Tilapia Bio floc Experimental Trials in Fresh & Sea water

Mohammed Ibrahim Othaibi, Abu Bakar Mohammed Sahli, mouffaq hamed Al-Ghamdi, Mohammed Saad Hazza

Jeddah Fisheries Research Center,
Ministry of Agriculture,
Government of Saudi Arabia,
North obhur, Jeddah.

Abstract

Tilapia Bio floc Experimental Trials was conducted in Full strength sea water and fresh water with minimum water exchange. The control tanks with same stocking density were operated in parallel to compare the results. The stocking density of all the experimental trials were uniform and the total number stocked in the bio floc tanks T-1, T-2, and T-3 & T-4 were 1000 pieces of 15 gm ABW. In the control tanks the stocking density was 51pieces/cubic meter and the total pieces stocked 1200. The fish were fed with pellet feed having the protein level of 42. The parameters like salinity, Ph, Temperature and Dissolved oxygen were recorded daily and the parameters like ammonia, Nitrite and TSS recorded weekly and found to a acceptable level. In the bio floc tank, the suspended solid load was controlled through the settlement tanks. The addition of an external solid removal tank for the fresh water bio floc tank (T-1 & T-2) was established and the solid loads removed frequently based on the imhoff cone reading. The growth rate in all the trials tanks were measured monthly and the feeding adjusted based on the growth performance. The overall performance in the fresh water bio floc tanks were satisfactory when compare with the full strength seawater and controlled tanks. The gaining average body weight in the sea water bio floc tanks were better than the fresh water floc and controlled tanks. The percentage survival was better in the controlled tanks.

Introduction

The bio floc technology is a new technique used in the aquaculture industry and the technique needs to be carefully to obtain the good result. This system will require lot of equipments which include a solid removal facility or foam fractionators, continuous air supply facility to keep the floc under suspension, culture tank must be concrete or HDPE lined with suitability for bio floc type of operation.

The operation would require constant checking of chemical parameters like dissolved oxygen, Total ammonia, nitrite, and PH. So it would be inevitable to have lab facility adjacent to the production facility in case of large volume of operation under this technical system. Similarly the instruments like salinity refract meter to measures the salinity raise up due to evaporation, the

dissolved oxygen meter to measure the level of dissolved oxygen in the morning and the PH meter.

Fisheries research center already have gathered good information and relevant experience in the bio floc operation through running the shrimp bio floc system. With this information the team has decided to run the Tilapia bio floc system in marine and fresh water system. The results achieved from these results will be compared to conclude the effective method of operation and could be applied to other species like Asian sea bass.

This fish, ***Oreochromis*** Tilapia have distribution throughout the world and *O. spilurus* believed to be the first fish species cultured. There are positive aquaculture characters possessed by Tilapia like, tolerance to poor water quality and they eat wide range of natural food organisms. But the commercial tilapia farming is still a constraint due to high sensitivity to temperature fluctuation and early sexual maturity that results in spawning before fish reach market size.

Materials & methods

The system for this experiment has been designed newly in the hatchery-2 location, the raceways tanks for bio floc operation facility. The fiber glass tank of 17.5 cubic meters is equipped with Eco2; this is a static aerator that works on the principle hydraulically. The sea water is pumped through Eco2 and controlled with nozzle. So this system does not require additional aeration facility since the Eco2 works and serves as both (water exchange & Aeration) effectively and continuously. The Eco2 also would facilitate the uniform distribution of water or the floc.

There were three set of operation has been conducted with tilapia fish. All these trials were continuously run for a period of 6 months to conclude the concept.

1. In the marine water system, pumped from the tube well was filled initially in the culture tank (FRP- 17.5 cubic meter) and floc developed. There will not be any more addition of water except the coverage of salinity loss. A sedimentation tank was provided to remove the excess solid load developed by the operation. The clear water from the sedimentation is continuously pumped through the Eco2 to the culture tank.

2. In the Fresh water system, Fresh water from outside source brought and filled in the culture tank and floc developed. No additional fresh water was added to the culture tank except maintain the level through evaporation. A sedimentation tank was provided to remove the excess solid load developed by the operation. The clear water from the sedimentation is continuously pumped through the Eco2 to the culture tank. Further, the

solid removal additional set up was established to remove the excess solid load based on the hoffcone readings.

3. In the full strength sea water pumped from the tube well, conventional method of operation of tilapia culture was operated as controlled system. Sea water is continuously pumped to the culture tank and the water exchange percentage would be 200 % daily and the feeding carried out manually with available local feeds. This system was continuously supported with aeration.

Tanks	Culture system	date stocked	Number of fish	Initial ABW	cultuer days
T-1	Fresh water bio floc	01 March 2013	1000	15.14	205
T-2	Fresh water bio floc	01 March 2013	1000	16.56	205
T-3	Sea water bio floc	02 March 2013	1000	16.72	204
T-4	Sea water bio floc	02 March 2013	1000	16.81	204
T-5	Control system	02 March 2013	1200	15.01	204
T-6	Control system	02 March 2013	1200	14.68	204

Facility for 1 & 2 equipped with Eco2

Facility for conventional method

Bio floc is the mix of detritus with associated bacteria, algae, protozoa, rotifers, copepods and other micro organisms. In simple terminology the process of bio floc could be explained as ability of recycling the nutrients released through the metabolic activities of the aquatic organisms. This process is always happening in the natural ecosystem, in the enclosed fresh water ponds or in the huge sea, the process of recycling continues with various living being which included heterotrophic microorganisms' feeds on organic matter.

Water quality parameters like dissolved oxygen, water temperature, salinity and PH were measured daily and the parameters like Total ammonia, nitrite and TSS measured weekly. Hydrated lime, Ca (OH) 2 was frequently added to fresh water bio floc tanks to maintain the PH level nearer to 7.00. The lime was added to the settlement tank and the water pumped so that the high –PH water was gradually added to the rearing tank. Water loss in the fresh water bio floc tanks T-1 & T-2 due to evaporation and solid removal was replace weekly or as an when required.

The tilapia fingerlings were produced from the JFRC Tilapia seed production facility and stocked at the rate of 18 pieces per cubic meter. The initial stocking size was 10 gm and the growth performances recorded monthly through sampling. The average growth gaining was better in the full strength sea water bio floc tank, T-3 shows 30.71 and the T-4 shows 283.57 and the fresh water bio floc tanks 1 & 2 shows 21.43 & 20.71 where as the control tanks T-5 & T-6 shows 18.00 & 18.14 respectively. The growth variation was due to the survival of the fish, high survival tank shows low growth gaining.

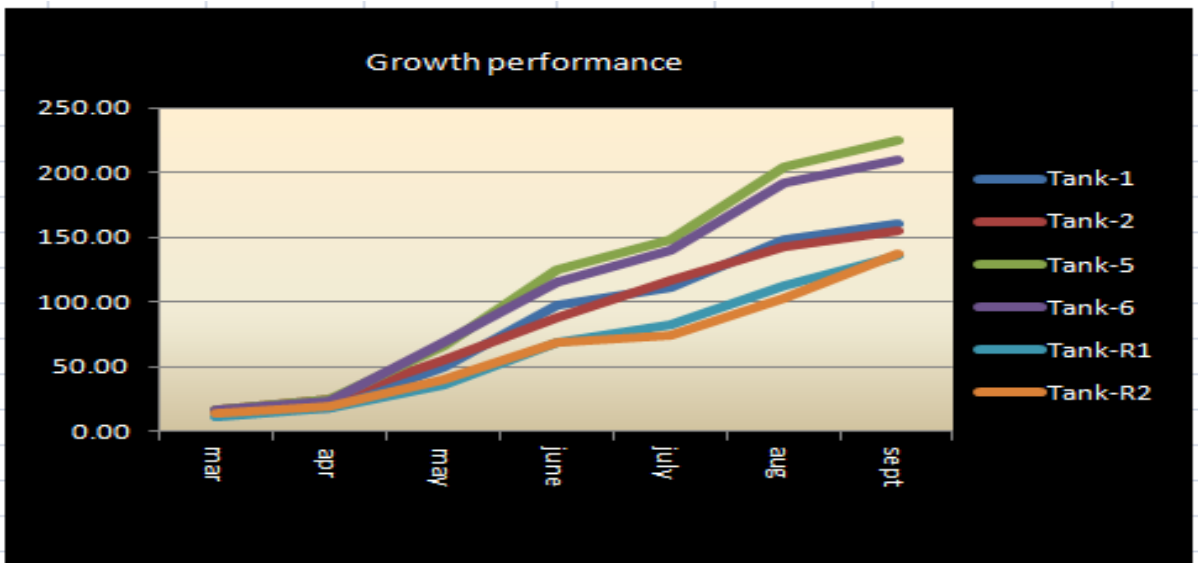
Detail	Tank-1	Tank-2	Tank-3	Tank-4	Tank-5	Tank-6
Initial stocking	1000	1000	1000	1000	1200	1200
weight gain/month/gm	21.43	20.71	30.71	28.57	18.00	18.14
Bio mass/ kilogram	135.00	146.00	131.00	134.00	139.00	149.00
Average Body weight/gm	160.00	155.00	225.00	210.00	136.00	137.00
Number Fish Harvested	844	942	582	638	1022	1088
Final Survival percentage	84.38	94.19	58.22	63.81	85.17	90.63
Feed Used in kilo gram	251	254	388	404	324	318
Feed Conversion Ratio	2	2	3	3	2	2

Addition of carbohydrate, molasses was carried out to reduce the concentration of inorganic nitrogen in the culture tank through the microbes which immobilize the inorganic nitrogen in the tank. In general based on the previous results of Bio floc operation, the carbohydrate addition needed to reduce TAN concentration by 1 mg/lit N (1gm N/cubic meter) is 20 mg (20 gm/Cubic meter.

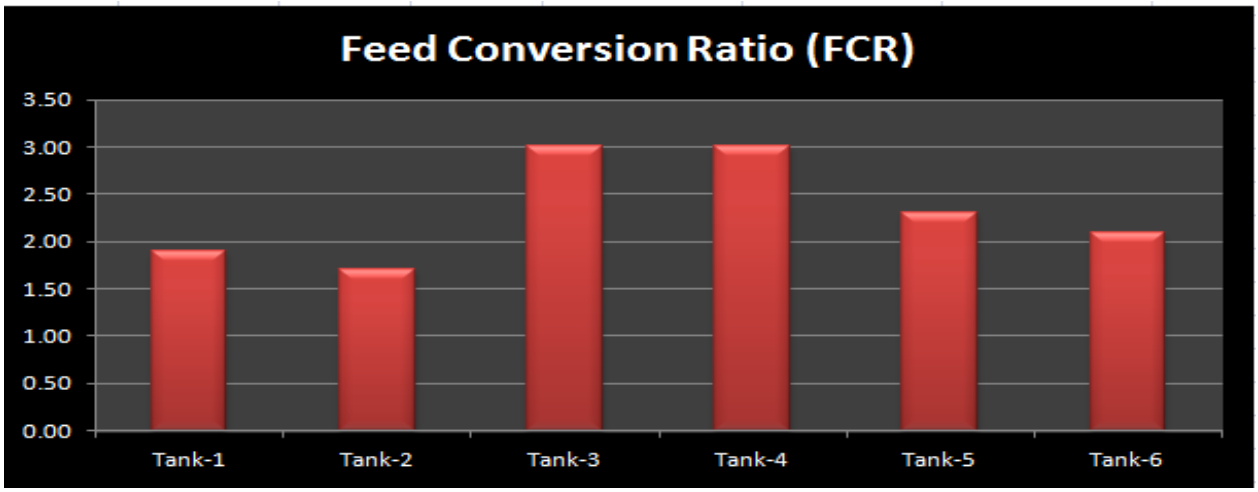
The floc concentration was maintained by taking samples in the transparent container and observing the concentration of suspended particles. The floc concentration was calculated using calibrated **IMhoff cones**. Water from the bio floc culture tank was filled in the cone; 1 liter of allowed to settle for 20 minutes. The ideal floc volume can reach up to 20 to 40 ml in the case of fish ponds and critical limit was be 50 ml. The floc level was maintained below 50 ml/lit, and the excess solid load was removed through the external solid removal facility.

Results & discussion

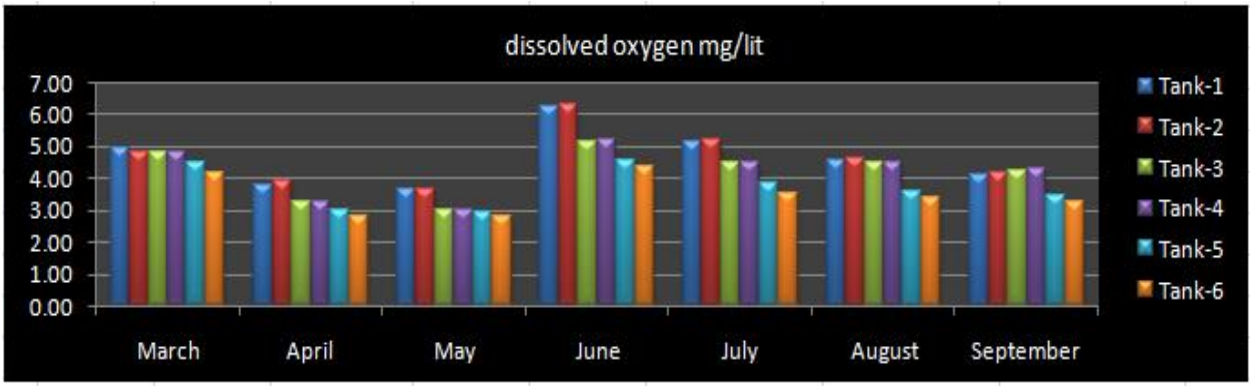
Production performance observed better in the fresh water bio floc tanks T-1 & T-2 , in T-1- 135 Kg and T-2 146 kilogram harvested where as in T-3 & T-4 131 and 134 kilogram was harvested. The initial stocking quantity was 1000 pieces in each tank. The continuous flow through tanks T-5 & T-6 was stocked with 1200 pieces of fingerlings and the final harvested quantity 139 and 149 kilo gram harvested respectively.



High feed conversion ration were recorded in the Sea water bio floc tanks, T-3 & T-4- FCR1: 3 and the fresh water & control tanks showing FCR- 1:2. The daily feeding rates were calculated based on the average body weight sampling results. Feed consumption was steadily increased in the sea water biofloc tanks where as the in the fresh water tanks the feed consumption less due to good floc formation. The overall production was achieved in the fresh water bio floc, 53.5 kilogram per cubic meter where as the sea water and control tanks were 35.8 kg and 47.9 kg per cubic meter respectively.



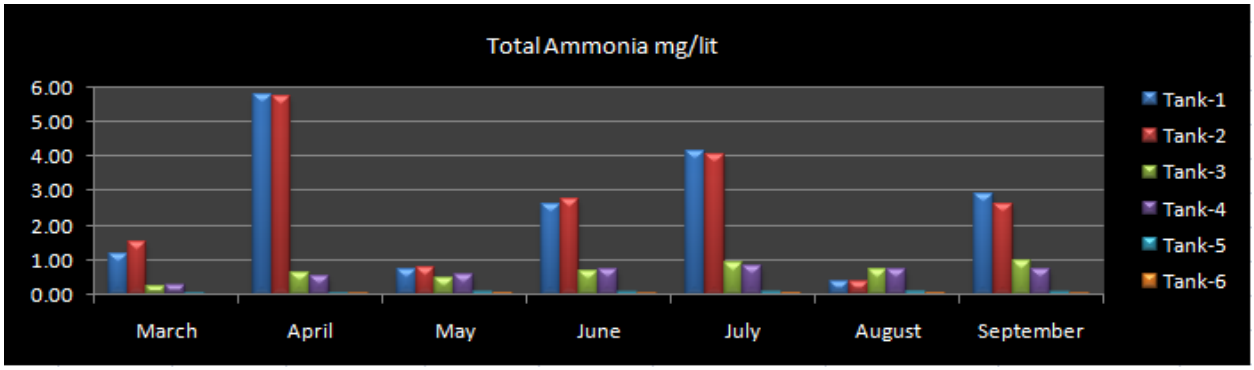
Water quality was maintained throughout the trials and the most of the parameters were acceptable levels. The dissolved oxygen in all the culture tanks was in normal level between 3.4 mg/lit to 4.7 mg/lit. In the fresh water bio floc tanks T-1 & T-2 the DO level was better than the sea water bio floc tanks, T-1 & T-2 -3.7 – 6.3 mg/lit and T-3 & T-4 3.0 -5.2 mg/lit. In the control tanks, T-5 & T-6 the dissolved oxygen level was all most constant without much variation.



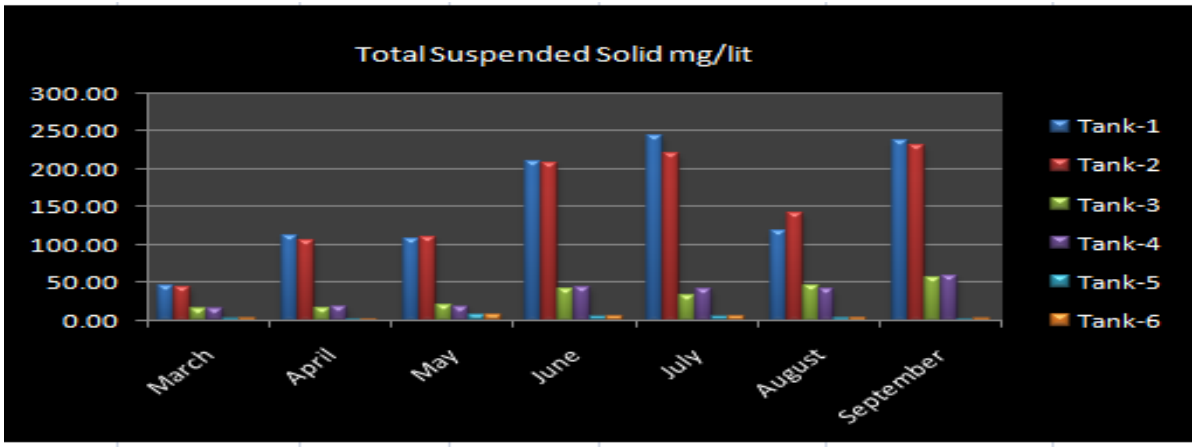
Salinity levels in the fresh water bio floc tanks have been rising due to evaporation or due to the addition of molasses, the source for carbohydrate. This raise was controlled through addition of

new fresh water to the culture tank. The average salinity in the freshwater trial was 2.7 ppt and the minimum salinity 0f 0.9 and the maximum of 3.9 ppt. The variation of salinity in the culture tanks did not affect the growth of the fish. The salinity range in the sea water bio floc tanks were showing high fluctuations and this controlled by providing 5 percent sea water addition everyday to keep the salinity to a desirable level.

Total ammonia level averaged 2.5 mg/lit in the T-1 & T-2, 0.6 mg/lit in the trial tank T-3 & T-4, 0.07 mg/lit in T-5 and 0.04 mg/lit in T-6. The ammonia value reached peak of 9.2 mg/lit in the fresh water bio floc trial tanks T-1 & T-2 during the month of April for a two days. The fish does not face mortality and found to be normal activity.



The nitrite nitrogen level in the culture tanks T-1& T-2 were increased up to 5.01 mg/lit and this was controlled in the fresh water Bio floc tanks. But in the culture tanks T-3 & T-4 the level went up to 5.74 mg/lit and remain 4.37 mg/lit up to harvesting date. Where as in the control tank the N03-N remain very low and the average level was 0.03 mg/lit.The Total Suspended Solid (TSS) was normal while starting the trial and increased up to 245 mg/lit in the culture tank T-1, T-2- 231 mg/lit, T-3-57 mg/lit, T-4 – 60 mg/lit where us the TSS level was below 8.00 mg/lit in the control tanks. The TSS levels in the culture tanks T-1 & T-2 was controlled by external settlement tank periodically.



water Quality Values	Tank-1	Tank-2	Tank-3	Tank-4	Tank-5	Tank-6
Dissolved Oxygen (mg/lit)	4.6 (3.7-6.3)	4.7 (3.7-6.3)	4.2 (3.0-5.1)	4.2 (3.0-5.2)	3.6 (2.9-4.5)	3.4 (2.7-4.3)
salinity (PPT)	2.7(0.9-3.9)	2.7(0.9-3.9)	46.4(44.6-47.0)	46.4(44.6-47.3)	43.2(43.0-43.5)	43.3(43.0-43.6)
Temperature(C)	28.7 (25.2-32.4)	28.6 (25.1-32.2)	28.6 (25.1-32.2)	28.7 (25.2-32.4)	29.5 (26.9-33.2)	29.4 (27.4-32.4)
PH	7.3 (6.7-8.4)	7.3 (6.6-8.5)	8.0 (7.8-8.4)	8.00 (7.8-8.4)	8.1 (7.9-8.6)	8.1 (7.8-8.6)
Total Ammonia-N (mg/lit)	2.53 (0.39-5.76)	2.55 (0.37-5.71)	0.67 (0.26-0.99)	0.64 (0.27-0.84)	0.07 (0.03-0.09)	0.04 (0.01-0.06)
Nitrite-Nitrogen (mg/lit)	1.03 (0.01-4.99)	1.05 (0.01-5.01)	3.43 (0.01-4.18)	3.3 (0.00-4.15)	0.03 (0.01-0.09)	0.01 (0.01-0.02)
Total suspended Sloind (mg/lit)	153 (45-245)	151 (45-231)	33 (15-57)	34 (15-60)	4 (2-8)	4 (2-8)

Conclusions

From this trial we understand that the fresh water bio floc is working better than that of the full strength sea water bio floc culture. There were no water exchanges in the fresh water bio floc where as 20 % water exchanged in the sea water bio floc tank to keep the salinity under control through evaporation. The floc formation was very little in the sea water bio floc where as the floc formation was very good and good FCR achieved in the fresh water bio floc tanks.

The usage of external solid removal facility is the additional advantages to the fresh water bio floc system which helped to control the TSS and keep the parameters like total ammonia and nitrite nitrogen under control.

This trial was terminated unexpectedly due to the power failure. Consecutive trial need to be conducted to conclude the experiment.