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Effect of Biomanuring on Earthworms population under organic cotton

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Abstract
A field experiment was conducted during *kharif* season of 2019-20 and 2020-21 at Centre for Organic Agriculture Research and Training field, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The results after experiment indicated that, additions of nutrients through organic nutrient sources with alone and in combination were significantly influenced population of earthworms. The combined split application of vermiwash @ 10% applied by means of drenching and soil application of compost @ 3 t ha^{-1} and neem cake @ 500 kg ha^{-1} recorded significantly maximum (56666.67 ha^{-1}) population of earthworms and minimum population was found in alone application of jivamrut @ 10% (40000.00 ha^{-1}) applied in four equal splits during second crop cycle of cotton i.e. 2020-21.

Keywords: Cotton, biomanuring, earthworms

1. Introduction
In India the first green revolution tremendously enhanced the agricultural production but on the other hand abundant use of synthetic fertilizers, growth promoter's, pesticides and improved seed varieties, adversely affected ecosystems like soil, water and food contamination and gene pool of wild seeds. Also indiscriminate use of chemical fertilizers and synthetic pesticides disturbs the texture and physico-chemical properties of soil as well as affect the human health and caused environment hazards. The second green revolution started as organic farming and organic farming is a system of natural farming which helps to fulfill requirement of the food and nutrition of society without depleting the essential natural resources of agriculture (Sundararasu and Jeyasankar, 2014) [5]. Around 3600 types of earthworms are found in the world and are signified from every soil type of the globe (Verma and Prasad, 2005) [6].

Earthworms are an important organism in the soil doing great service for mankind for millions of years now. It combines immense social, economic and environmental values together which is now being realized and recognized. Earthworms are often referred to as farmer's friends and nature's ploughmen. Earthworms are natural ploughers of the soil throughout day and night, maintaining the fertility and porosity of the soil. Earthworms play a key role in the biology of soil as versatile natural bioreactors. The earthworms, work as "fine drainage maker", which not only improve the water and air circulation in the soil, but also mixing of organic and mineral substances. During their feeding, they promote increased microbial activity, which in turn accelerates the breakdown of organic matter and stabilization of soil aggregates. Earthworms degrade all types of organic wastes such as agricultural wastes, animal droppings, weeds, forest litter and agro-industrial wastes, favour faster development of worms and eventual compost production.

Earthworms play a vital role in converting organic wastes to useful vemicompost. The dead worm's tissue discharges nitrogen in form of nitrates 25%, ammonia 45%, organic soluble compound 3% and other material 27% (Satchell, 1967) [3]. Also they feed on dead organic substances present in soil that is ingested together and after digestion, along with the undigested food is finally egested in the form of worm casting (Subbarao, 2002) [4]. These materials improve the nutrient quality of vermiwash.

keeping this view in mind, attention has been focused on the biomanuring by utilizing different sources of nutrients *viz.* jivamrut, cow dung slurry, vermiwash, vermicompost, compost and neem cake. Though the different sources which are applied in alone and in combination had been given due importance, the perfect combination on which population of earthworm were

recorded to be maximum yet to be quantified. Hence present investigation was carried out to assess the average population of earthworm under organic cultivation on cotton crop.

Material and Methods

A field experiment was conducted during *kharif* season of 2019-20 and 2020-21 at Centre for Organic Agriculture Research and Training field, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to study the effect of biomanuring on earthworms population under organic cotton. The soil of the experimental site was medium, black in colour with good drainage. The experiment was laid out in Randomized Block Design. The nine treatments were replicated thrice. The treatments were Application of Jivamrut (10%) in four equal splits 20, 40, 60 and 80 DAS (T_1), Application of Cow dung slurry (10%) in four equal splits 20, 40, 60 and 80 DAS (T_2), Application of Vermiwash (10%) in four equal splits 20, 40, 60 and 80 DAS (T_3), T_1 + Compost @ 3 t ha^{-1} + 500 kg ha^{-1} Neem cake (T_4), T_2 + Compost @ 3 t ha^{-1} + 500 kg ha^{-1} Neem cake (T_5), T_3 + Compost @ 3 t ha^{-1} + 500 kg ha^{-1} Neem cake (T_6), Application of Compost @ 10 t ha^{-1} in four equal splits 20, 40, 60 and 80 DAS (T_7), Application of Vermicompost @ 5 t ha^{-1} in four equal splits 20, 40, 60 and 80 DAS (T_8) and Control - Biomulching of sunhemp at 35 DAS (T_9). Sowing was done by dibbling on 27th June 2019 and 17th June 2020. Data on earthworm population was analyzed by analysis of variance (Panse and Sukhatme, 1978) [2]. *Eisenia foetida* species of earthworm was observed. At flowering stage of 2020-21, population of earthworms counted in square meter area of each treatment plot and then converted into hectare area and mean was work out.

Result and Discussion

The data regarding of earthworm count recorded during the present experiment are placed in Table 1 and showed in plate I. The mean of earthworm was observed to be 47407.41 ha^{-1} at flowering during 2020-21.

Table 1: Earthworm count ha^{-1} at flowering stage as influenced by different treatment during 2020-21.

Treatment	2020-21	
	Square meter area	Per ha
T_1: Application of Jivamrut (10%) in four equal splits 20,40,60 and 80 DAS	4.00	40000.00
T_2: Application of Cow dung slurry (10%) in four equal splits 20,40,60 and 80 DAS	4.33	43333.33
T_3: Application of Vermiwash (10%) in four equal splits 20,40,60 and 80 DAS	4.67	46666.67
T_4: T_1 + Compost @ 3 t ha^{-1} + 500 kg ha^{-1} Neem cake	4.33	43333.33
T_5: T_2 + Compost @ 3 t ha^{-1} + 500 kg ha^{-1} Neem cake	5.33	53333.33
T_6: T_3 + Compost @ 3 t ha^{-1} + 500 kg ha^{-1} Neem cake	5.67	56666.67
T_7: Application of compost @ 10 t ha^{-1} in four equal splits 20,40,60 and 80 DAS	5.33	53333.33
T_8: Application of Vermicompost @ 5 t ha^{-1} in four equal splits 20,40,60 and 80 DAS	4.33	43333.33
T_9: Control (Biomulching of sunhemp at 35 DAS)	4.67	46666.67
S.Em±	0.19	1870.28
CD at 5%	0.56	5607.09
General mean	4.74	47407.41

The significantly higher population of earthworms recorded with combined application of vermiwash applied through drenching @ 10% along

Plate I: Earthworm count ha^{-1} at flowering stage as influenced by different treatment during 2020-21.

with soil application of compost @ 3 t ha^{-1} and neem cake @ 500 kg ha^{-1} (T_6) was 56666.67 ha^{-1} and this was found comparable with cow dung slurry applied in combination with compost and neem cake (T_5) and alone application of compost @ 10 t ha^{-1} applied in four equal splits (T_7). The least population of earthworm recorded with alone application of jivamrut @ 10% applied in four equal splits (40000.00 ha^{-1}).

Higher population of earthworms might be due to sufficient moisture availability in soil resulted in more population of earthworms. Also might have attributed due to more readily availability of nutrients from compost. A fully decomposed compost contains a large proportion of earthworm casts. Addition of compost to soil affects soil microorganisms directly by providing source of nutrient and indirectly by changing chemical and physical soil properties which stimulate microbial growth and activity including earthworm's population. Neem seed cake as a form of organic manure on decomposition, promotes an increase in soil microbial communities along with earthworms and this in turn will affect the growth and yield of crop. Similar kind of results were recorded by Duong, 2013 [1].

Conclusion

Vermiwash @ 10% applied along with compost @ 3 t ha-1 and neem cake @ 500 kg ha-1 was found to be best treatment for recording average population of earthworms during 2020-21.

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