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Effects of different C:N ratios on growth and survival of spotted scat (*Scatophagus argus*) in the biofloc system

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ABSTRACT

This study is to determine the suitable C:N ratio for growth and survival of spotted scat (Scatophagus argus) cultured in the biofloc system. The experiment was in completely randomized design with three replications of four treatments in different ratios of C:N including (i) control treatment (without adding molasses); (ii) C:N=10:1; (iii) C:N=15:1; (iv) C:N=20:1; each treatment was triplicated. Spotted scat with average initial weight of 3.59 g were stocked in the 0.5 m^3 tanks at a density of 40 fish/m^3 and cultured at salinity of 5 ppt. Molasses was used to create and maintain biofloc formation in each treatment. After 4 months of culture, the spotted scat in the C:N=15:1 treatment had an average weight of 34.9 g and had the highest growth, highest survival rate, highest biomass, lower feed conversion ratio, and were significantly different (p<0.05) from the other treatments. The lowest survival rate and the yield were found out in the control treatment. Thus, the spotted scat cultured in the biofloc system with supplementation of molasses (C:N=15: 1) could be suitable for this species.

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1 INTRODUCTION

Spotted scat (*Scatophagus argus*) is a species with moderate size, favored meat and high commercial value (Ly Van Khanh, 2012). Towards the diversification to improve the sustainability of coastal aquaculture in the Mekong Delta, the spotted scat is one of most important targeted species. With trend of diversification of aquaculture farming systems towards sustainable development, the culture technique of spotted scat; therefore, this species needs to be studied in order to enhance the diversity of culture species in Vietnam, especially in the Mekong Delta. Up to now, the research on the spotted scat is rare, and rather to focus only on classification, description, biological characteristics, and reproduction (Ly Van Khanh, 2012); there are very few studies on grow-out farming. The difficulties in the commercial production of spotted scat are concerning to poor water quality and high food conversion ratio (FCR) resulted in negative impact on the environment and low economic efficiency of this species.

Biofloc technology is one of the new technology that can solve two problems in aquaculture: (1) removal of waste materials and metabolic products into biomass of heterotrophic bacteria in the water treatment ponds, (2) use of biofloc as additional food for fish in culture pond (Hopkins, *et al*., 1993; Avnimelech *et al*., 1994). In the biofloc systems, the important factor to control the ammonia concentration is the ratio of C:N, and thus through manipulation carbohydrate sources via feeding amount can be applied commonly (Avnimelech, 1999; Hargreaves, 2006). Therefore, based on this principal, the spotted scat tank applied biofloc technology could help to maintain water quality and reduce water exchange. Besides, spotted scat as omnivore and thus with the presence of phyto-planktonic species incorporated in the floc is possibly the sources of natural food, which in turn help to reduce the feeding rate or to slow down the food conversion ratio in the farming systems could be expected. To improve the efficiency of spotted scat cultured with biofloc, the quantity of carbohydrate adding to the pond and the suitable C:N ratios are needed to find out the better fish growth and water quality. The out-puts from this study are considered as the basic culture technology information for spotted scat culturing in the biofloc system in order to improve the economic benefit and sustainability of farming systems.

2 METHODS

The study was carried out in experimental hatchery of College of Aquaculture and Fisheries, Can Tho University.

2.1 Experiment setup

The experiment was completely randomized set up with four treatments and three replicates each. Four treatments were applying molasses in different ratios of C:N: including (i) control treatment (without adding molasses), (ii) C:N as 10:1, (iii) C:N as 15:1, and (iv) C:N as 20:1.

The experimental system has 12 tanks (0.5 m^3 - tank) with 0.8 m water depth and salinity of 5 ppt. The fish with average individual weight of 3.59 g were stocked at the density of 40 fish/m^3. The experimental period was four months; the fish was fed twice a day (8 am and 4 pm) by commercial feed (Grobest with 35% protein) at *ad libitum* feeding. The experimental tanks were aerated to maintain the dissolved oxygen level higher 4 mg/L and suspend of biofloc without damage its form of biofloc. The molasses to produce the biofloc had carbohydrate and nitrogen concentrations of 33.70% and 1.44%, respectively.

During the culture period, molasses was added to the culture tanks once a day to maintain the C:N ratio designed. Based on the amount of feed fed to spotted scat, the amount of molasses added into the culture tanks was calculated as indicated by Avnimelech (1999).

$$C:N = \frac{C = Approximately\ 50\%\ of\ total\ feed\ amount}{N = \%\ of\ protein\ in\ \ feed \times 0.155}$$

2.2 Data collection

Water quality: water quality parameters were measured fortnightly; in which temperature and pH was measured by HANNA recorder (7 am and 2 pm); transparency was measured by Secchi dish (6-8 am); TAN and N-NO_2 were measured by test kit Sera (6-8 am). Biofloc particles were randomly selected to measure the wide and length under the microscope monthly. The volume of biofloc (Floc Volume Index, FVI) was estimated monthly by using settlement method (30 minutes) in the Imhoff cone.

Fish sampling: Fish were randomly collected to 30 individuals to determine the initial weight, height and length of fish. Bi-monthly, in each treatment ten fishes were randomly selected to estimate growth rates as the body weight, height and length, and to determine the survival rates of fish, as well. At the end of experiment, all fish were weighed and measured their height and length individually then the total number of fish was counted in every tank to determine growth and survival rate and total biomass of fish.

During experiment period, the feed used was recorded to calculate the feed conversion ratio (FCR). The growth rate of fishes, volume of floc (FVI), FCR, survival rate, total biomass of fish, and coefficient of variation (CV) of fish weight were calculated as following equations:

– Daily weight gain (g/day) = (W_{final} – $W_{initial}$)/t

– Specific growth rate of weight (%/day) = 100 x [(lnW_{final} – $lnW_{initial}$)/t]

– Daily length gain (cm/day) = (L_{final} – L_{intial})/t

– Specific growth rate of length (%/day) = 100 x [(lnL_{final} – $lnL_{initial}$)/t]

– Daily height gain (cm/day) = (H_{final} – $H_{initial}$)/t

– Specific growth rate of height (%/day) = 100 x [(lnH_{final} – $lnH_{initial}$)/t]

Where: W: weight (g), L: length (cm), H: height (cm) and t time (day)

– FCR = amount of feed fed (g)/weight gain of fish (g)

– Survival rate (%) = 100 x (no. fishes harvested /no. fishes stocked)

– Fish biomass (kg/m^3) = total weight of harvested fishes (kg) total water volume/m^3

– Coefficient of variation (CV) = $\frac{S}{\overline{X}}$ x 100

Where: S: standard deviation of fish weight

$\overline{X}$: mean of fishes

Volume of biofloc (FVI): FVI = Volume of floc./Volume of water sample (mL/L)

2.3 Data analysis

The data collected were analyzed by descriptive statistics (mean, standard deviation), and the differences among the means of the growth performances were determined by using one-way ANOVA and Duncan test ($p<0.05$) with SPSS version 16.0.

3 RESULT AND DISCUSSION

3.1 Water quality

The results indicated that the average of water temperature in the morning and afternoon were fluctuated in range of 26.5-28.6ºC (Table 1). The suitable temperature for warm water fish is from 25 to 32ºC (Truong Quoc Phu, 2009). Average of pH in the morning ranging from 7.89-7.97; afternoon ranging from 8.43-8.54 was considered as the suitable pH for the growth of this species (Ly Van Khanh, 2012). According to Boyd (1998), the pH suitable for aquatic animals is in the range of 6.5-9.0 with daily fluctuation less than 0.5 per day. Therefore, the water temperature and pH in the experimental tanks were in suitable ranges for the growth of spotted scat.

Table 1: Temperature and pH in the experiment

Treatment	Temperature (ºC)		pH	
	7:00	14:00	7:00	14:00
Control	26.6 ±0.26	28.5±0.22	7.9±0.03	8.5±0.10
C:N=10:1	26.5±0.02	28.5±0.04	7.9±0.05	8.5±0.06
C:N=15:1	26.7±0.01	28.6±0.08	7.9±0.06	8.4±0.05
C:N=20:1	26.6±0.19	28.2±0.27	7.9±0.04	8.4±0.02

The average of transparency was from 20.6-28.0 cm (Table 2). In the treatment with high C:N ratio, the water transparency was low compared to low C:N ratio treatments; the low transparency may be caused by the higher volume of biofloc compared to other treatments. The suitable transparency for fish pond is from 20-30 cm, and 30-45 cm for shrimp pond (Truong Quoc Phu, 2009). The concentration of TAN in the treatments averaged from 0.34-0.78 mg/L, of which the highest value was in the control treatment (without biofloc), and lowest in the C:N = 15:1 treatment.

Average concentrations of N-NO_2 varied in the range of 0.50-1.65 mg/L, in which the highest level was found in the control treatment. This could be due to poor development of biofloc leading to low absorption TAN and N-NO_2 of beneficial bacteria compared to other treatments. The N-NO_2 and TAN concentrations decreased when the FVI increased. Thereby, the adding molasses into the culture tanks is necessary to maintain better water quality and produce the natural foods for fishes.

According to Boyd (1998), N-NO_2 concentration should not go over 10 mg/L (optimum is <2 mg/L); and TAN from 0.2 to 2 mg/L is suitable for aquaculture (Truong Quoc Phu, 2009). The TAN concentrations in the experimental tanks were reduced in the end of experiment due to the nitrification activity or evaporation of ammonia in the strong aeration condition (Le Van Cat *et al*., 2006). In general, the water quality parameters in this experiment are in the suitable ranges for the growth of the spotted scat.

Table 2: Transparency, TAN and N-NO_2 parameters in the experiment

Treatment	Transparency (cm)	TAN (mg/L)	N-NO_2 (mg/L)
Control	28.0±0.64	0.78±0.03	1.65±0.04
C:N=10:1	23.5±0.46	0.36±0.11	0.71±0.13
C:N=15:1	22.0±0.72	0.34±0.08	0.50±0.04
C:N=20:1	20.6±0.90	0.37±0.08	0.87±0.18

3.2 The size and volume of biofloc

The biofloc size and volume have tended to increase from early stage to the end of experiment in all treatments. There was wide range of biofloc volume average from 5.05-31.0 ml/L from the control to C:N = 15:1 treatment (Table 3) and increase from low to high concentration of molasses adding treatment. In the early stage, the size of floc is mall and after that, the floc size developed to bigger size because of incorporating more organic matter at the end of experiment by growing up of beneficial bacteria, protozoans and algae. When the composition of floc is rich, the small size of floc can bunch together to establish the larger floc size. Result showed that the average of biofloc size was greatest (0.44 x 0.31 mm) in the treatment molasses adding with C:N = 15:1, and was smallest (0.33 x 0.23 mm) in the control treatment (no molasses adding). There width of floc was greatest in the treatment of C:N = 15:1, following as C:N = 20:1, C:N = 10:1, and control treatments ($p<0.05$). Meanwhile, the length and the volume of floc were large in the treatments of C:N = 15:1 and 20:1, followed by C:N = 10:1, and control treatment ($p<0.05$).

Table 3: Dimension of floc in different C:N ratios after culture four months

Treatment	Floc size		
	Length (mm)	**Width (mm)**	**FV (mL/L)**
Control	0.33±0.02[a]	0.23±0.00[a]	5.05±0.66[a]
C:N=10:1	0.37±0.01[b]	0.25±0.00[b]	20.2±1.66[b]
C:N=15:1	0.44±0.01[c]	0.31±0.01[c]	31.0±2.38[c]
C:N=20:1	0.41±0.02[c]	0.29±0.01[d]	30.0±3.54[c]

Values with different superscripts within a column are significantly different (p<0.05)

The development of biofloc was depended on amount of molasses supplementation, aeration condition, and especially grasping the biofloc by spotted scat. According to Avnimelech (2012), biofloc includes bacteria, protozoan, and algae in which, the heterotrophic bacteria are dominant. Therefore, in the end of the experiment, the volume of floc has increased due to more amount of feed fed and molasses added, stronger aeration could favor the development of heterotrophic bacteria. The increased density of heterotrophic bacteria, algae and organic materials to compose the larger size of floc. The suitable FVI for aquaculture is from 15-20 mL/L; even in the case of larger size of floc the fish grows is still not be affected (Avnimelech, 2012; Hargreaves, 2013).

3.3 The growth performance of fish

3.3.1 Growth in weight

The average weights of the spotted scat after two months of culture varied from 17.9-23.8 g, in which the smallest size was observed in the control treatment (no biofloc) which was significantly different ($p<0.05$) from the C:N=15:1 treatment but not significantly different ($p>0.05$) from the C:N =10:1 and C:N = 20 treatments. ($p<0.05$).

After four months of culture, the mean weight of fish in the C:N =20:1 and C:N =15:1 treatments were 34.9±1.55 g and 30.5±2.85 g, respectively. These two treatments were significantly larger ($p<0.05$) than those in the control (23.5±2.67 g) and the C:N =10 treatments (25.1±3.57 g). The difference in weight of fish could be associated with the presence of biofloc in the culture tank as food supplement for fish. When the size and volume of floc well developed, this will cause the rich of heterotrophic bacteria, phytoplankton and zooplankton to maintain the water quality, in turn that convert the toxic gases as a role of probiotics (Avnimelech, 2012; Tacon, 2000). Consequently, the treatment with developed biofloc results in better growth of fishes.

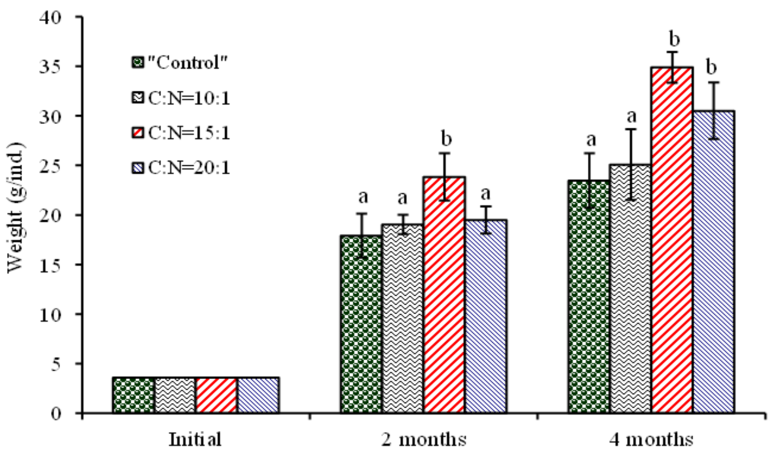

Fig. 1: The development of fish weight through four-month experiment

Table 4 showed that growth performance (daily weight gain and specific growth rate of weight) of spotted scat after four months culture in the C:N=15:1 treatment was greatest compared to the others; the fish weight growth of this treatment was significantly greater that those of control and C:N=10:1 treatments ($p<0.05$), but was not significantly different from that of C:N=20:1 treatment ($p>0.05$). In specific, the fish in C:N=15:1 treatment had the greatest daily weight gain and specific growth rate of weight as 0.26g/day and 1.98%/day, respectively, followed by C:N=20:1 (0.22 g/day, 1.78%/day), C:N=10:1 (0.18g/day, 1.61%/day) and control treatment (0.17g/day, 1.56%/day). The daily weight gain and specific growth rate of weight of fish in this study are better than those reported by Ly Van Khanh *et al*. (2010) (i.e. when the fishes was cultured in 55‰ salinity with the daily weight gain as 0.14 g/day and specific growth rate of weight as 1.48 %/day), and Hoang Nghia Manh (2010) (after six months culture, the spotted scat had the daily weight gain from 0.078-0.090 g/day).

Table 4: Growth in weight after four months of culture

Treatment	Initial weight (g)	Final weight (g)	DWG (g/day)	SGR (%/day)
Control	3.59±0.73	23.5±2.67^{a}	0.17±0.02^{a}	1.56±0.10^{a}
C:N=10:1	3.59±0.73	25.1±3.57^{a}	0.18±0.03^{a}	1.61±0.12^{a}
C:N=15:1	3.59±0.73	34.9±1.55^{b}	0.26±0.01^{b}	1.98±0.04^{b}
C:N=20:1	3.59±0.73	30.5±2.85^{b}	0.22±0.02^{b}	1.78±0.08^{b}

Values with different superscripts within a column are significantly different ($p<0.05$)

3.3.2 Growth in length

After two-months culture, the average length of fish was from 7.72 to 8.77 cm. The fish in C:N=15:1 treatment had the greatest length (8.77±0.38 cm), and was significantly different from the remained treatments ($p<0.05$). Meanwhile, the length of fish in the control treatment (7.72±0.27 cm) was slightly smaller than that of C:N=10:1 (8.09±0.24 cm) and C:N=20:1 (7.97±0.21 cm) treatments ($p>0.05$). The average length of fish ranged from 8.73-9.91cm, and the fish reached 9.91±0.12 cm length in the C:N=15:1 treatment which was the longest one and significant difference ($p<0.05$) compared to the others excluding C:N=20:1 treatment. The control treatment had poorest length growth (8.73±0.32 cm length). The difference of fish length was not found between control and C:N=10:1 treatment (9.02±0.54 cm) ($p>0.05$), meanwhile it was significantly found between control treatment with C:N=20:1 and C:N=15:1 treatment ($p<0.05$) (Figure 2).

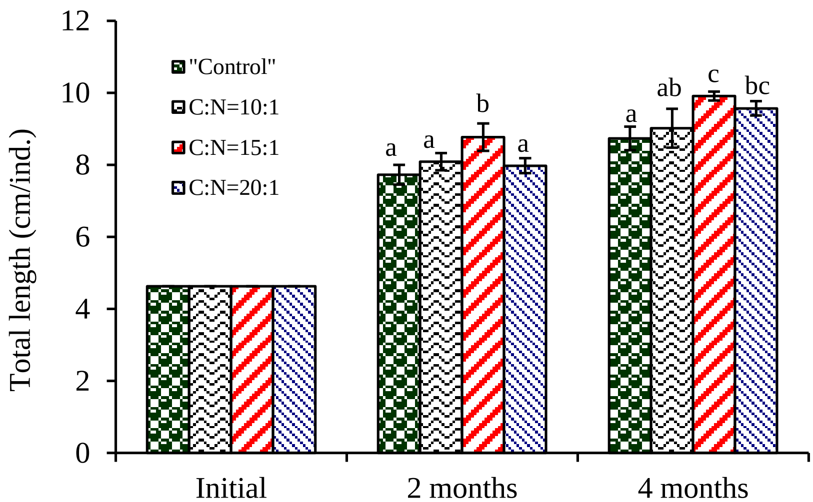

Fig. 2: The development of fish length through four-month experiment

Table 5 indicated that the development in length of fish after four-month culture ranged from 0.03-0.04 cm length/day (0.53-0.63%/day) in all treatments. The C:N=15:1 treatment having the greatest length of fish 0.04 cm/day (0.63 %/day) was significantly different from that of C:N=10:1 and control treatments ($p<0.05$), but was not significantly different from that of C:N=20:1 ($p>0.05$). The growth in length of fish was lowest in the control treatment (0.03cm/day; 0.53%/day) that was slightly lower than that of C:N=10:1 treatment ($p>0.05$) but was significantly different from those of remained treatments ($p<0.05$). The difference about the fish length development was not found out between C:N=10:1 and C:N=20:1 treatment ($p>0.05$). In general, the growth in length of fish is better than the result reported by Hoang Nghia Manh (2010); in the experiment culture on the different feed and stocking density resulting in the average daily length gain ranged from 0.030-0.033 cm length per day.

Table 5: Growth rate in length after four months of culture

Treatment	Initial length (cm)	Final length (cm)	DLG (cm/day)	SLG (%/day)
Control	4.63±0.35	8.73±0.32[a]	0.034±0.003[a]	0.53±0.03[a]
C:N=10:1	4.63±0.35	9.02±0.54[ab]	0.037±0.004[ab]	0.55±0.05[ab]
C:N=15:1	4.63±0.35	9.91±0.12[c]	0.044±0.001[c]	0.63±0.01[c]
C:N=20:1	4.63±0.35	9.57±0.20[bc]	0.041±0.002[bc]	0.60±0.02[bc]

Values with different superscript within a column are significantly different ($p<0.05$)

3.3.3 Growth in height

After two months, the average height of fish ranged from 4.11-4.64 cm. The height of fish in the treatment C:N=15:1 as 4.64±0.14 cm was significantly greater than those of C:N=20:1 and control treatments ($p<0.05$, but did not differ from that of C:N=10:1, significantly ($p>0.05$). The average height was lowest in the control treatment (4.11±0.17 cm), but was not significantly different from those of C:N=10:1 (4.34±0.14cm) and C:N=20:1 (4.31±0.21 cm) treatments. After four months of culture, the height of fish in four treatments ranging from 4.67–5.22 cm, could be significantly separated into two groups as: (1) control (4.67±0.27 cm) + C:N=10:1 (4.67±0.09 cm) treatments, and (2) C:N=15:1 (5.22±0.06 cm) treatment ($p<0.05$); meanwhile the C:N=20:1 (4.95±0.09 cm) treatment was belonged on both of two groups (Figure 3).

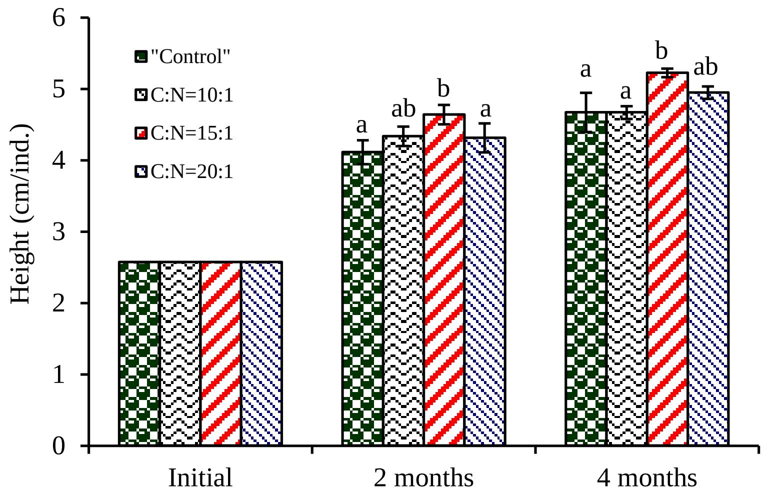

Fig. 3: The development of fish height through four-month experiment

Result indicated that the average of fish height ranged from 0.018-0.022 cm/day (0.50-0.59%/day). C:N=15:1 treatment having the daily height gain and specific growth rate of height of 0.022±0.000 cm/day and 0.59±0.01 %/day, respectively, was greatest and significantly different from C:N=10:1 (0.017±0.001 cm/day; 0.50±0.02 %/day) and control treatment (0.018±0.002 cm/day; 0.50±0.05%/day) ($p<0.05$), was not significantly different from the C:N=20:1 (0.020±0.001 cm/day; 0.55±0.01 %/day) ($p>0.05$). The development of fish height of the control treatment was lowest compared to other treatment, was significantly different from those of C:N=15:1 and 20:1 treatments ($p<0.05$), but was not significantly different from that of C:N=10:1 treatment ($p>0.05$) (Table 6).

Table 6: Growth in height after four months of culture

Treatment	Initial height (cm)	Final height (cm)	DHG (cm/day)	SHG (%/day)
Control	2.57±0.20	4.67±0.27^{a}	0.018±0.002^{a}	0.50±0.05^{a}
C:N=10:1	2.57±0.20	4.67±0.09^{a}	0.017±0.001^{a}	0.50±0.02^{a}
C:N=15:1	2.57±0.20	5.22±0.06^{b}	0.022±0.000^{b}	0.59±0.01^{b}
C:N=20:1	2.57±0.20	4.95±0.09^{ab}	0.020±0.001^{ab}	0.55±0.01^{ab}

Values with different superscript within a column are significantly different (p<0.05)

3.3.4 FCR

The FCR of treatments varied from 1.64-3.46; there was significant difference among four treatments ($p<0.05$) (Table 7). FCR was lowest (1.64±0.08) in the C:N=15:1 treatment, significantly different from three remained treatments ($p<0.05$). The control, C:N=10:1; C:N=20:1 treatment had FCR 3.46; 2.62; 2.19, respectively; there was difference of FCR among three treatments, significantly ($p<0.05$). Result indicated that when the biofloc have developed well, that helped to increase the edible food, to improve water quality and the fish growth better, contributing to reduce the FCR. The FCR of control treatment was highest (i.e. 3.46) due to the poor water quality/ fish growth, and low survival rate compared to other treatments ($p<0.05$). The ratio of C:N in the tilapia ponds indicated that biofloc can improve the protein utilization and water quality, and reduce the feed costs (Avnimelech. 1999). According to Nguyen Tien Hoa (2012), applying the biofloc in the intensive tilapia ponds reduced about 10% amount of feed consuming, but did not affect the growth and survival rate of tilapia.

Table 7: Feed conversion ratio through four months experiment

Treament	FCR
Control	3.46±0.17^{d}
C:N=10:1	2.62±0.26^{c}
C:N=15:1	1.64±0.08^{a}
C:N=20:1	2.19±0.02^{b}

Values with different superscript within a column are significantly different (p<0.05)

3.3.5 Survival rate and biomass of fish

After two months, the survival rate of spotted scat of these treatments ranged from 81.3-95.8%. The survival rate was lowest in the C:N=20:1 treatment (81.3±6.25%), and significantly different from remained treatments ($p<0.05$). In the first month, the water had not been matured yet as poor biofloc development was recorded; at that time the molasses added into C:N=20:1 treatment is more than those of other treatments, while a number of heterotrophic bacteria was not high enough to metabolize the large amount of carbon added. Therefore, the pH of culture tank in C:N=20:1 treatment was down leading to fish stressed and high mortality compared to remained treatments. The survival rate of C:N=15:1 was the highest (95.8±3.61%), and lower survival in C:N=10:1 and control treatment with similar survival rate of 93.8±6.25%, but not significantly different ($p>0.05$) to C:N=15:1 treatment and the lowest on was C:N=20:1 treatment (Fig. 4).

After four months, the average survival rates ranged from 58.3-79.2%. The survival rate of C:N=15:1 was significantly highest (79.2±7.22%) ($p<0.05$) compared to the control and C:N=20:1 treatment, but did not significantly differ from the C:N=10:1 (70.8±3.61%) ($p<0.05$). Meanwhile, the control treatment had lowest survival rate (58.3±3.61%), did not significantly differed from ($p<0.05$) C:N=20:1 treatment (62.5±6.25%), but significantly differed from two remained treatment ($p<0.05$) (Fig. 4). In the last two months, the biofloc had developed well, the heterotrophic bacteria consumed the carbon from the added molasses to increase their biomass. Besides, the bacteria absorbed the $N\text{-}NH_4$ and $N\text{-}NO_2$ which were emitted from fish to maintain and improve the water quality. In the C:N=15:1 treatment, there was rich biofloc resulted in the greatest survival rate and growth of fish. In the other hand, the biofloc poorly developed in the control treatment.

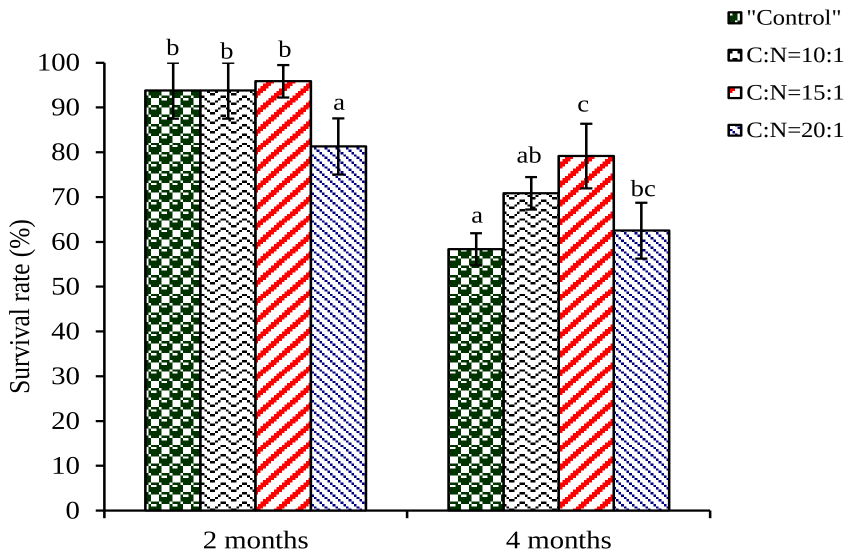

Fig. 4: The survival rate of fish height through four months experiment

The average biomass of spotted scat reached from 545-1.102 g/m^3 in all treatments (Table 8). Spotted scat biomass was significantly greatest in the treatment of C:N=15:1 (1.102±60.3 g/m^3) compared to remained treatments (p<0.05). Meanwhile, the spotted scat biomass was significantly lowest in the control treatment. The difference of fish biomass were not found out between the C:N=10:1 (708 g/m^3) and C:N=20:1 (758 g/m^3) (p>0.05).

After 4 months of stocking, the coefficient of variation of fish weight (CV) ranged from 0.18-0.35 in all treatments. The CV was highest in the C:N=15:1 treatment (0.35±0.06), significantly different from that of control treatment (p<0.05), but did not significantly differ from that of C:N=20:1 and 10:1 treatment. There was a significant difference of CV between the control and C:N=15:1 and 10:1 (p<0.05), but no difference between control and C:N=20:1 treatment was found out (p>0.05).

Table 8: Biomass and CV of fish through four-month experiment

Treatment	Biomass (g/m^3)	CV (%)
Control	545±37.6^a	0.18±0.03^a
C:N=10:1	708±82.4^b	0.30±0.08^b
C:N=15:1	1.102±60.3^c	0.35±0.06^b
C:N=20:1	758±19.8^b	0.28±0.03^{ab}

Values with different superscript within a column are significantly different (p<0.05)

The wide range of CV showed that the fish has disparity in size. After four months, the control treatment has a range from 15.0-27.5 g/fish. Especially, there was not any of fish with weight larger than 35.0 g/fish. In C:N=10:1 treatment, the average fish weight of 20 g/fish was dominated, the largest body weight reached approximately 50 g/fish; meanwhile the other groups of fish size have occupied an equal amount. In the treatment of C:N=15:1, the fish weight was greater than that of other treatments, and most the group of 30 g/fish was dominant; especially in this treatment, the number of fish within range 50-70 g/fish accounted quite large amount. The C:N=20:1 treatment group of 20.0-23.3 g/fish had dominated, next to the group of 30.0-43.3 g/fish finally as group of 50.0g/fish.

4 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

The C:N=15:1 treatment helped to sustain better water quality, therefore spotted scat with greatest daily weight gain (0.26 g/day), specific growth rate of weight (1.98 %/day) and survival rate (79.2%), and has the lowest FCR (1.64). Spotted scat cultured in biofloc tank system by using molasses as carbohydrate source at C:N=15:1 ratio resulted in the best growth performance.

4.2 Recommendation

The study on the spotted scat culture in the biofloc systems with other sources of carbohydrate should be considered in order to find out the most suitable carbohydrate source for this culture species.

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