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Short Communication

Influence of Season on Sewage sludge Vermiprocess than Chemical Nutritive Status

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Abstract:

Earlier works in line of food budget studies in *Eudrilus eugeniae* on cattle dung and cane sugar pressmud as feed substrate under the influence of rainy, winter and summer seasons gave way for the present study in similar lines using activated sewage sludge as feed substrate for the hatchlings to extended post reproductive periods. As an act of bioremedial process transformation of activated sewage sludge into vermicompost as stabilized manure for the agricultural lands is a known fact, provided a steady-state of production targets of vermicomposted sewage sludge is ensured at the receiving ends. The disturbances in the worm activity was noted especially in summers although there was no significant differences in the chemical composition of the sewage sludge. Climate other than the nutrition seem to act upon. Henceforth a detailed study of eaten food and its fate from hatchlings to post reproductive periods in rainy, winter and summer season were mandatory. Food budget data were needed to conclude the effect of season on utilization of activated sewage sludge. The inferences were drawn based on food consumption (C) and its energy allocations through feces (F), assimilation (As), Conversion (K) and Metabolism/Respiration (R).

Keywords: activated sewage sludge, fate of eaten food, food budget, hatchlings to extended post reproductive periods, seasonal effects.

1.0 Introduction:

Influence of competition on the food consumption and production of youngones that are dependant on bioenergetic factors are common in nature (Brocksen, 1966; Parmelle and Crossley, 1988; Daniel, 1991; Ramesh et al, 1997; DST Report, 1997; Dominguez et al, 1997a). Laboratory works pertaining to safe conversions of sewage sludge in presence of suitable earthworm candidates are enormous (Mitchell et al, 1980; Hartenstein and Hartenstein, 1981; Dominguez et al, 2000; Sinha et al, 2009). For the continual production of vermicompost thro'out the year without an act of dwindling in the vermiprocesses in outdoors for profit oriented ventures, a detailed study under semi-natural laboratory conditions is a pre-requisite in rainy, winter and summer season. Study of growth, food consumption, changes in the body weight under environmental conditions like temperature, moisture are of paramount importance that have a role to play in out door operations for uninterrupted productions of vermicompost. Energy budgets of compost earthworms, their growth efficiencies, losses and uses of food energy as fate of eaten food are the pre-requisite necessities. Earlier laboratory works

(Davis and Warren, 1965; Brocksen, 1966) supports the climatic effects in organisms' food consumption and its utilization. Analyzing how compost earthworms' manage their energy resources is known thro' boenergetic studies. Movement of energy thro' an organism from the point of vermicompost production under varied agro-climatic seasons of rainy, winter and summer were prerequisite from the personal experiences of large scale out-door conversions. The current study was taken up in three seasons by utilizing classical compost earthworm *Eudrilus eugeniae* by providing ad libitum feed substrate of stabilized activated sewage sludge.

2.0 Materials and Method:

Three/Four developmental stages as age groups were catagorized for the ease of collection of data for food budget studies as: small immature, large immature, adult(1), adult (2) and adult (3). The experiments began with the onset of every season and continued until normal feeding and defecating activities were shown by the worms in triplicates. The details of the experiment conducted are as shown in the previous works by the author (Sunitha, 2011; 2012). The physico-chemical parameters of

activated sewage sludge was done for worm unworked (control) and worm worked (vermicompost) in three seasons. As much difference was not seen mean readings are given in

3.0 Results and Discussion:

Table 1: Chemical nutritive status (mean data of rainy, winter and summer season) of activated sewage sludge as feed substrate and in vermicompost

Nutritive status	Feed substrate (activated sewage sludge)	Feces (vermicompost)
Total Nitrogen (%)	2.18	1.68
Total organic matter (%)	57.0	34.5
C : N ratio	15:1	12:1
Iron Oxide (ppm)	714	857
P ₂ O ₅ (%)	1.29	0.63
Calcium Oxide (%)	13.91	6.96
Magnesium Oxide (%)	0.85	0.28
Potassium Oxide (%)	1.28	0.34
Sodium (%)	1.75	1.22

Impact of environmental parameters on compost earthworms have been known through several workers for the appropriate knowledge related to vermicomposting for successful utilization of compost earthworms (Picci et al, 1986; Holmstmp et al, 1990; Butt, 1991; Hernandez, 1991; Reinecke, 1992; Hallett et al, 1992; Reddy and Pasha, 1993; Holmstmp, 1994; Dominguez and Edwards, 1997b; Dominguez, 2000; Hou et al, 2005). Compost earthworms' successfulness within the range of environmental conditions to which its structural, physiological and behavioural characteristics permit them to adopt. Metabolism is the crucial subject. In the present study it is pooled up under the activities of locomotion/coelomic fluid production and secretion/respiration/excretion as the energy spent depicted as 'R'. Much of the energy in the form of metabolism was spent in summer season due to prevailing climatic factors of summer heat. This was the most neglected and unknown factor and scarcely discussed during vermiprocesses as technology development hitting the vermifarmer with dwindled productions even though ensured with active and productive worm biomass, supply of partially – aerobically stabilized sewage sludge and with appropriate percent moisture of av.60% in summer season depicting the fact that in terms of survival the worms' spent the energy on body metabolism. Thus this study stress on the fact that the regular practices of conventional vermiproduction data revealing 10 – 15% utilization to the body and the

Table: 1. The obtained data after statistical analyses are enumerated through food budget studies (see **Table. 2**).

rest of energy thrown out as feces is not always true in summers (Kale et al, 1994; Kale and Sunitha, 1997).

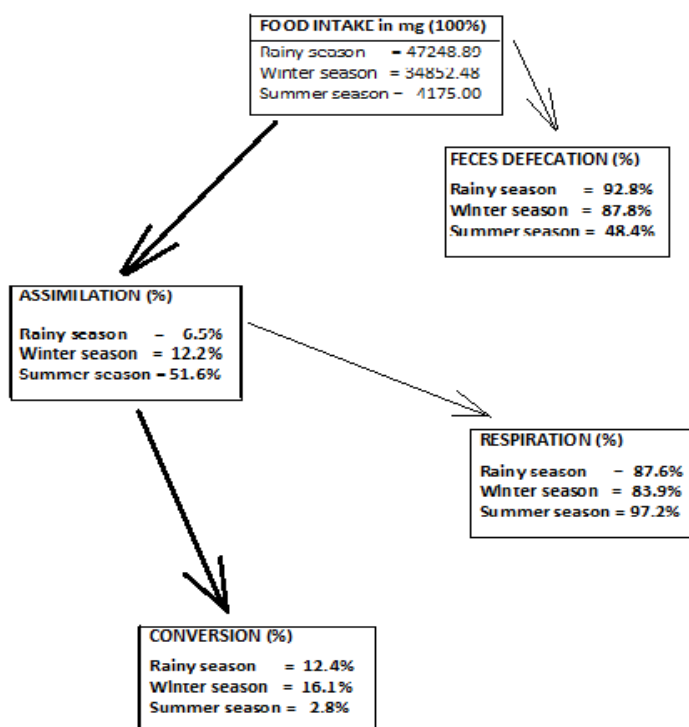
Food availability is one of the environmental conditions that determine growth and is a sensitive parameter dependant on the environment. The possible fates of food that is consumed is the forms of food utilization budget is the possibility of showing the distribution of energy and materials among the other possible fates (**see Table: 2**). Food intake in *E. eugeniae* has shown to increase several times in comparison to growth or age of the worm. Assuming that the food intake is 100% in mg the energy allocations shown in **Flowchart: 1** reveals the interesting aspects from the point of production of vermicompost from commercial angle. Although food intake is low in rainy season there is comparatively more feces defecation observed. However for the practicality aspect in rainy season the percentage of feces is 92.8% and 87.8% in winter season. A vermifarmer's cost of production would be higher in summer season and this season is not a feasible one for the reason that only 48.4% vermicastings are obtained in comparison to the maximum consumption over other seasons. However from the point of disposal sense this season is best for maximum conversions in obeying the rules and regulations of Pollution Control Boards. The other details of assimilation, conversion and respiration (metabolism) are self explanatory as shown in **Flowchart: 1**.

Table 2: Food utilization as a function of age group in *E. eugeniae* (fed ad libitum) on activated sewage sludge in different seasons

Season	Age group	Fate of eaten food in mg				
		C	F	As	K	R
Rainy	Small immature	1266.67	81.5	18.4	15.0	84.9
	Large immature	4827.33	58.0	41.9	2.5	97.4
	Adult(1)	12914.17	61.9	38.0	1.3	98.6
	Adult(2)	16683.33	85.9	14.0	2.6	97.3
	Adult(3)	Nil	Nil	Nil	Nil	Nil
Winter	Small immature	2081.67	57.6	16.0	5.1	94.8
	Large immature	7874.44	88.8	13.7	19.1	80.8
	Adult(1)	8835.83	91.0	24.0	14.0	85.9
	Adult(2)	9102.86	93.6	25.0	4.4	95.5
	Adult(3)	13906.67	89.0	15.0	2.7	97.2
Summer	Small immature	3316.67	86.4	13.5	18.7	81.2
	Large immature	10064.33	21.19	78.8	1.8	98.1
	Adult(1)	10084.00	54.8	45.1	3.3	96.6
	Adult(2)	37723.33	22.9	77.0	0.2	99.7
	Adult(3)	Nil	Nil	Nil	Nil	Nil

*C = dry food intake; *F = feces defecated; *As = assimilation; *K = conversion; *R = oxidation

Flow chart: 1 – 'T' diagram showing energy allocations of consumed food in *E. eugeniae* fed ad libitum on activated sewage sludge in different seasons



4.0 Conclusion:

Study reveals the effect of rainy, winter and summer season has a role to play in distribution of energy (allocation of energy) through food consumption. Chemical composition (an indicator of nutritive status) of the feed substrate of activated sewage sludge did not differ in respect to seasons. It is advisable that the commercial venturing must strictly avoid vermiprocesses in summer season in avoidance of high cost of productions except for the vermery maintenance; however the other two seasons are ideal for vermiaactivities.

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