ISSN: 2347-5129
IJFAS 2014; 1(4): 08-11

www.fisheriesjournal.com
Received: 01-02-2014
Accepted: 15-02-2014

E. Sugumaran,
Aquaculture Laboratory,
Department of Zoology,
Annamalai University,
Annamalainagar- 608002,
Tamilnadu.
E-mail:esmever4u@gmail.com
Tel: +91-9095082508

M.V. Radhakrishnan,
Aquaculture Laboratory,
Department of Zoology,
Annamalai University,
Annamalainagar- 608002,
Tamilnadu.
E-mail: mvrkrishnan44@yahoo.com
Tel: +91-9486421472.

Correspondence:
M.V. Radhakrishnan,
Aquaculture Laboratory,
Department of Zoology,
Annamalai University,
Annamalainagar- 608002,
Tamilnadu.
E-mail: mvrkrishnan44@yahoo.com
Tel: +91-9486421472.

Effect of Sugarcane Bagasse and Supplemental feed on Length and Weight of the catfish *Clarias batrachus* (Linn.)

E. Sugumaran and M.V. Radhakrishnan*

ABSTRACT
The present investigation has been conducted to understand the effect of sugarcane bagasse an artificial substrate on length weight relationship of *Clarias batrachus* for a period of 120 days. Sugarcane bagasse bundles (Length 50 cm; diameter 4cm) of 5 kg were hung in large cement tanks (5x5x1 m) with 15 cm soil base with well water in 6 of the 9 tanks randomly at the rate of 5 kg each, by suspending the bundles at regular distances from bamboo poles kept across the tanks. Fingerlings of *Clarias batrachus* (Av. Length 2.5 cm; Av. Weight. 3.18 g) were stocked at 40 per tank, two weeks after the addition of manure and substrate. No feed was provided to the fish in 3 of the substrate-added tanks (T_1), while a pelleted diet was fed to the fish in the remaining 3 substrate-added tanks (T_2) and the other 3 tanks without substrate (T_3). The length and weight of individual fish in each tank were measured at the start and every 15 days to monitor growth response. The parameters showed a significant response and high value in bagasse and supplemental feed group (T_2) followed by without substrate (T_3) and sugarcane bagasse alone group (T_1). These results showed that sugarcane bagasse can effectively be use as a substrate for the culture of the catfish *Clarias batrachus*.

Keywords: Sugarcane bagasse, Artificial substrate, *Clarias batrachus,* length and weight.

1. Introduction
In fish sampling programs length and weight data are used to estimate growth rates, age and other components of fish population dynamics [1], allow fisheries scientists to convert growth-in-length equations to growth-in weight in stock assessment models [2-6], estimate biomass from length frequency distributions [2,7], and calculate fish condition [7]. Length-weight relationships are also useful for comparing life history and morphological aspects of populations inhabiting different regions [3,5]. In the present study *Clarias batrachus* has been selected because the ability to adapt to fresh and brackish waters with very low oxygen content and to grow under generally poor environmental conditions make these fish extremely valuable for small and large scale rural fish farming [8]. Moreover, carnivorous species generally need a high protein diet and are therefore considered to be more expensive to produce, even though the costs will depend largely on local availability and price for the required feed stuffs. To compensate for feeding costs, most carnivorous species command higher market prices. Such species generally have greater export markets and therefore attract substantial investments. Species that are hardy and can tolerate unfavourable conditions will have the advantage of better survival in relatively poor environmental conditions that may occur occasionally in culture situations. Recently, substrate-based farming practices are considered viable low cost technologies as they help in sustainable aquaculture production [9]. Sugarcane bagasse is the fibrous residue remaining after sugarcane stalks are crushed to extract their juice, generated in large quantities and is currently used as a renewable resource in the manufacture of pulp and paper products and building materials. The present study has been designed to find out the effect of substrate (sugarcane bagasse) on length and weight of the catfish *Clarias batrachus*.

2. Materials and Methods

Irrespective of sex, healthy specimens of *C. batrachus* (2 ± 2 cm length and 3.14 ± 2g weight) were collected locally from a single population and confined to large cement tanks in the laboratory. The experiment was conducted over a period of 120 days in nine 25 m^2 (5 X5 X1 m) cement tanks with 15-cm soil base [9]. In all the tanks initially added 0.25 kg of quick lime and 2.5 kg of poultry manure. Water was filled to the tanks from a perennial well and a depth of 90 ± 2 cm was maintained throughout the experimental period. Subsequently, poultry manure was applied at 0.3 kg per tank every 15 days. Sugarcane bagasse, procured locally, was sun dried and bundles were made using nylon rope; they were introduced into 6 of the 9 tanks randomly at the rate of 5 kg each, by suspending the bundles at regular distances from bamboo poles kept across the tanks. After 45 days, once again 1.25 kg of the substrate was supplemented to each of the designated tanks.

Fingerlings of *C. batrachus* (av. Length 2.5 cm and av. Weight 3.18 g) were stocked at 40 per tank (16 000·ha^{-1}) two weeks after the addition of manure and substrate. No feed was provided to the fish in 3 of the substrate-added tanks (T_1), while a pelleted diet formulated [10] (Table 1) was fed to the fish in the remaining 3 substrate-added tanks (T_2) and the other 3 tanks without substrate (T_3) at 5% body weight for the first 30 days and 2% thereafter, in two equal rations daily. Individual fish in each tank were weighed at the start and every 15 days to monitor growth response. Water quality parameters which include dissolved oxygen, pH and ammonia were kept within the range of 6.7-6.9 (mg/l), 7.2-7.8 and 0.16-0.18 (mg/l), respectively and were considered favourable in fish culture tanks [11]. The length and weight of individual fish in each tank were measured at the start and every 15 days to monitor growth response [12] in all tanks for 15d, 30d, 45d, 60d, 75d, 90d and at the end of 120 days. The experiment consisted of a completely randomized design with three replicates for each three dietary treatments. Statistical analysis of the data included the one-way analysis of variance (ANOVA) using the SPSS version 10.0 for windows on PC (Statistical Graphics Corp, US). Significant mean differences were separated at 5% [13] whereas appropriate and values are expressed as means ± SE.

Table1: Ingredient proportion and proximate composition of feed (wet weight basis)

Ingredient	%	Proximate composition	%
Fish meal	25	Moisture	7.29 ± 0.13
Rice bran	40	Crude protein	28.17 ± 0.66
Groundnut oil cake	25	Crude fat	3.15 ± 0.08
Tapioca flour	10	Crude fibre	15. 90 ± 0.54
		Ash	13.80 ± 0.62
		NFE	31.69
		Energy content	12.50 (KJ^{-1})

* Average of three values ± S.E

3. Results and Discussion

The growth response of *C. batrachus* using sugarcane bagasse as a substrate for 120 days is given in table 2. The length and weight of the fish showed progressive increase from the start to 120 days. High value for both the parameters were recorded in bagasse and supplemental feed group (T_2) followed by feed alone group (T_3) and sugarcane bagasse alone used group (T_1). Growth of fish and overall productivity of fish culture depend on a variety of nutrient carriers [14]. The amount of different nutrients present in any natural aquatic environment is generally low and so unproductive, while the quantity required for the growth of fish and fish food organisms (phytoplankton, zooplankton and bottom fauna /flora) is comparatively large[15]. When too much nutrient carriers (organic and inorganic) are used for fish culture, a substantial amount are lost through several ways and may become pollutants. Therefore, a large application of nutrient carriers may become hazards to fish [15]. Although inorganic fertilizers and organic manure contain various essential elements, all of them are not necessary for fish growth, so need to be conserved and carefully managed [14]. Organic substances such as plant materials, food scraps and paper products can be recycled using biological process. The intention of biological processing is to control and accelerate the natural process of decomposition of organic matter. Development of viable low-cost technologies and their application to current farming practices would help in enhancing aquaculture production [9]. Substrate based aquaculture is one such technology that has generated a lot of interest in recent years [16-19]. By providing organic matter and suitable substrates, heterotrophic food production can be increased several folds which in turn would support fish production. Substrates provide the site for epiphytic microbial production, consequently eaten by fish-food organisms and fish. Fish harvest microorganisms directly in significant quantities, either from microbial biofilm on detritus or from naturally occurring flocks in water column.

Table 2. Showing the length (cm) and weight (g) of the catfish *C. batrachus* reared in different experimental groups for 15d, 30d, 45d, 60d, 75d, 90d and 120 days.

Experimental Groups	Parameters	Initial	Experiment Duration (days)						
			15d	30d	45d	60d	75d	90d	120d
Sugarcane bagasse alone (T_1)	Length	2.5 ± 0.01	3.1 ± 0.00	4.6 ± 0.02	5.5 ± 0.01	6.2 ± 0.04	6.8 ± 0.05	8.5 ± 0.04	10.2 ± 0.02*
	Weight	3.18 ± 0.21	5.20± 0.18	9.10 ± 0.15	10.25± 0.12	12.28 ± 0.19	15.10± 0.12	18.00± 0.24	20.37 ± 0.50*
Sugarcane bagasse + Supplemental feed (T_2)	Length	2.49 ± 0. 22	3.5 ± 0. 21	5.2 ± 0.20	5.9 ± 0.15	6.8 ± 0.01	7.2 ± 0.04	9.5 ± 0.02	12.2 ± 0.25*
	Weight	3.20 ± 0.05	6.18 ± 0. 02	10.25 ± 0. 04	14.12± 0. 00	17.32± 0.25	19.24± 0.24	21.35± 0.21	24.17± 0.09*
Supplemental feed only (T_3)	Length	2.5 ± 0.01	3.3 ± 0.04	4.8 ± 0.02	5.7 ± 0.01	6.5 ± 0.02	7.0 ± 0.04	9.1 ± 0.05	11.9 ± 0.21*
	Weight	3.18 ± 0.21	5.95 ± 0.08	9.75 ± 0.15	14.10± 0.06	16.18 ± 0.02	18.75± 0.04	20.28± 0.06	21.34 ± 0.19*

* $p< 0.05$

In the present study the length and weight of the fish showed progressive increase in both the parameters in all the experimental groups. Our earlier study revealed that sugarcane bagasse not only affects water quality parameters but help to increase the growth of zooplankton [20]. Hence it can effectively be used as a substrate for the growth of planktons in aquaculture ponds. Provision of substrate would therefore, be useful for the growth of microbial biofilm [21]. Apart from forming food for fish, biofilm improves water quality by lowering ammonia concentration [22, 23]. The growth performance of fish was the best in substrate + feed treatment, being significantly higher than in substrate-alone or feed-alone treatments. The significantly better growth of fish in the combination treatment indicates that the species can efficiently utilize natural as well as artificial diets when provided together.

4. Conclusion

In India fish farmers are fully engaged in the culture of carp and other fish species and are less familiar with the culture of the catfish *C. batrachus* because of the lack of feeding techniques. Moreover, biodegradable substrates appear to be better in terms of promoting bacterial biofilm formation and the biomass. Traditionally, farmers fertilize their ponds or apply a combination of fertilizers and feed. The fish production was consistently higher in the periphyton system than in the substrate-free controls. It seems likely that the increased fish production partly results from the additional food that the periphyton provides. In traditional fishponds, the pond bottom is the only substrate on which some larger benthic algae grow but seldom make the ponds highly eutrophic due to shading by plankton blooms. In periphyton-based system, attached algae, zooplankton and invertebrates easily colonize the substrate in the water column, on which fish can graze more efficiently on planktonic food.

5. Acknowledgements

The authors are thankful to University Grants Commission, New Delhi, India for financial assistance and Dr. R. Karuppasamy, Professor and Head for the encouragement.

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