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Standardization of Vermi-Composting Technology for Cold Arid Conditions of Kargil

Nazir Hussain[1], Anwar Hussain[2], Mansoor Hussain[1], Mohd Mehdi[1], Nassreen Fatima[1], Eajaz Ahmad Dar[*1]

[1]Krishi Vigyan Kendra, Kargil (SKUAST-K)-194103

[2]High Mountain Arid Agricultural Research Institute, Leh (SKUAST-K)-194101

*Corresponding Author E-mail: darajaz9@gmail.com

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ABSTRACT

The present investigation entitled "Standardization of vermi-composting technology for cold arid condition of Kargil" was conducted at Krishi Vigyan Kendra Kargil, SKUAST-K. The treatments consisting of combination of two environments (E_1-vermicompost prepared above heap and E_2-vermicompost prepared in underground pits) and two covering materials (C_1-simple black alkathene covering and C_2-double layered gunny bag with wheat straw followed by black alkathene) was conducted in Completely Randomized Block Design. The results revealed that vermicompost and worm production was significantly higher in E_2 as compared to E_1. Similarly both vermicompost and worm production was significantly higher in C_2 than C_1. However, the un-decomposed composting material followed the opposite trend for both the environment and the covering material as it was higher in E_1 and C_1 as compared to E_2 and C_2, respectively.

Key words: *Vermicompost, Earthworms, Pit, Heap, Black alkathene*

INTRODUCTION

Vermicomposting is bio oxidation and stabilization of organic material involving the joint action of earthworms and microorganisms[1], where organic waste resources are converted into nutrient rich plant growth media i.e. vermicompost. Studies reveal that worms seem well fitted for such kind of operations, because of their surface activity, their ability to colonize organic material quickly and their ability to minimize malodor formation. However, involvement of earthworms in composting process decreases the time of stabilization of the waste and produces an organic pool with energy reserves as vermi compost[2], Vermiculture or vermin composting is derived from the Latin term vermi, meaning worms' and composting is essentially the consumption of organic material by earthworms. This speeds up the process of decomposition and provides a nutrient-rich end product, called vermin compost, in the form of 'worm castings'. For centuries, earthworms have been used as a means of decomposing wastes and improving soil structure. The vermicompost production technology is being popularized so as to get a rich organic nutrient source.

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Excessive use of fertilizers causes environmental pollution and destroys the balance of the ecosystem[3]. Thus, biological fertilizers can be considered a suitable solution for overcoming this problem. In fact, using organic fertilizers like vermi compost and mycorrhizal fungi can be used in a sustainable agricultural system[4]. Earthworms digest the organic waste and convert it to vermicompost with high nutrient value, porosity, water absorption and retention water that improves crop growth and yield[5]. Edward and Bätz[6] found that earthworms significantly increased plant growth in culture media. 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 serious withdrawal symptoms. The excessive use of nitrogenous fertilizer (particularly urea) has also led to increase in the level of inorganic nitrogen content in groundwater (through leaching effects) and in the human food with grave consequences for the human health. Chemically grown foods have adversely affected human health.

The compost derived by decomposing waste with the help of earthworms is a very valuable technology to overcome the grave consequences of the excessive use of inorganic fertilizers. However, production of vermicompost in the cold arid regions is very challenging because the shivering cold during winter does not permit growing of any crops in the region. The same has been proved true with all types of insects including earthworm. So, the repeated introduction of vermin culture from outside every year has proved not only economically non viable but also become an obligation in popularity of vermin composting technology. On the other hand, keeping in view the short season in cold arid regions, rapid decomposition techniques for both animals and plants wastes are utmost need of the hour. Thus, it becomes imperative to evolve a technique to prevent earthworm from low freezing temperature and continue their activity during the harsh winter also.

MATERIAL AND METHODS

The experiment was conducted during 2015 at Krishi Vigyan Kendra, Kargil (34.5˚ North and 76˚ East at an elevation of 2,676 meters (8,780 ft) above mean sea level, in the state of Jammu and Kashmir. The treatments consisting of combination of two environments (E_1-vermicompost prepared above heap and E_2-vermicompost prepared in underground pits (2×2×2 feet)) and two covering materials (C_1-simple black alkathene covering and C_2-double layered gunny bag with wheat straw (6 cm) followed by black alkathene) was conducted in Completely Randomized Block Design. In each treatment the quantity of composting materials (partially decomposed FYM and crushed weeds) and vermi culture was kept same i.e. 8 cubic feet and 2 kg respectively. The treatments were conducted with three replications and the entire operation i.e. closing of heap and pits was completed on 15th November. After a prolonged packing in both the environments to avoid freezing damage, data on quantity of fully decomposed vermin compost recovered, population of worms and undecomposed materials were recorded at the time of opening of heaps and pits i.e during first week of March when the outside temperature was mild.

RESULTS AND DISCUSSION

Vermicompost production:

The data present in Table 1 revealed that vermicompost production was significantly higher in E_2 as compared to E_1. Similarly the vermicompost production was higher in C_2 as compared to C_1. The vermicompost production was 189 % higher in E_2 than E_1 and similarly 88 % higher in C_2 as compared to C_1. Significant interaction was found between prevailing environment and the covering material used. The vermicompost production was higher in E_2C_1 (12.9 kg) as compared to E_1C_2 (9.1 kg), that implied that the pit method was better as compared to heap method irrespective of the covering material used. The higher vermicompost production may be due to prevelance of better conditions for the growth of earthworms and decomposition of composting material. Higher production of vermicompost under optimum conditions was also reported by Dominguez and Edwards[7].

Worm production:

The production of worms was significantly higher in pit method as compared to the heap method (Table 1). Significantly higher worm production was recorded in C_2 as compared to C_1. The percentage increase in production of worms with change in vermicompost production from heap to pit method was 214 % and similarly the worm production was 65 % higher when double layered gunny bags were used with black alkathene as compared to sole alkathene only. The interaction effect revealed that the worm production was significantly higher with E_2C_1 as compared to E_1C_2. The worm production may be higher due to the fact that survival chance of worms kept in pits covered with gunny bags and black alkathene, increases due to maintenance of higher temperature during winter. Arancon *et.al.*[5] also reported higher production of worms under similar conditions.

Un-decomposed composting materials:

The data presented in Table 1 revealed that higher un-decomposed composting material was left in E_1 as compared to E_2. Similarly the undecomposed material was higher in C_1 as compared to C_2. This may be due to the reason that the vermicompost as well as the worm production was higher in E_2 and C_2, and thus the left over material was less.

CONCLUSION

The present study concluded that under cold harsh arid condition of Kargil, production of vermicompost in pits and covering with double layer of gunny bags+wheat straw and black alkathene is superior as compared to production of vermicompost by heap method and covering with black alkathene only.

Table 1: Effect of method of production and covering material on vermicompost production, worm production and on the quantity of left over un-decomposed composting materials

	Covering material		
Environment	**C_1**	**C_2**	Mean
	Vermicompost production (kg)		
E_1	1.6	9.1	5.4
E_2	12.9	18.3	15.6
Mean	7.3	13.7	10.5
LSD (p=0.05)	Environment=0.9 Covering=0.9 Interaction=1.4		
	Production of worms (kg)		
	C_1	C_2	Mean
E_1	3.7	7.7	5.7
E_2	14.2	21.6	17.9
Mean	8.9	14.7	11.8
LSD (p=0.05)	Environment=1.2 Covering=1.2 Interaction=1.9		
	Un-decomposed composting materials (kg)		
	C_1	C_2	Mean
E_1	48.6	31.5	40.1
E_2	22.4	10.1	16.3
Mean	35.5	20.8	28.2
LSD (p=0.05)	Environment=2.2 Covering=2.2 Interaction=3.1		

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