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Full Length Research Paper

Vermitechnology: A new dimension to raise a nation's GDP and scientific management of vegetable waste

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The present world confronts with unwelcoming environmental complications generated by large scale production of solid waste. India is the fastest growing nation after china so as any developing nation India is also facing the problem of scientific management of Organic waste, as reflected from the data published by Indian council of agricultural research that during year 2014 vegetable production in India was 162.19 million tons (http://icar.org.in/). Out of which 30% of total production get wasted due to inadequate infrastructure. Approximately 48 million tons of vegetables become wasted every year in India. So as to deal with this problem the bioconversion of vegetable waste were carried out in controlled, conditioned by using four local earthworm species. Out of these earthworm species used for vermicomposting the *Lampito mauritii* was reported to be highly efficient for the production of vermicompost (78.3%) as well as an increase in earthworm biomass of 49.3% on vegetable, moreover GDP can be increased by approximately four hundred crores rupees ($62947520) by converting just one million tons of vegetable waste. The present study was conducted to calculate the vermitechnological potential of earthworm species of Jammu on vegetable waste and also help in economic value add to the Nation's GDP.

Key words: Earthworms, GDP, potential, vermicomposting, vermiculture, and vegetable waste.

INTRODUCTION

All across the world, people are facing a wealth of new and challenging environmental problems every day. There are issues of climate change, Global warming, water crisis, waste management, fossil fuel, and unemployment among others, but almost all of these issues can be traced back to poverty. Poverty can directly be linked to overpopulation and it is a serious threat and a matter of concern for each and every single individual on planet Earth. On 1st Earth Summit in Stockholm the then prime Minister of India Smt. Indira Gandhi rightly said "The environment cannot be improved in conditions of poverty". The poverty and overpopulation lead to many serious problems in today's world, but the most prominent is solid waste generated mostly in developing nations. Municipal solid waste is defined as any waste generated by household, commercial and/or institutional activities and is not hazardous. Managing solid waste generally involves planning, financing, construction and operation of facilities for the collection, transportation, recycling and final disposition of the waste (WTERT, 2012). According to European councils' directive "Waste is any substance or object which the holder discards or intends or is required to discard." Waste if it is hazardous or toxic, it could even be a harbinger of disease and death, not just for living beings, but for all that sustains life, for example, water, air, soil and food. This article aims at identifying one of the solutions that can contribute towards meeting the above mentioned challenges by contributing to the GDP thereby resulting in increased per capita income and disposable income. Vermitechnology is the process by which biological degradation of organic wastes takes place in controlled conditions due to the earthworm feeding of the materials. Systems of growing earthworms range from simple low-technology systems in windrows through heaps of boxes to complex continuous breeding systems. There are mainly two approaches of Vermitechnology: one is the process of vermicomposting resulting in the production of organic manure and aiding

in waste management and the other is its application in the conservation processes or reclamation of waste lands (especially organic farming) (Abbasi and Ramasamy, 2001). 'Vermitechnology' for generation of income from waste and scientific management of organic waste may be a possible solution which can not only aid in proper management of organic waste but also help in economic value addition to the Nation's GDP.

MATERIALS AND METHOD

Collection of earthworms: Epigeic species of earthworms (Perionyx *sansibaricus (Michaelsen, 1891), Lampito mauritti (Kinberg, 1866)*, *Metaphire posthuma (Vaillant, 1868) and Amynthas morrisi (Beddard, 1892),*Palviwal and Julka (2005) has been identified by Dr JM Julka Former Jt Director &Emeritus Scientist Zoological Survey of India. Earthworm species has been collected from moist, well aerated, loose soils rich with organic matter, at a depth of 3 to 10 cm from soil surface in the urban and sub-urban areas of Jammu District . **Preparation of Vermibeds:** Vermibeds were prepared in wooden boxes of size 40cm x 30 cm x 26 cm using paddy straw, sand and garden soil and 40g of earthworms in each vermibed. **Processing of bio waste**: 240 gm of Shredded vegetable waste was separately transferred into vermibeds slowly in a period of 2-3 days replicas of three sets of vermibeds for each type of waste were prepared **Collection of vermicompost**: After the completion of vermicomposting process, the loose layer of soil along with decomposed organic material (bio waste) from each type of vermibed was collected. **N,P,K analysis** of all types of vermicompost produced by different types of earthworm species on leaf litter was carried out in fertilizer lab of Agriculture Department Jammu using Kjeldahl method for nitrogen , Gravimetric Quinolinuim Phospho- Molybdate method for Phosphorus and (Sodium Tetra Phenyl Borate) method for Potassium respectively.

RESULT AND DESCUSION

The data of vermicompost production potential present in the **(Table-1 and Fig.1)** showed that variable bioconversion potential in different earthworms species on same substrate, overall analysis of vermicompost production by different species of earthworms on vegetable waste revealed that *Lampito mauritti* produced maximum 1.9±0.39 kg (78.3%) vermicompost in two year study period followed by *Perionyx sansibaricus* producing 1.79±0.33kg(73.9%) vermicompost in two year study period followed by *Amynthas morrisi producing* 1.82±0.37kg(72.5%) vermicompost during study period and minimum 1.68±0.35kg (67.9%) vermicompost produced *Metaphire posthuma* during study period. The analysis of the data regarding the increase in biomass (Table-1 and Fig.1) of four species of earthworm on vegetable waste revealed that *Lampito Mauritius* was observed to exhibited higher (49.3%) vermiculture potential as compared to *Perionyx sansibaricus*, *Amynthas morrisi* and *Metaphire posthuma* (31.1%, 34.6 and 27.1%) on Vegetable Waste . Moreover, by comparative analysis of the production potential of different earthworm species during different seasons of the year showed that the highest production potential during (Aug-Oct) by all earthworm species due to the ideal temperature and moisture **(Table-1**). It was concluded that the vermicompost production potential of earthworm species i.e. amount of vermicompost produced vary with type of earthworm species used on same substrate that is vegetable waste but all the earthworms species produced good quality of vermicompost and rich in NPK. More or less similar observations were made by earlier workers using different species of earthworms on different substrates. Sinha and Sinha (2000), Chaudhuri *et al.* (2003) while studying the biodegradation of organic waste using mixed species of *Eudrilus eugeniae, Eisenia foetida* and *Perionyx excavates.* The comparison of chemical characteristics of vegetable waste vermicompost revealed that all the vermicompost exhibited that average pH in the range of 7.1 -7.4. Moreover NPK (Table -2) Showed that vermicompost from vegetable waste by *Perionyx sansibaricus* exhibited highest values as compared with other type of vermicompost this was followed by vermicompost from vegetable waste by *Lampito mauritii* and least value of average NPK was exhibited VVM vermicompost from vegetable waste by *Metaphire posthuma*. These findings corroborate the by earlier workers Graff (1970), Dussere (1902) and Nethra *et al* (1999). According to an Indian council of agricultural research during 2014 India produced 162.19 million tons of vegetables out of which 30% of total production gets wasted due to inadequate infrastructure. Approximately 48 million tons of vegetables become waste every year in India but we can convert 37.58 million ton waste into vermicompost by using only one earthworm species *Lampito mauritii*, the vermicompost production potential of this species is 78.3% in every season of the year. The government approved rate of vermicompost is four rupees per kilogram; a simple calculation reflects that the GDP can be increased by approximately Indian Rupees Four Hundred Crores ($62947520) from just one million tons of vegetable waste excluding infrastructure cost.

CONCLUSION

In the light of the above results, it was concluded that the management of vegetable waste by vermicomposting is highly recommended on a commercial scale. The Central Government can establish vermicomposting units in all the fruit and vegetable markets in collaboration with State

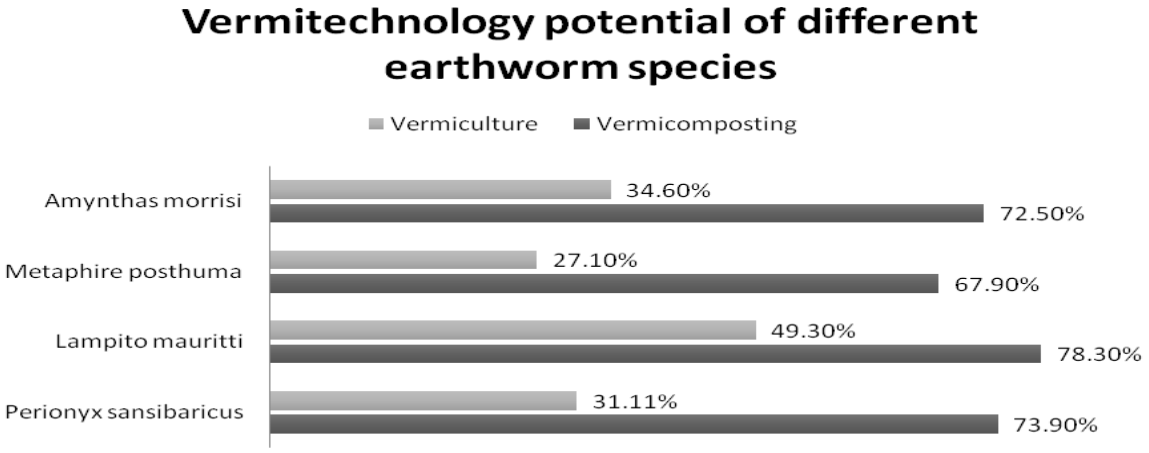
Table 1. Vermitechnological potential of different species earthworm on vegetable waste during different seasons of the study period.

Season	Earthworm species				
	Parameter for vermicompost Production potential.	*Perionyx sansibaricus*	*Lampito mauritti*	*Metaphire posthuma*	*Amynthas morrisi*
May-July	Avg. vermicompost production in gm (kg)	1.975±0.035	2.15±0.07	1.87±0.035	2.05±0
	Avg. increase in earthworm biomass (%)	32.96%	53.88%	28.41%	39.86%
Aug-Oct	Avg. vermicompost production in gm (kg)	2.025±0.035	2.25±0.07	1.95±0	2.1±0
	Avg. increase in earthworm biomass (%)	49.72%	62.5%	40.35%	40.47%
Nov-Jan	Avg. vermicompost production in gm (kg)	1.25±0	1.3±0	1.125±0.35	1.2±0.33
	Avg. increase in earthworm biomass (%)	35.15%	40.99%	19.43%	22.47%
Feb- Apr	Avg. vermicompost production in gm (kg)	1.925 ±0.035	1.9±0	1.77±0.35	1.9±0.35
	Avg. increase in earthworm biomass (%)	20.51%	39.99%	20.36%	22.84%
Total vermicompost harvested during study period (Kg)		1.79±0.33	1.9±0.39	1.68±0.35	1.82±0.37
Avg. vermicompost harvested during study period (%)		72.50%	78.30%	67.90%	73.90
Avg. increase in earthworm biomass during study period (%)		31.11%	49.3%	27.1%	34.6

Table 2. NPK analysis of vermicomposting produced by different species of earthworm on vegetable waste

Name of the species	Avg.pH	Avg. Nitrogen (N)%	Avg. Phosphorous (P)%	Avg. Potassium (K)%
Perionyx *sansibaricus*	7.32	4.02	2.16	1.71
Lampito mauritti	7.4	3.36	1.97	1.62
Metaphire posthuma	7.45	2.10	1.28	1.38
Amynthas morrisi	7.1	3.08	1.90	1.62

Figure 1. Vermitechnological potential of different earthworm species on vegetable waste during study period.



Governments. The investment will contribute to GDP and also aid in organic waste management in a better way with the eradication of poverty to a large extent. India is the fastest growing economy of the world, for steady

and sustainable development, India needs to adopt such eco-friendly technologies which not only contributes positively to the GDP of the country but also helps in scientific management of vegetable waste.

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