concurrence with the earlier reports^[18, 19]. Potassium levels were more (507) in casts compared to the soil samples. Earthworms play a major role in supplying organic matter to the soil food webs and make it more available to other soil microorganisms.

Under adverse conditions, more energy is needed and the metabolic rate increases. This enhanced activity cause soil particles in the gut to be ground more finely, and enhances the release of nutrients from bound N, P, and K in the soil and this supports the higher levels of these nutrients in earthworm castings^[20].

Conclusions

From the present study, higher levels of N, P, K, organic matter was observed and it suggests the nutrient rich condition in the castings. pH value is slightly more than the soil and it is favorable for the growth of Earthworm, they usually prefer alkaline conditions.

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