COMPARISON OF MAGGOT CULTURE AS AQUAFEED IN SUSTAINABLE AQUACULTURE USING DIFFERENT ORGANIC WASTES

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Abstract.

. Abattoir waste, poultry dung and maize bran waste were collected, oven dried to constant weight and used for maggot culture. Maggot production was monitored for first occurrence time and collections were made after full production period. The sizes in length (cm) and weight (g) of maggot at full production capacity were measured and quantity produced computed for each substrate. This experiment lasted for four weeks. The results of the experiment showed that the shorter maggot first occurrence time of 48-72hours was recorded in fresh poultry dung waste and the highest time of 72-120 hours was recorded in fresh processed maize bran waste. There was significant difference between the first time of occurrence of maggot in these two wastes. The highest mean weight and length of 0.023 ±0.009g and 1.7 ±0.55cm were recorded in maggot raised in fresh poultry dung waste. There was no significant difference ($p>0.01$; $p>0.05$) between the weight and length of maggot at full grown time when raised in fresh abattoir waste and fresh poultry dung. 22.89g of live maggot/kg of waste was raised in poultry dung followed by 14.93g/kg waste from fresh abattoir waste and least of 6.79g/kg of waste. The nutritive value of the maggot meal varied with each dung with maggot from poultry dung been the richest. Based on the result of this experiment effort could be more intensified using both abattoir waste and poultry dung to raise maggot meal for sustainable aquaculture practices.

Key words: maggot, waste management, nutrient value, sustainable aquaculture, aquafeed.

Introduction

In Nigeria, over 932.5 tonnes of poultry manure and abattoir wastes are produced annually due to the well-established poultry and livestock industries, which are expanding at 6-8% annually (Adejinmi, 2000). The large turnout of these wastes imposes threat of disposal to the poultry and cattle slaughtering industries and as well a serious pollution norm to the incumbent environment and man's health hence an efficient and effective means of poultry waste disposal becomes imperative. Recycling of organic wastes has therefore assumed significant role in aquaculture for enhancement of detritus food chain though this in most cases is limited to dung from poultry, livestock and horse. Manure is the principal food of many insects in nature especially housefly and black soldier fly (Calvert, 1976; Newton *et al.*, 2005). Their utilization of manure contributes to the natural recycling of nutrients and the insect produced food for many larger animals. Scientists in China, USSR, United States, Mexico, Eastern Europe, Israel, Australia, Benin Republic and Nigeria to mention a few, have studied and exploited manure digestion activity by insects to produce high quality feedstuff. Production of maggot from waste materials either from plants or animals origin is a biodegradation process, which has the advantage of producing useful animal protein (Calvert, 1976; Ugwumba *et al.,* 2001 and Sogbesan *et al.*,2006) for fish, poultry and other livestock and useful organic manure (scum) that could be useed to fertilize farms for crop production. This process curtails the problems of waste disposal. Lately the emphasis of maggot production had shifted away from animal protein production to potentially using the insect to solve the problem associated large amount of manure produced on Concentrated Animal Feeding Operation. The objective of this project is to verify production capacity of cattle rumen pouch content (Abattoir waste), Poultry dung and fresh processed maize bran in maggot production in a search for a better disposal means and conversion of the wastes to useful nutrients for fish.

Materials and Methods

Abattoir waste was collected directly from the pouch of the cattle into a basin at the major abattoir in Kainji and transported to the laboratory. Poultry dung was collected into a flat bowl between 6.30 and 7.30 a.m before the daily cleaning exercise from the integrated fish farm poultry pen of National Institute for Freshwater Fisheries Research, New-Bussa, Niger-state and transported to the laboratory and maize bran waste was collected after sieving and extraction of the corn starch into a bowl. All the collected wastes were oven dried to constant weight and weighed separately. 1 litre of water was added to each dried 1kg substrate and packed in a jute bag. The substrates were exposed to housefly *Musca domestica* for feeding between 8.00-10.00GMT within the aviary premises of National Institute for Freshwater Fisheries Research, New-Bussa, Niger-State during which they laid eggs while feeding on the wastes. Maggot production was monitored for first occurrence time and collections were made after full production period. The sizes in length (cm) and weight (g) of maggot at full production capacity period were measured and quantity produced computed for each substrate. This experiment lasted for four weeks.

Processing of the animal feedstuffs and feed formulation.

The cultured maggots were harvested and processed into dry meal. The processed maggots were ground into powdered form, analyzed for proximate composition and amino acid compositions.

Statistic analysis

All data collected were subjected to analysis of variance [ANOVA}. Comparisons among treatment means were carried out by one way analysis of variance followed by Tukey's test (0.05). Least Significance differences (LSD) was used to determine the level of significance among treatments using SPSS 10.0 Windows 2000 and Graph pad Instat packages.

Results and Discussion

Table 1 shows the occurrence time of maggot using different substrates. Table 2 shows mean length and weight of maggot cultured in different substrates while Table 3 showed quantity of waste needed for maggot production using different substrates. The proximate compositions of the maggots cultured in different substrates are presented on Table 4 along with that of the conventional fish meal. Fig. 1 shows the rate of maggot production.

Using any of the wastes in this study will go a long way in producing maggot and serve as appropriate medium of disposal and management of organic wastes. Calvert *et al.* (1969) had mentioned that the only way out of the huge loss of poultry and livestock dung and waste is to use natural organism which could break down the wastes by biodegradation, thereby providing a source of animal protein for fish and livestock so as to reduce the recurrent cost of aquaculture production which has been on a geometrical increase as a result of hike in prices of the conventional ingredients especially fish meal and soybean (Olomola, 1990, Falaye, 1992 and Sogbesan and Ugwumba, 2006). While occupying the organic wastes, insect aerate it, reducing odour. Maggot as well modify the microflora of manure potentially reducing the harmful bacteria (Erickson *et al.*, 2004). The all year round production of maggot as the animal protein source which is one of the objectives of the study could be achieved with the result so far. The cultured maggot contained the required nutrient composition needed for fish feed though there were variations between the compositions based on each culture substrate. The culture technique of maggot is very simple (Sogbesan *et al.*, 2006) and the capital investment is relatively cheaper compare to that of raising clupeids into fish meal. Hence, it is highly recommended to fish farmers. The results from this study provide basic information on the utilization of maggot meals as dietary protein as substitutes for fish meal in low-cost diets for tropical fishes. Cuticle of maggot like other arthropods contains chitin and if maggots are processed industrially to recover the oil using oil expeller, it might also be possible to add additional steps to recovery of chitin and chitosan which have significant value in several industries (Newton *et al.*, 2005). The refined product would have significant greater feeding and economic value than the original dried maggot meal. Protein has also been reported as the most costly nutrient in fish diet. The nutrient quality of feed ingredient is one of the major prerequisite apart from availability before such ingredient is recommended for feed production. The crude protein content recorded for each of the non-conventional animals is in line with that of other alternative protein supplements of animal origin fed to fish (Wee, 1998) which indicates that feeding fish with any of these ingredients will not pose the problem of malnutrition on them.

Recommendations

Based on the result of this experiment, effort should be enacted into research so as to perfect the utilization of both poultry wastes and cattle rumen pouch waste in maggot production. Technology could still be borrowed from other scientist within and outside the nation on large scale cum commercial production of maggot. The beauty of such research is not only in the provision of maggot as animal protein substitute for fish meal but also in sanitizing our environment, reduction in the organic waste moisture, offensive odour, pollution potential hence, reducing the waste health hazard.

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Table 1: The occurrence time of maggot using different substrates

Substrates	First Maggot Occurrence time in (Hr.)	Time for Full Production (Hr)
FPBMW	72-120 (96)[b]	120 144 (132)[b]
FCRP	56-72 (64)[a]	72 -108 (90)[a]
FPDW	48-72 (60)[a]	72 -96 (84)[a]

*** mean in parentheses**

Table 2: Mean length and weight of maggot cultured in different substrates

Substrates	Mean length (cm)/ SEM	Mean weight (g) /SEM
FPMBW	0.7 0.3	0.0103 0.04
FCRP	1.3 0.7	0.0178 0.07
FPDW	1.7 0.55	0.023 0.009

Table 3: Quantity of waste needed for maggot production using different substrates.

Substrates	Amount (g)/Kg substrate	Number Produced/kg of substrate	Quantity of substrate (kg) for I kg of live Maggot	Quantity of substrate (Tonne) for I tonne of dry Maggot
FPMBW	6.79	659	147.3	6.13
FCRP	14.93	839	66.98	2.79
FPDW	22.89	995	43.69	1.82

Keys:

FPOW Freshly processed maize bran Waste.

FCRW Freshly collected cattle rumen waste.

FPDW Freshly collected poultry dung waste.

Table4. Proximate composition of the tested animal protein sources.

Composition	Maggot Meal FPMBW	Maggot Meal FCRP	Maggot Meal FPDW	Fish meal (Clupeid)
Crude Protein %	44.33^{b}	46.56^{ab}	50.42^{c}	71.46^{a}
Ether Extract %	18.06^{ab}	19.74^{a}	20.61^{a}	7.97^{c}
Crude fibre %	9.63^{a}	8.23^{a}	1.56^{b}	1.18^{c}
Ash %	7.23^{c}	10.22^{b}	11.65^{b}	18.22^{b}
Nitrogen free Extract %	10.98^{a}	7.58^{b}	5.62^{c}	3.17^{d}
Dry matter %	90.23^{a}	92.33^{a}	89.86^{a}	90.21^{a}

All values on the same row with the different superscripts are significantly difference $p<0.05$.

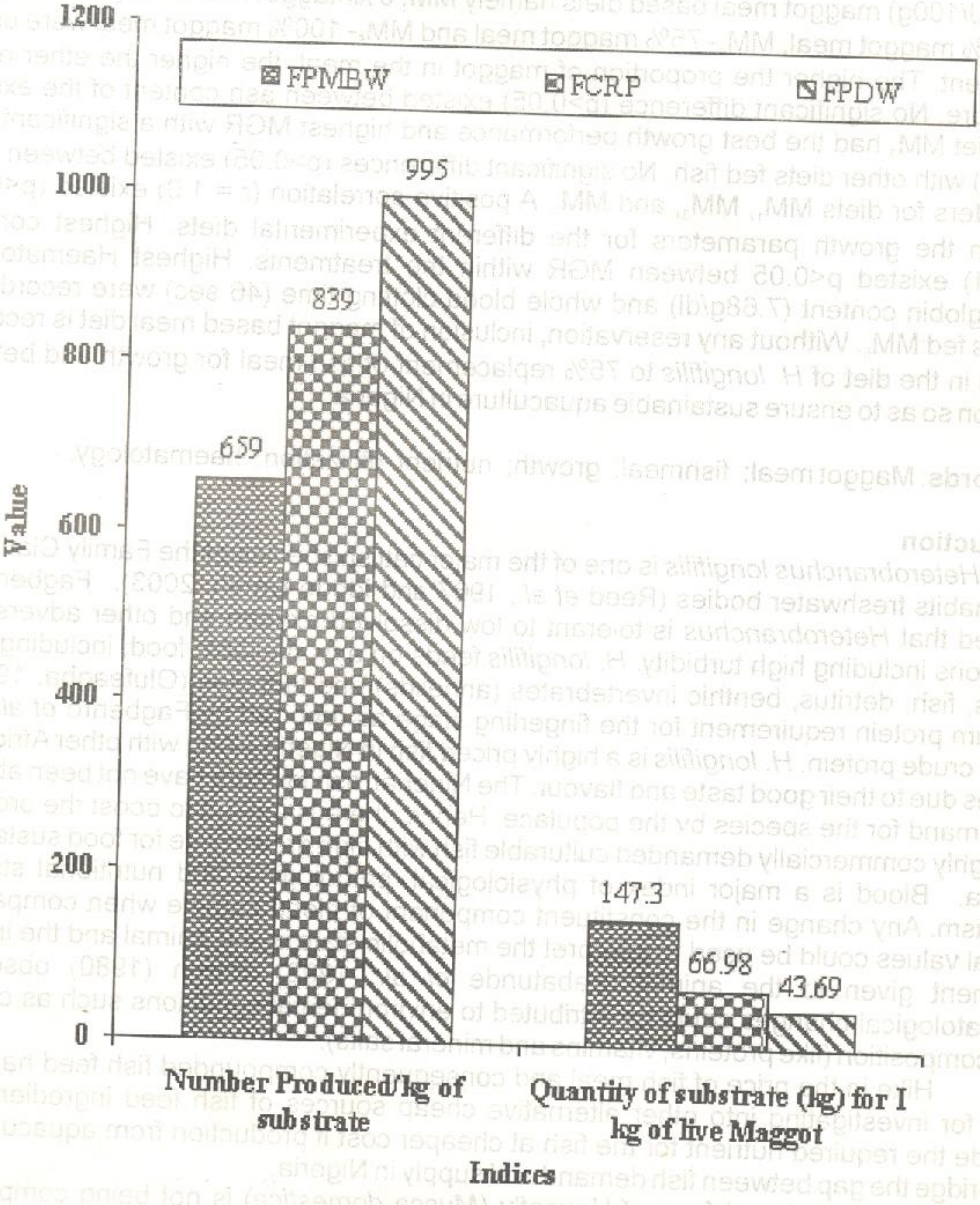

Figure I. Maggot production and wates needed