Journal of Cell and Animal Biology Vol. 3 (5), pp. 067-070, May, 2009
Available online at http://www.academicjournals.org/JCAB
ISSN 1996-0867 © 2009 Academic Journals

Full Length Research Paper

Growth performance of *Alma millsoni* fed with brewers dried grain (BDG) and coconut husk

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Accepted 22 April, 2009

The growth performance of *Alma millsoni* cultured on 'brewers dried grain and coconut husk was studied in a completely randomized design with three treatments (Control, brewer's dried grain and coconut husk) and three replicates. Earthworms were cultured in plastic bins of 60 x 30 x 30 cm. While coconut husk was used as the bedding, the earthworms were fed with brewer's dried grain, coconut husk or no extra feed other than the bedding. Growth performance of the earthworms was measured every week. The proximate composition of the earthworm was conducted using standard procedures. The mean weight of the earthworms under the three different treatments was significantly different ($P < 0.05$); with earthworms fed brewers dried grain recording the highest mean weight (1.03 ± 0.50). No significant difference was observed in the percentage crude fibre, crude protein and moisture between *A. millsoni* from different treatments; whereas a significant difference ($P < 0.05$) was observed in the percentage crude fat and ash between *A. millsoni* from the different treatments with *A. millsoni* fed brewers dried grain recording the highest percentage crude fat. Weight of worms was significantly and positively correlated to feed source ($P < 0.05$). The implication of this is that earthworms fed with brewers dried grain gained weight above those fed with coconut husk or the control but the weight gain observed may have been as a result of the increase in crude fat content of the earthworms since there was no difference in their crude protein content. Culturing of earthworm on either coconut husk or brewers dried grain must therefore be accompanied with a protein source.

Key words: Earthworm, culturing, growth, performance, proximate, composition.

INTRODUCTION

Earthworms have been shown to be of great importance in soil fertility, soil improvement and soil amelioration (Paoletti, 1999). The importance of earthworms in vermincompost and as such biodegradation of waste can never be over emphasized because vermicompost is a veritable organic fertilizer which can help in the reduction of inorganic fertilizer to the soil and earthworms are the focal species in this respect (Lee, 1985; Kladivko, 1986; Ruz Jerez et al., 1988; Abbot, 1989; Edwards and Bater, 1992).

Apart from these, earthworms have been touted as feed supplement and are being considered as replacement for fishmeal in animal diets. Studies have shown that the quality of earthworm protein is at par with that of fish (Edwards and Niederer, 1988 and Dynes, 2003). But for earthworm to seriously compete with fishmeal as protein supplement there is a necessity to establish a standard procedure of mass culturing of the worms. Several feeds have been used to culture earthworms such as cow slurry (Hand et al., 1988); dairy processing plant sludge (Kavian and Ghantneker, 1991; Gratelly, 1996); rice stubble and mango leaves (Talashika et al., 1999) and water hyacinth (Gajalakshmi et al., 2001, 2002). Sherman (2003) also reported that earthworms will feed on varieties of materials such as animal manures, food scraps, shredded or chopped cardboard or paper, grains, marshes and cotton seed meal.

Sherman (2001) had earlier reported that there is potential market for vermiculture and vermicomposting operations but it was pointed out that this is dependent on understanding of the ideal condition for worm growth, reproduction, health and proper identification of earthworms suitable for vermiculture and those suitable for vermincomposition.

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Table 1. The descriptive statistics on the final weights of *A. millsoni* obtained under the different treatments.

Treatment	N	Mean ± SD
Control	359	0.59 ± 0.32
Coconut husk	360	0.63 ± 0.32
*BDG**	360	1.03 ± 0.51
Total	1079	0.75 ± 0.44

BDG- Brewers dried grain

Therefore since earthworms are being considered for such, it is important to intensify research on culturing and breeding (vermiculture) of earthworms as micro-livestock especially here in Nigeria where not much work on vermiculture has been done. In order to do this effectively there is a need to conduct research on the impact of various feed materials on the performance of various species of earthworms.

The present study therefore looked into the effect of two feed sources, coconut husk and brewers dried grain (BDG) on the growth performance and proximate composition of *Alma millsoni.*

MATERIALS AND METHODS

The study was conducted at the Olabisi Onabanjo University, Ago-Iwoye, Ijebu North area of Ogun State in SW Nigeria.

A. millsoni a limicolous (marsh-dwelling) earthworm belonging to the family Glossoscolecidae was used for this study. The earthworms were collected from the banks of streams and marshy environments by digging and hand sorting method.

Culturing of earthworms

Earthworms were cultured in plastic bins of 60 x 30 x 30 cm. Shredded coconut husk was used as base bedding which was covered with a top layer of soil in all the worm bins. Water was added to all bins to make the bedding soggy but not waterlogged; while 40 g of earthworm were introduced into each plastic bins.

Experimental design and treatments

The experimental design was completely randomized design with three treatments and three replicates. The treatments were;

Control: Earthworms in this group were not given additional feed source apart from the bedding.

Coconut husk: Earthworms in this group were given additional 50 g of ground coconut husk at two days interval

Brewers dried grain: Earthworms in this group were fed additional 50 g brewers dried grain at two days interval.

Readings

Thirty earthworms per treatment per replicate were picked at random at an interval of 7 days for four weeks and weighed individually. A top loading electronic balance with a precision of 0.01 g was used for the weighing. The earthworms were returned to their respective bins after each successive weighing.

Proximate analysis

The proximate analysis of the earthworms was conducted before and after the feeding experiment. The earthworms from each replicate were collected separately and washed to remove all debris and they were gut voided by placing them in paper mache for 24 h. These earthworms were placed in separate beakers of clean water and the temperature of the water was raised gradually without boiling until all earthworms were dead. These were transferred separately onto aluminium tray with labels for each replicate of earthworms (A-I). The tray containing the earthworm was transferred into the oven and the earthworm was heat dried at 40°C for 4 h and then at 100°C for another 5 h to ensure proper drying of the worms. The dried worms were collected per replicate, ground to powder and weighed separately. These were then sealed in sterile nylon sachet and transferred to the laboratory for proximate analysis. The standard procedure of AOAC (1995) was used to conduct the proximate analysis.

Data analysis

The descriptive statistics: Analyses of variance and Duncan multiple range test of significance were conducted on the weights and proximate composition obtained in the study using the Statistical Package for Social Sciences (SPSS) version 11.0 and was presented as tables (Table 3).

RESULTS AND DISCUSSION

We observed that there was a significant difference between the mean weights of the earthworms in all treatments ($P \leq 0.01$) with *A. millsoni* fed brewers dried grain recording higher mean weight than those fed with coconut husk and the control group (Tables 1 and 2). The mean weights of earthworms from all treatments at all intervals of measurement were significantly different ($P \leq 0.01$). We also observed a consistent reduction in weights of the earthworms for all treatments except those fed brewers dried grain. It was observed that the weight of earthworms fed brewers dried grain dropped from an initial mean weight of 1.21 g to a lower one (0.89 g) at the second reading but a considerable increase in weight was recorded in the third (0.97 g) and fourth (1.05 g) readings.

The consistent depreciation in weight of earthworms at each intervals of measurement especially those in the control and those fed coconut husk indicates that coconut husk did not yield any meaningful energy to the earthworms as such revert to using their stored energy for maintenance which, resulted in the observed weight reduction. This agreed with the studies of Bansal and Kapoor (2000) and Chaudhuri and Bhattacharjee (2002) which showed that the use of plant residue must be accompanied by a nitrogen source such as cattle dung to yield a better result but none of these studies showed whether the gain in biomass was as a result of increase in protein or fat content of the earthworms.

The proximate analysis of the earthworms at the end of

Table 2. Analysis of Variance of the Mean Final weights *of Alma millsoni* obtained under the different treatments.

	Sum of squares	df	Mean square	F	Sig.
Between groups	42.668	2	21.334	141.047	0.01
Within groups	162.749	1076	0.151		
Total	205.417	1078			

Table 3. Duncan Multiple Range Test on the Final Mean weights of *Alma millsoni* obtained under the different treatments.

Treatments	BDG	Coconut husk	Control
Mean weight	1.03^a	0.63^b	0.59^b

Mean with the same superscripts are not significantly different

Table 4. Proximate Analysis *of Alma millsoni* from all treatments at the end of the experiment.

		N	Mean ± SD
% Crude fibre	Control	3	2.92 ± 0.27
	Coconut husk	3	3.19 ± 0.29
	BDG	3	3.36 ± 0.19
	Total	9	3.16 ± 0.29
% Fat	Control	3	3.81 ± 0.55
	Coconut husk	3	5.12 ± 2.19
	BDG	3	9.52 ± 0.37
	Total	9	6.15 ± 2.83
% Crude Protein	Control	3	88.87 ± 5.61
	Coconut husk	3	91.25 ± 8.81
	BDG	3	81.98 ± 5.88
	Total	9	87.36 ± 7.30
% Crude ash	Control	3	5.14 ± 0.36
	Coconut husk	3	5.13 ± 0.28
	BDG	3	4.02 ± 0.23
	Total	9	4.76 ± 0.61
% Moisture	Control	3	12.44 ± 0.89
	Coconut husk	3	11.15 ± 2.24
	BDG	3	11.89 ± 1.31
	Total	9	11.82 ± 1.48

the experiment (Table 4) revealed that there was no significant difference between the percentage crude fibre, crude protein and moisture content of *A. millsoni* whereas the percentage crude fat and ash were significantly differrent ($P \leq 0.01$) with *A. millsoni* fed brewers dried grain recording the highest percentage crude fat (Table 5 and 6). This suggests that the higher mean weights observed for *A. millsoni* fed with brewers dried grain was probably as a result of the increase in percentage crude fat content of the worms. There is therefore a relationship between the feed source of earthworms and their growth performance during vermiculture.

Though the growth performance (in terms of weight) of *A. millsoni* fed brewers dried grain was significantly higher compared to those fed coconut husk, we cannot still conclude that brewers dried grain is a better choice for vermiculture since the observed weight increase could have been as a result of the earthworms laying down fat rather than building tissue. Furthermore, since no significant difference was observed in the crude protein content of earthworms under all treatments, it is therefore concluded that neither the use of brewers dried grain nor coconut husk as feed source is good for vermiculture if there is no accompanying nitrogen source.

Table 5. Analysis of variance of the proximate analysis of *A. millsoni* from all treatments at the end of the 4th run.

		Sum of squares	df	Mean square	F	Sig.
% Crude fibre	Between groups	0.295	2	0.148	2.261	0.19
	Within groups	0.392	6	0.065		
	Total	0.687	8			
% Fat	Between groups	53.721	2	26.861	15.325	0.01
	Within groups	10.517	6	1.753		
	Total	64.238	8			
% Crude protein	Between groups	139.099	2	69.550	1.452	0.31
	Within groups	287.303	6	47.884		
	Total	426.402	8			
% Ash	Between groups	2.494	2	1.247	15.253	0.01
	Within groups	0.525	6	0.087		
	Total	3.019	8			
% Moisture	Between groups	2.515	2	1.258	0.502	0.63
	Within groups	15.027	6	2.505		
	Total	17.543	8			

Table 6. Duncan multiple range test of proximate composition of *A. millsoni* from all treatments obtained at the end of the experiment.

Treatments	BDG	Coconut husk	Control
% Crude fibre	3.36^a	3.19^a	2.92^a
% Crude fat	9.52^a	5.12^b	3.81^b
% Crude protein	81.08^a	91.25^a	88.87^a
% Ash	4.02^b	5.13^a	5.14^a
% Moisture	11.89^a	11.15^a	12.44^a

Mean with the same superscripts are not significantly different

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