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A comparative study of the vermicomposting efficiencies of the Australian earthworm"*Eisenia fetida*" and the Indian species "*Perionyx ceylanensis*"

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Abstract

Vermicomposting, a sustainable method of organic waste management, has gained significant attention due to its environmental benefits and potential in soil enrichment. Central to this process are earthworm species, such as the Australian Eisenia fetida and the Indian variety Perionyx ceylanesis (Jai Gopal). This review paper aims to provide a comprehensive comparison of these two earthworm species concerning their efficacy in vermicomposting and the quality of vermicompost produced. Through an extensive review of existing literature, this paper examines various factors such as feed consumption rates, reproduction rates, nutrient content of vermicompost, and the overall efficiency in converting organic waste into nutrient-rich compost. Furthermore, ecological implications and practical considerations, including adaptability to different climates and waste types, will be explored. The findings of this comparative study will contribute to a better understanding of the suitability and potential of these earthworm species in enhancing vermicompost quality, thereby facilitating informed decisions in organic waste management practices.

Keywords: *Vermicomposting, Eisenia fetida, Perionyx ceylanesis, Organic waste management, Compostquality.*

Introduction

Vermicomposting is a rapid process that involves the bio-oxidation of the waste, and the stabilization of the waste as a consequence of the complex interactions between various species of earthworms and microorganisms (Aira and Domínguez 2008a). This method is also referred to as vermicocomposting in some circles. The upshot of this is a phenomenon known as humification, in which organic stuff that was unstable is completely oxidized and then stabilized (Adhikary 2012). The procedure quickens the rate at which the organic matter is broken down, which results in changes to both the material's physical and chemical characteristics. Vermicomposting, often known as VC, is a technique that involves the use of earthworms to convert organic waste into a material that is similar to humus and is known as vermicompost. Vermicompost often contains a significant amount of a wide array of essential nutrients. According to Kale (1982), the process of composting has the potential to transform any and all of these different kinds of waste into rich materials. The effectiveness of the VC in terms of its positive effects on the physical, chemical, and biological characteristics of the soil, as well as its function as a source of nutrients, is directly influenced by the quality of the compost. In order to enhance the quality of vermicompost (Usharani et al, 2019), it would be beneficial to conduct a study contrasting the Australian earthworm *Eisenia fetida* and the Indian variety Jai Gopal. This study would involve analyzing a number of factors, including the earthworms' biological characteristics, reproductive rates, composting efficiency, and the nutrient content of the vermicompost that was produced as a result. The following is a rundown of some important factors that should be considered. The various research paper and articles have been reviewed which were based on quality of vermicompost formed from different types of organic wastes. (Kapila and Verma, 2021)

Materials and Methods:

Study Area: Mau Chitrakoot is study area of Birendra Kumar Savita

Collection of earthworms: The earthworms collected from Dr. Ajay Kumar Krishi Vigyan Kendra Naini Prayagraj Uttar Pradesh 211008.

The three pits have been prepared of size 3×3×3 feet. In first Pit the horticulture waste is filled. In second pit Dry waste paper leaf waste is filled. In third Pit kitchen waste is filled. For making vermicompost from this waste the earthworm *Eisenia fetida and Perionyxceylanensis* species is used. All three pits left for the 90 days. After 90 days finally the vermicompost is prepared. For comparing the quality of vermicompost prepared from different types of organic wastes the Nitrogen (N), Phosphorus (P), Potassium (K), composition and Moisture Content (M.C) was determined. Total 6 samples was taken of vermicompost prepared from different types organic wastes and their average NPK percentage composition and standard derivation (SD) value is calculated (Chandrakar and Pachlore, 2022)

Table 1: Pit 1 – Horticulture waste *(Eisenia fetida)*

1	1	0.4	0.7	2.8
2	1.01	0.41	0.71	2.81
3	1.02	0.42	0.72	2.82
4	1.03	0.43	0.73	2.83
5	1.04	0.44	0.74	2.84
6	1.05	0.45	0.75	2.85
Avg.	1.025	0.425	0.725	2.825
SD	1.029166667	0.02	0.02	0.02
Mean	5.275	2.175	3.725	14.575

Table 2: Pit 2 – Dry waste paper leaf waste *(Eisenia fetida)*

1	1.2	0.5	0.6	2.9
2	1.21	0.51	0.61	2.91
3	1.22	0.52	0.62	2.92
4	1.23	0.53	0.63	2.93
5	1.24	0.54	0.64	2.94
6	1.25	0.55	0.65	2.95
Avg.	1.225	0.525	0.625	2.925
SD	0.02	0.02	0.02	0.02
Mean	6.308333	2.691667	3.208333	15.09167

Table 3: Pit 3 – Kitchen waste *(Eisenia fetida)*

Sample	Nitrogen %	Phosphorus %	Potassium %	Moisture Content %
1	1.4	0.6	1	3.5
2	1.41	0.61	1.01	3.51
3	1.42	0.62	1.02	3.52
4	1.43	0.63	1.03	3.53
5	1.44	0.64	1.04	3.54
6	1.45	0.65	1.05	3.55
Avg.	1.425	0.625	1.025	3.525
SD	0.02	0.02	0.02	0.02
Mean	7.3416667	3.208333	5.275	18.19167

Table: 4 The NPK content of different types of organic wastes

Pit	Typesof organic wastes	Nitrogen %	Phosphorus %	Potassium %	Moisture content
1	Horticulture Waste	1.03	0.43	0.73	2.83
2	Drywaste paperleaf waste	1.23	0.53	0.63	2.93
3	Kitchen waste	1.43	0.63	1.03	3.53

Table 1: Pit 1 – Horticulture waste *(Perionyx ceylanensis)*

Sample	Nitrogen %	Phosphors %	Potassium %	Moisture Content %
1	1.03	0.71	0.6	2.7
2	1.04	0.72	0.61	2.71
3	1.05	0.73	0.62	2.72
4	1.06	0.74	0.63	2.73
5	1.07	0.75	0.64	2.74
6	1.08	0.76	0.65	2.75
Avg.	1.055	0.735	0.625	2.725
SD	0.03	0.03	0.03	0.03
Mean	6.5	4.526667	3.848333	16.79833

Table 2: Pit 2 – Dry waste paper leaf waste *(Peionyx ceylanensis)*

Sample	Nitrogn %	Phosphorus %	Potassium %	Moisture Content %
1	1.03	0.71	0.6	2.7
2	1.04	0.72	0.61	2.71
3	1.05	0.73	0.62	2.72
4	1.06	0.74	0.63	2.73
5	1.07	0.75	0.64	2.74
6	1.08	0.76	0.65	2.75
Avg.	1.055	0.735	0.625	2.725
SD	0.03	0.03	0.03	0.03
Mean	6.5	4.526667	3.848333	16.79833

Table 3: Pit 3 – Kitchen waste *(Perionyx ceylanensis)*

1	1.3	0.5	1.1	3.4
2	1.31	0.51	1.11	3.41
3	1.32	0.52	1.12	3.42
4	1.33	0.53	1.13	3.43
5	1.34	0.54	1.14	3.44
6	1.35	0.55	1.15	3.45
Avg.	1.325	0.525	1.125	3.425
SD	0.03	0.03	0.03	0.03
Mean	6.825	2.691667	5.791667	17.675

Table: 4 The NPK content of different types of organic wastes

Pit	**Types of organic wastes**	**Nitrogen%**	**Phosphorus %**	**Potassium %**	**Moisture content**
1	Horticulture waste	1.055	0.735	0.625	2.725
2	Drywastepaper leaf waste	1.325	0.825	0.525	2.825
3	Kitchen waste	1.325	0.525	1.125	3.425

Results:

The NPK composition is highest in vermicompost prepared from kitchen aste then followed by paper- leaf waste, horticulture waste. The functions of NPK nutrients in plants as follow

Nitrogen (N): A component of all living cells and a necessary part of all proteins,enzymes andmetabolioc processes in the synthesic and transfer of energy. Also a component of chlorophyll, the green pigment in plants, responsible for photosynthesis. Helps plants with rapid growth, increased seed and fruit production and improves quality of leaves and vegetation.

Phosphorous (P): Like Nitrogen , phosphorous is essential to the process of photosynthesis Stimulates root and shoot growth , helps and plant set buds and flowers , improves vitality , and increases size and yield. Involved in the formation of all essential oils, sugars and starches

Potassium (K): Absorbed by plants in larger amounts than all mineral elements except nitrogen and in some cases ,calcium. Helps plants build protein, aid sphotosynthesis, improves fruit quality and reduces diseases.

WT :- Taken 500 gm *Eisenia fetida and 500* gm *Perionyx ceylanensis*

pH :- *Eisenia fetida and Perionyx ceylanensis* can survive in a pH range of 5 to 9. Most experts feel that the worms prefer a pH of 7 or slightly higher. The range of 7.5 to 8.0 was found optimum. In general, the pH of worm beds tends to drop over time. If the food sources are alkaline, the effect is a moderating one, tending to netural or slightly alkaline .If the food source or bedding is acidic (coffee grounds, peat moss) then the pH of beds can drop well below7. Discussion

Vermicomposting is a rapid process that involves the bio-oxidation of the waste (Vyas et al., 2022), the biological breakdown of the waste, and the stabilization of the waste as a consequence of the complex interactions between various species of earthworms and microorganisms. This method is also referred to as VC in some circles. The upshot of this is a phenomenon known as humification, in which organic stuff that was unstable is completely oxidized and then stabilized. The rate of natural biodegradation of organic wastes (debris of leaves and grasses) in India ranges from 50 to 80 t ha-1 year-1, whereas the rate of natural biodegradation in the United Kingdom is from 18 to 40 t ha-1 year-1 (Koul et al., 2022). This is due to the presence in India of waste-eating tropical species of earthworms that are particularly voracious. Earthworms are able to perform quick biodegradation thanks, in part, to India's favorable climate conditions, which include a warm and humid climate (Geremu et al., 2020). The growth of so-called 'beneficial decomposer bacteria' in waste biomass is stimulated by the activity of an earthworm, which also serves as an aerator, grinder, crusher, chemical degrader, and biological stimulator. Earthworms consume the organic component of the waste biomass when the appropriate circumstances of temperature and moisture are present. The food is broken down into very minute particles in the earthworm's gizzard, and then it is transported to the intestine where it is broken down further by enzymes.

Vermicompost produced by the activity of earth-worms is rich in macro and micronutrients, vitamins, growth hormones, enzymes such as proteases amylases, lipase, cellulose and chitinase and immobilized micro flora Vermicompost is optimal organic manure for better growth and yield of many plants. It can increase the production of crops and prevent them from harmful pests without polluting the environment. Application of vermicompost increased growth, improved plants nutrient content, and improved the quality of the fruits and seeds.

References:

1. Adhikary, S. (2012). Vermicompost, the story of organic gold: A review. *Agricultural Sciences*. 3: 905-917.
2. Aira, M. and Domínguez, J. (2008a). Optimizing vermicomposting of animal wastes: effects of dose of manure application on carbon loss and microbial stabilization. *J Environ Manage,* 88:1525–1529.
3. Chandrakar, M.R. and Pachlore, G.S. (2022). Status of NPK in vermicompost prepared from diverse categories of organic waste material. *Eco. Env. & Cons*.3: 144-148.
4. Geremu, T., Hailu, H., and Diriba, A. (2020). Evaluation of nutrient content of vermicompost made from different substrates at Mechara Agricultural Research Center on Station, West Hararghe Zone, Oromia, Ethiopia. *Ecology and Evolutionary Biology*, *5*(4), 125-130.
5. Kale, J. (1982). Assessing the impact of composting and vermicomposting on bacterial community size and structure, and microbial functional diversity of an olive-mill waste. *Bioresour Technology*, 100(3): 1319-26.
6. Kapila, R., Verma, G., Sen, A. and Nigam, A. (2021). Evaluation of Microbiological Quality of Vermicompost Prepared from Different Types of Organic Wastes using *Eisenia fetida*.*Agricultural Science Digest*, 41 (3): 445-449.
7. Koul, B., Yakoob, M. and Shah, M.P. (2022). Agricultural waste management strategies for environmental sustainability. *Environ Res.* 2022; 206: 1122-85.
8. Usharani, K. V., Roopashree, K. M., and Naik, D. (2019). Role of soil physical, chemical and biological properties for soil health improvement and sustainable agriculture. *Journal of Pharmacognosy and Phytochemistry*, *8*(5), 1256-1267.
9. Vyas, P., Sharma, S., and Gupta, J. (2022). Vermicomposting with microbial amendment: implications for bioremediation of industrial and agricultural waste. *BioTechnologia*, *103*(2), 203-215.