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RESEARCH ARTICLE

Novel Vermicomposting of Chicken Slaughter Waste (CSW) with Earthworm *Lampito mauritii* for formulating efficient Fish Fodder

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Abstract

"The effort of preparing the soil which earthworms carry out is of incalculable value and could not be performed more efficiently by any machinery invented and made by man" (Niir Board). Thus the present study planned with the novel objective of exploring the opportunity of converting Chicken Slaughter Waste (CSW) which is otherwise an organic pollutant to a value added product by using vermicomposting as a tool. The interior objective is to inspect the quality of the vermicomposting produced from the chicken slaughter waste, to prepare a formulated fish-feed by means of the earthworm raised in the culture and to study the outcome of the formulated fish-feed on the growth rate and efficiency of a preferred fish. Vermicomposting of the CSW in the concentration of 0, 25, 50, 75, and 100% in combination with paddy straw was carried out using *Lampito mauritii,* an Earth worm specie native to India. The fish feed was prepared by using 20% and 40% of *Lampito mauritii* earthworms and is fed to experimental fish *O.mossambicus* in determining the growth rates and efficiency. Our study shown that, the formulated fish feed blended with appropriate proportions of earthworm substitution significantly enhanced the growth rates and growth efficiency in *O.mossambicus*. Therefore with this research outcome, it is demonstrated that the chicken slaughter waste for vermicomposting of *Lampito mauritii* earthworm assists in developing an efficient fish feed with minimal economic investment.

Introduction:-

The poultry industry is growing rapidly worldwide and contributes towards attending to key national development goals, as well as, in humanizing the standard of living of people through poverty alleviation and creating employment opportunities (Agblevor *et al*., 2010). (Roeper *et al*., 2005) contended that the problem coming along with the poultry production is the manure that needs to be taken care of, as a non-appropriate treatment or disposal can become risky for environment and humans. For instance, wastes can support the spread of diseases and may pollute soil and groundwater resources if not properly handled.

Vermicomposting is a method of setting up enriched compost with the use of Earthworms. The remuneration of compositing is multiple. Compositing has the ability to reduce poultry litter, dispose of carcasses, stabilize trace minerals and reduce odors (Turnell *et al*., 2007). Also, compositing can kill pathogens and help control disease outbreaks (Chaundry *et al*., 2008). Disposal of poultry waste by burying in pits creates ground water pollution and other hazards in its surroundings. The study explore the possibilities of using the CSW in a constructive way by making value added products through vermicomposting.

Materials and methods:-

The study is sketched out with two phases. Phase I: The vermicomposting was carried out using CSW which includes feather, flesh and fecal. These wastes collected from chicken slaughter houses from Chennai (TN).The vermi-bed was prepared with CSW and with varying proportion paddy straw collected from Loyola College, Chennai. Vermi-bed was filled in six plastic troughs with 12.5cm in diameters and with depth of 22cm. The base layer filled with gravel stones at 1cm height then predigested wastes of 5 Kg in each trough (the partially air-dried chicken slaughter house wastes was choked down finely and mixed with cow dung and mixed with garden soil mixture). After seven days of observation, a sum of 40 adult *L.mauritii* worms weighing 20 gm in each trough is purchased from ERI, Loyola College, Chennai (TN) were initiated into the vermi-bed. After the experimental period of 60days the earthworm and the vermi compost is separated. The separated compost is sliced into pieces to feed fish. The Vermicompost is subjected to the analyses of physical and chemical.

Phase: II the fish feed were prepared from the phase-I. The combinations of ingredients chosen were corn flour, rice bran, groundnut oil cake, and brewer's yeast which is typical of fish feed and described in (Table:1.0) All the ingredients were mixed and kneaded well to form dough. The dough was pressured, cooked, cooled, pressed in a semi press and air dried.

Table: 1.0 Dietary content (in gms) in the Ingredients of Corn flour, Rice bran, Oil cake, Yeast & Earth Worm

Ingredient	Corn flour	Rice bran	Oil cake	Yeast	Earthworm
Diet-1	280g	200g	120g	20g	-
Diet-2	280g	200g	120g	20g	200g
Diet-3	280g	200g	120g	20g	400g

The three tanks were set with six fish each with a weight of nearly 5 g and fed with prepared fish feed for 12 successive days. The initial and final weight of the fish and the growth rate was calculated. The feeding rate was calculated from the difference between the fed and the unfed.

Statistical Analysis:-

The mean and standard deviation of the growth rate were calculated. The growth rate of the fish on the control diet was compared with those fed with diet contain 200g and 400g earthworms using student 't' test.

Results:-

Analysis of Vermicompost Samples:-

The experiment was carried out to study the bio-fertilizer producing potential of CSW through vermicomposting has clearly exposed that the superiority of the compost is remarkably augmented when it is added to the composting medium. The data acquired from the physic-chemical analysis of the compost is presented in table.

The quality of the most important nutritive elements such as nitrogen, potassium and phosphorus (NPK) increased considerably in the compost obtained from the beds with CSW. However, the level of increase in them was influenced by the proportion of the waste in the compost bed. For example the % of NPK was 0.59% 0.16% and 1.112% correspondingly in the fertilizer obtained from the bed with 100% straw. The same increased to 1.24%-0.46%-2.49% in 1005 chicken waste. 1.822%-0.61%-2.61%in50%+50%combination of straw and chicken waste, 1.29%,0.48%-2.64%in 25%+75% chicken waste and straw combination and 1.67%-0.54%-2.67%in 75%+25% chicken waste and straw combination. Obviously highest nitrogen content was observed when the compost mixture contained 50%and 50% chicken waste.

Table: 2.0 Table depicting the comparison of Physico Chemical parameters for the Control and the Experimental Samples investigated

S.No	Name of the Parameter	Control	Sample-1 100% Straw	Sample-2 100% Chicken waste	Sample-3 50%+50% Chicken waste + Straw	Sample-4 25%+50% Chicken waste + Straw	Sample-5 75%+25% Chicken waste + Straw
1	pH	7.69	6.98	7.88	8.38	8.20	7.42
2	Electrical conductivity(dsm-1)	1.06	1.78	1.62	1.32	1.45	1.42
3	Organic carbon (%)	0.23	0.33	4.20	4.32	4.16	4.28
4	Organic matter (%)	0.46	0.66	8.40	8.62	8.32	8.56
5	Total nitrogen (%)	0.82	0.59	1.24	1.82	1.29	1.67
6	Total phosphorous (%)	0.23	0.16	0.46	0.16	0.47	0.54
7	Total potassium (%)	1.84	1.12	2.49	2.61	2.64	2.67
8	Total sodium (%)	0.22	0.12	0.23	0.26	0.29	0.29
9	Total calcium (%)	2.69	4.56	5.29	5.69	5.16	5.19
10	Total magnism (%)	2.10	1.06	2.25	2.64	2.26	2.59
11	Total sulphur (%)	0.21	0.12	0.53	0.54	0.51	0.58
12	Total zinc (%)	1.06	0.22	1.67	1.69	1.62	1.68
13	Total manganese (%)	2.32	0.98	2.54	2.69	2.58	2.61

The enrichment was more than double for nitrogen and potassium and it was virtually three times for phosphorus. In broad, the compost mixture the contained 50% or 25% chicken waste was found to be the most enriched one terms of NPK.

The quality of zinc and manganese improved almost 5 fold when the chicken waste added to the composting medium. For instance, the amount of zinc amplified from 0.22 ppm to 1.69ppmin the fertilizer obtained from 100% straw was compared to that of 50% +50% wastes and straw. Similarly the quantity of manganese was 0.98ppm in 100% straw medium. It improved to 2.67ppm in 50%+50% waste straw medium. There was a significant increase in the organic matter in the fertilizer obtained in the chicken waste medium. The C: N ratio for the chicken waste contained fertilizer 6 whereas, that of the 100%straw was nearly 1. The pH of the fertilizer sample from the chicken waste was comparatively higher than the one obtained from the 100% straw. A marginal decrease was noticed in electrical conductivity in the chicken waste provided fertilizer than the 100% one.

Yield of Earthworms:-

The weight of earthworm produced diverse in different composting tanks in this experiment. A remarkably higher amount of earthworm is produced in the composting medium that contained 50% to 50% chicken waste (Table: 3.0). The weight of the earthworms increased from 20gms to 45.45gms in the 100% straw medium. On the other hand the medium with 25% +75% chicken and straw medium was 43gms.

Table: 3.0 showing the Various Concentrations of wastes in Earthworm (in no.) and Body weight (in gm)

S.No	Various concentration of wastes	Earthworm Number (in no.)			Body weight(gm)		
		0days	**30days**	**60days**	**0days**	**30days**	**60days**
1	Sample I-(control)	40	63	85	20	23	27
2	Sample II-(100% Straw)	40	73	97	20	27.01	35.45
3	Sample III-(100% chicken waste)	40	89	104	20	26	31.10
4	Sample IV -(50%+50% Straw+ chicken waste)	40	79	125	20	39.52	61.40
5	Sample V-(25% straw + 75% chicken waste)	40	73	108	20	30.40	45.05
6	Sample VI-(75% straw 25% chicken waste)	40	62	81	20	31.33	43

Earthworm fish meal and growth in fish:-

Two diets prepared with two different quantities of earthworms: one diet contacting 20% and another with 40% earth content. The results of the experiment conducted to study the feeding rates, growth rates and growth efficiency. After feeding the *O.mossambicus* with the formulated diet are presented in the (Table: 4.0) the results revealed that there was an increase in the growth in fish, fed on the diet contained earthworms. The growth rate of the fish, fed on the controlled diet was statistically evaluated with ones fed earthworms- containing diet. The results revealed a substantial increase in the growth rates of the groups of fish fed the formulated diets containing earthworms ($p<0.05$)

Table: **4.0** Comparison of control and selected samples for student t-value test and df for growth rates.

Comparison	t-value	df	Significant/ Non significant
Control $_{Vs}$200g	55.42	10	Significant
Control$v_{s.}$400g	8.42	10	Significant

The competence of growth also increased from 10% to 20%and 20.1% in earthworm containing diet. This trail experiment has clearly exposed the supreme nature of the formulated diet containing earthworms flesh.

Discussion:-

The results of this study that was intended to explore the possibility of adding value to the CSW have established that vermicomposting is an efficient tool for this purpose. CSW is discarded in the outskirts of cities which causes environmental contamination. The results of this study illustrate that the earthworm can be used as organic tool to convert them to constructive bio-fertilizer. In adding up to it, the earthworms that are obtained from the culture is found to be an excellent alternate in a formulated diet for fishes to promote growth in them.

Increase in the superiority of manure on addition of certain specific wastes to the composting mixture is reported by many researchers. Increased mineralization of the compost by the addition of olive oil cake is reported by (Gandhi *et al*., 1997). Similarly, (Noor 2009) recorded that addition of small quantity of coffee ground to chicken waste to compost mixture result in higher percentages of the various nutritive elements in the manure. Similarly, wastes from breweries, paper wastes (Butt, 1993), urban food and animal wastes (Edward, 1988) are also found to be good in mineralization, the present study does not confirm the reduction in the C: N ratio in the Vermicompost. Composting with earthworm is reported to reduce the C: N ratio of the mixture (Gandhi *et al*., 1997). In a study made by this group, such a reduction is noticed during a prolonged duration of composting, nearly 90 days. The time given for vermicomposting is only 60 days in this study. Although the mineralization is on considerably in increase the macro and micro nutrients, the organic carbon content of the mixture still remains high in the fertilizer. However, the result of the study are in confirmation with observation of many researchers (Sreenivas *et al.,* 2000), the compost provides all nutrients in readily available form.

Another notable observation of this study is that the earthworms obtained from the composting process can be used in producing fish feed. The growth rate and growth efficiency of tilapia is found to be in considerable increase, when fed on the formulated diet. The proportion of earthworm in the fish's meal is also considered to be vital. Very high quantity of earthworm (100%) does not have a constructive effect on growth rate in fish. A proportion up to 75% is found to be effective in the feeding rate (Hung, 2010). The result of this study have shown that substitution by 20% and 40% earthworm significantly increase the growth, but there is no dissimilarity between the growth rates of the fish fed with 20%and 40% earthworm.

This study substantiates the fact that, vermicomposting is a simple and cheap technology to recycle organic waste, which can otherwise pose environmental harms. The advantage of this technology can be further extended to production of commercially important fish and poultry feed. With the fast increasing cost of fish and chicken feed ingredients, the earthworms will make a very cheap alternate in these feeds. Nonetheless, further work is to be carried out to develop advanced technologies to produce formulated diets.

Conclusion:-

The chicken waste is one of the major pollutants if not properly disposed. Poultry feathers can be treated chemically or biologically with microbes to improve the nutritive value of feather wastes which can be used as animal feed. They can also be biologically converted into feed supplements, biodiesel, and biodegradable plastic and organic fertilizer.

Altogether, wastes can be effectively utilized if properly treated to reduce the ill effects and a range of value added products like fertilizer, biodiesel, animal feed, electricity, bone meal and biodegradable plastic can be produced.

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