



VERMIBIOTECHNOLOGY: AN INNOVATIVE TECHNOLOGY FOR ORGANIC WASTE DISPOSAL

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ABSTRACT: Vermibiotechnology is an innovative technology for biodegradation of solid waste mass with the help of earthworms. In India, about 25 million tons of urban solid waste is generated every year out of which 75% is simple organic waste which causes soil, water and air pollution. The best suitable method of disposal of solid organic waste is vermicomposting which has already entered in domestic and industrial market in advance countries and also in India. In the present paper an attempt has been made to study four different vermiculture site situated in Gulbarga and Bidar district for improvement of soil structure as well as yield production. It has been observed that in two sites polyculture method have been adopted where as in other two sites monoculture method have been adopted. The soil structure in the farms where vermicompost are used gets completely changed specially in porosity, retention of water and contents of humus. Many microbes population are also increased. Percentage of calcium, magnesium and phosphates become high. In my opinion, vermibiotechnology is highly ecofriendly technology and hence the government and environmentalist group should play important role to aware the general public especially women's group to use their organic waste as useful resource for production of vermicompost so as to keep environment clean, enhance crop production and save the living beings from harmful effect of fertilizer, biopesticides, weedicides, eutrophication, bio magnification which latter causes several types of genetic and chromosomal mutations.

1. INTRODUCTION

Vermibiotechnology is an essential ecofriendly technology for generating wealth from waste. Although, this realization has awakened the global population to thought seriously to utilize earthworm for benefit of mankind and also for environment (Kale, R.D., 1988). It is one of the scientific method of solid waste management with the help of earthworms rightly called "cinderella of organic farming".

In this paper an attempt has been made to correlate the soil structure and fertility by vermibiotechnology. Vermicompost which is prepared by biological action of earthworms, provides a best platform to restore and retain the

natural properties of soil. On the other front wide spread use of vermibiotechnology has resulted in an increased employment opportunities and rapid development of rural area. It is the need of hour that scientific community of the country should give serious attention to standardize and popularize vermibiotechnology on a country wide basis.

2. METHODOLOGY

For the study of effect of vermiculture on soil, four (04) vermiculture farms have been taken on sample basis viz. vermiculture farm near railway station Gulbarga, Sahabad in Gulbarga, Halbarga in Bidar and Enkur village in Bhalki designated as S-1, S-2, S-3, and S-4 respectively. Physio-chemical analysis of vermicompost were done to assess the different constituents to quantity direct and indirect benefits.

Vermicompost have been taken from three different locations of each farm. Sample analysis were carried out as per standardized method. Physical as well as chemical analysis were carried out and have been mentioned in table I and table II. For assessing potential effects, local farmers of that area as well as persons related to vermiculture farm were consulted.

Vermibiotechnology

This is essentially an environment friendly technology for generating wealth from waste. Composting is usually done on commercial basis by farmers in an elevated area with shed. In the shed, pits are usually made up of width of 3ft, height of 3ft and length at any extent. The bottom area was filled with broken black bricks upto 3-4 cm followed by layer of husk and sand to make thickness 6.5 to 7.5 cm. Above this, a layer of loamy soil was spread to 15 to 16 cm. Watering was done compulsorily.

After completion of bedding 80 to 100 locally available earthworms were introduced alongwith small lump of cowdung on the soil. Entire unit was covered by broad leaves. Spraying of water were continuously done during entire farm. After the end of month juveniles of Earth worms had appear which was the healthy sign. For this govt. had given the subsidy amount to the farmer ranging between 25000 to 75000.



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Farmers are usually using organic wastes from their farms i.e. agrowaste and cattle dung. These organic waste were added to farm pit up to 31 days, as a spread on bed twice in a week. Each application, was under 5 cm. in thickness. p^H and temperature were maintained as 6.8 to 7.5 and 25°C to 30°C. Watering was continued upto 42nd day to 45th day and after that stopped. Earthworms compel to go in to deeper region in search of humus (Ghosh-2004) and vermicompost was ready to use.

3. VERMICOMPOST

It is physically, chemically and biologically degraded organic substances produced by action of earthworms, when soil on which earth worms feed is mixed with intestinal contents of earthworms. Physically the soil is finely grinded in the gut of earthworm which increases the surface area of soil particle and promote bacterial growth for further decomposition and soil forming process. Finally, intestinal contents as well as metabolic waste of earthworm are returned to the soil through cast, urine, mucoprotein and dead tissues. These vermicompost are very rich in protein content and on composition yield nitrate to the soil (Edward C.A., Bohlen, P. 1996). Since earthworm increases bacterial population and soil aeration, the process of nitrification is accelerated. The enzyme cellulose present in gut of earthworm play active role in humus formation (Lavella P and Martin A)

1. Vermiculture Farm near Railway Station, Gulbarga (S-1) – It is the oldest Vermiculture farm in North Karnataka region situated just 0.5 km from Gulbarga Railway station. Vermicomposting practice is continued from the last 10 years. The farm is managed by NGO of that region. Area of farm is 150 sqft. (15' x 10'). Kitchen waste and agrowaste are used as raw material. Soil texture is coarse. Endogestic varieties of earth worms were inoculated, with large and small size and weak pigmentation. Earthworms are usually reddish in colour. Vermicompost of this farm usually supplied to nearby farmers at the rate of 600 to 700 per 10 kg. As per information given by farmers of that area, vermicompost are giving good results specially for sugar cane and pigeon pea crops.
2. Vermiculture farm at Sahabad, Gulbarga (S-2) - This farm is situated in Sahabad about 20 k.m. away from Gulbarga, managed by one of the progressive agriculturist of that area. Karnataka Govt. has given Rs. 25000/- as subsidy out of the total cost Rs. 100000/- total area of farm is 180 sqft. (10' x 18'). Dungs of cattles and agrowaste are used as raw material. The anecicas well as endogestic varieties of earth worms were inoculated here. The main significant point of this farm is extra ordinary length of earthworm which reaches upto 2.5 to 3 ft. in length. Organic matter present in dung contribute in

development of earthworm (Edward C.A. and Boblen P.J. 1996) Vermicomposting is done since last five years. The cost of vermicompost is same likesite-01 i.e. Rs. 600 to 900 per 10 kg. Vermicompost is sold to nearby farmers. Farmers of that area generally cultivate sugar cane, sorghum and wheat. They are using vermicompost alongwith chemical fertilizer and obtaining excellent result in plant growth as well as crops yield.

3. Vermiculture Farm at Halbarga – This farm is situated along the road side of Bidar-Udgir road, 20 km away from Bidar. The total area of farm is 120 sqft. Consisting 04 unit of each 10 ft. length and 03 ft. width (10' x 12') covered with hut type shed. The farm is managed by agriculturist of the same place by taking subsidy of Rs. 25000/- from Govt. agrowaste, poultry waste and kitchen waste are used as raw material. Endogestic variety of earthworms were inoculated here. These earthworms are usually 10 to 12 inches in size with light colouration. Here vermicomposting is done since 05 year and used in their own farm as well as sold to nearby farmers. Vermicompost is giving good results for gram, pigeon pea and green gram especially.
4. Vermiculture farm at Enkur – This farm is situated near Enkur village at Bhalkitaluka of Bidar district about 10 km away from Bhalki at Davargaon cross. Total area of farm is 180 sqft. (12' x 15') in 05 unit of 3ft width covered by tin shed. Soil texture is coarse. Sugar cane waste leaves and kitchen wastes are used as raw material. Endogestic as well as anecic species of earthworms were inoculated here which form vertical burrow in the soil. The farm is managed by individual farmer. Vermicomposting has been started only four year back. Vermicompost is sold to nearby farmers at the cost of Rs. 40 to 50 per kg.

4. DISCUSSION

As per survey and study of various vermicomposting farms, it is observed that

1. Choosing right type of earthworms are essential. Usually endogestic or anecic types of earthworm should be introduce in vermicomposting. (Lavella P. and Martin A.)
2. Earthworm ingest large amount of mineral soil and organic material containing varieties of microorganisms. (Even and Guild 1948) found that microbial activities was higher in earthworm casts than surrounding soil.
3. Earthworms due to their burrowing habit literally plough the pitland by making vertical and horizontal burrow. Due to this, soil become porous which is turn is responsible for the accumulation and circulation of water and gases. It has been reported



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that vermicompost show an increase in soil air volume from 8 to 32% depending on the type of vermicompost. This improves infiltration and water holding capacity of the soil (Ghosh, Chitrashree, 2004)

4. The burrows made by earthworm extend up to 2-3 ft. During burrowing, water and moisture stored at considerable depth are brought to upper layer and made available to rest. This acts as biopump. The worm cast which are granular and porous increase the water absorption as well as water holding capacity of the soil (Lavella P and Martin A, 1992).
5. Earthworms stimulate microbial activities in the soil. During the course of feeding, maceration and intestinal content treatment takes place. Enzyme cellulose enhance the humus formation. Microbes present in vermicompost enhance the nitrogen fixation in the soil (Senapati, 1993).
6. Earthworms during the course of burrowing feed the soil alongwith organic content. The undigested materials which comes out as vermicast contain 1.8 to 2.9% nitrates, 2 to 3% phosphates, 1 to 1.5% Potassium and traces of Magnesium and Calcium etc. Thus it improves porosity, fertility and quality of the soil (James, S.W, 1991)
7. NPK Level is also enhanced in Vermicompost than surrounding soil. (Parthasarathi and Raghunathan 1999) found enhanced phosphate activities alongwith increased microbial activities.
8. A pale yellow colour transparent coelomic fluid obtained from earthworms known as vermiwash contains mucous secretion as well as excretory materials of worms. It has antiviral and antibacterial properties which protect the plants from bacterial and viral infections (Ismail, 1997)
9. Vermicompost cannot be described as being nutritionally superior to other manure but the unique way in which it is produced at low cost directly in the field makes it attractive for practical applications (James 1991)

5. PUBLIC UTILITIES

Vermibotechnology is known through out the world but it is practiced in only limited area in India. About 98% of farmers even now a days depend on different types of commercially available chemical fertilizer which reduce the fertility power of soil day by day. It should be perfectly replaced by vermicomposting alongwith other type of organic farming. For this different training and awareness programmes should be organized in rural area especially for giving proper training, field demonstration and extension activities for rural population particularly for women group. In the present work, it has been observed that vermicompost alongwith chemical fertilizer show excellent result in germination, growth and crop yielding capacity. Therefore,

we can say that it is a low cost technology for removing wastes like accumulation of food waste, paper waste, cattle waste, agriculture waste, kitchen waste and poultry waste etc. Vermiculture offers potential to convert waste material in to valuable organic manure useful for maintaining soil structure and fertility.

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TABLE - 01
PHYSICAL ANALYSIS

Sl. No.	Physical Parameter	Site S-1	Site S-2	Site S-3	Site S-4
1	Area of Farm in sqft.	150	180	120	180
2	Species of Earthworms used	Endogestic	Endogestic, Anecic	Anecic	Endogestic, Anecic
3	Texture of soil	Coarse	Coarse	Coarse	Coarse
4	Temperature °c	25	27	27	29
5	Quality of solid organic wastes used	Kitchen waste Agro waste	Cattle dung Agro waste	Agrowaste Kitchenwaste Poultrywaste	Agrowaste Kitchen waste
6	Water holding capacity (g/c c)	54.00	56.40	55.40	54.40
7	Physical Characteristics of Vermicompost	Black and granular	Black and granular	Black and granular	Black and granular
8	Colour of Earthworms	Red with light pigmentation	1. Red with light pigmentation 2. Black with dark pigmentation	Black with dark pigmentation	Red with light pigmentation Black with dark pigmentation
9	Weight of Earthworms	0.5 to 0.7 gm	1 gm to 1.5 gm	0.5 to 0.6 gm.	0.5 to 0.6 0.7 to 0.8

TABLE – 02
CHEMICAL ANALYSIS

Sl. No.	Chemical Parameters	Site S-1	Site S-2	Site S-3	Site S-4
1	p ^H	7.1	7.2	7.4	7.6
2	Nitrate %	1.8	2.0	2.4	2.1
3	Phosphate %	1.9	2.1	2.2	2.0
4	Potassium %	1.00	1.05	1.05	1.02
5	Magnesium	Traces	Traces	Traces	Traces
6	Calcium %	Traces	Traces	0.05	Traces
7	Porosity	Porous	Highly Porous	Porous	Porous