A trial production on bio-floc shrimp farming- FENNEROPENAEUS INDICUS in the kingdom of Saudi Arabia

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Abstract

A hands on grow out trial was conducted on FENNEROPENAEUS INDICUS to evaluate the growth performance in the microbial bio floc system. The white shrimp F.INDICUS is the most widely cultured species in the kingdom of Saudi Arabia. The production achievement of F.VANNAMEI through the microbial bio floc system was the main initiation behind this trial production.

The trial has been conducted in the square shaped concrete tank having 225 square meter water spread area. The experimental tank was fed only 50 % of the feed while the control tank fed with usual conventional feeding protocol. (There was a significant difference between the experiment and the control tanks in the FCR). Weekly weight gaining in the bio floc system was 0.72 gm/week and the control tank 0.69 gm/week.

The FCR was 1.38 in the bio floc tank and 2.43 in the control tank. The ABW of bio floc tank was 15 gm/164 DOC and the control tank 14 gm/164 DOC. Dissolved oxygen level was constant (4.5 mg/lit to 5.5 mg/lit in the experimental tank where as in the control tank fluctuated widely from 2.5 mg/lit to 7.5 mg/lit. The result concluded that the bio floc system was cost effective,(FCR : 1.38) faster growth, best water quality, no survival difference and bio secured.

Introduction

The Fish Farming Center was established in 1982 with the help of Unilateral Trust Fund (UTF), the agreement between the government of Saudi Arabia and the Food and Agriculture Organization (FAO) of the United Nations.

The main purpose of this unit would be developing aquaculture system through research and development which include identification of suitable site for farming, selection of cultivable species preferably marine species.

FFC have achieved to develop more than 100 aquaculture projects in the kingdom of Saudi Arabia. The important species concentrated by FFC are Tilapia, Barramundi, shrimp & Grouper. In this shrimp have taken a fast lead to spread in the coastal aquaculture system of KSA.

Indoor aquaculture is probably the only potential method that could be used to ensure 100 % safe source of sea food, free from all chemicals and heavy metals (Michael.B.Timmons,2007) ultra shrimp cultivation would function as typical factory that could produce continuous and required quantity, free from all contaminants.

The quality and quantity of finished products are assured without any difficulties. These shrimp factories produce large amount of Shrimp in a very small area. Ultra-intensive system is impressive example of big bio engineering achievements. (Fast, 1992)

Generally the stocking densities in these would be more than 250 post larvae per square meter. The survival would be more than 90 percent. Seed quality, feed management, floc development and carbon nitrogen ratio would be major protocol involved in this system.

Materials & methods

The trial production has been carried out at the Fish Farming Center, Jeddah, and Kingdom of Saudi Arabia. The trial was started on April 1 /2011 and completed on 11 September/2011

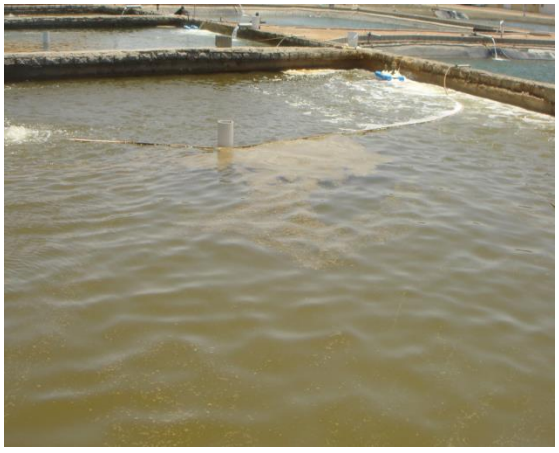
This is the “Zero water exchange system” by using heterotrophic management of water. This system consists of 225 square meter concrete tank fully equipped with air injector, central drainage system and foam fractionators. Nitrogen cycle takes place in the system where bacterial floc is intensively developed.

Pic.1. air injector (force 7)

Pic-2 .The Foam fractionators

Concrete tank is cleaned with detergent and disinfected with 50 ppm chlorine. The culture tank was allowed for sundry for a period of two days before filling the sea water. Then the sea water from the tube well was filled to maximum level of the tank.

The pond was fertilized with sodium nitrate, sodium silicate and monoammonium phosphate. In order to develop the phytoplankton grow, the TETRASELMIS algae from the outdoor algal tank was added. The air injector was used to agitate the entire water column.



Pic.3. Concrete tank used for the trial

BIO FLOC formation and control

The formation of bio floc in the shrimp farm is a complex process, the bacteria transforms organic and inorganic compounds to become sludge mass as bio floc. The process of floc formation has been facilitated by using wheat powder as a carbon source; this could be expressed as 3 kg of bio floc produced per 1 kg of wheat powder.

Pic.4. 3 week microbial floc formation

Stocking

The post larvae produced from the Fish Farming Center hatchery was stocked in the culture tank. The stocking density was 111 PL per square meter. (Tank- 225 square meter)The total number of PL stocked was 25,000.

Water quality

The water quality of the tanks was monitored daily for dissolved oxygen (DO) salinity and temperature using INNOVAQUA OXYMETER and refract meter. Nitrate,

Nitrite, total ammonia nitrogen (TAN) and PH were measured weekly. The total ammonia nitrogen averaged 0.04 mg/lit. The TAN concentration have reached maximum of 0.50 mg/lit during the trial.

To avoid ammonia toxicity, PH level was maintained below 8.0. High PH would affect the growth of nitrifying bacteria. Dissolved oxygen level also (DO) was maintained above 4 mg/lit by operating the air injector throughout the culture period.

Low DO is recognized as a major cause for Stress, slow growth and mortality in the bio floc culture system. Water salinity and temperature was recorded daily during the culture period. Temperature was fluctuating widely due to open system and Zero water exchange. The higher salinity caused the slow growth due to high evaporation.

Suspended solid level was controlled by using foam fractionators. The operation of the foam fractionators could be based on the amount of suspended solid load in the culture tank. The culture tanks water passes to the foam fractionators by gravitation flow along with suspended solid, a motor in the fractionators swirls the water and suck out the solid in the form of foam and the foam would be collected in the plastic tanks.

The excess of suspended solid particle would settle down and can accumulate in anaerobic soil layers, leads to various complications in culture tank.

Feeding

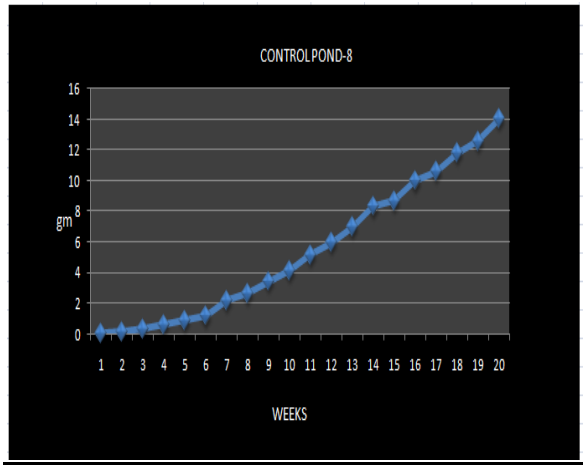
Actually the low protein feed, cheaper than high protein feed would be the ideal one for feeding the floc raised culture system. Due to the non availability of low protein feed, the high protein shrimp feed from the local shrimp feed plant was used to feed the shrimp.

Pic.5. 8 weeks Microbial Bio Floc

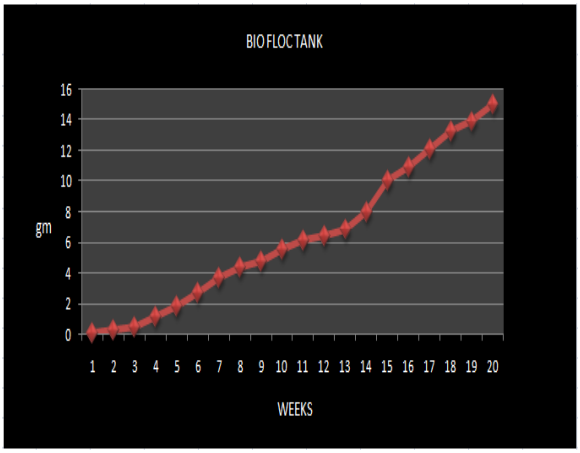
Initially the feeding protocol was intensive shrimp culture and subsequently reduced to 50 % based on the Floc formation. Beneficial microbe would flourish and help supplement the shrimp diet by recycling nutrients already in the pond with addition of a carbon source, wheat flour, these bacteria converts ammonium from shrimp waste in to protein. The FCR achieved in this trial is 1.38 and this could be possibly reduced to 1.00.

Growth

Growth was recorded through weekly sampling. The growth rate in the bio floc system was faster while comparing the non bio floc system. The growth performance of bio floc and non bio floc was closely monitored and the results are promising in the bio floc system. The average weekly weight gaining in the bio floc system was 0.72 gm per week and the non floc was 0.69 gm per week.



Pic.6. Control growth rate



Pic.7. Experimental growth rate

Harvest Result

The experiment tank was harvested on 150 DOC and the total quantity of 270 kilogram. The quality was branded as best by the local buyer and the good price offered. The experimental tanks bottom was very clean without sedimentation or excess feed left out.

Pic. 8. Harvest

Critical issues

a. The water evaporation in the culture tank would increase salinity which will hinder the growth of the shrimp
b. The dissolved oxygen level would be maintained constantly above critical limit. Failure would leads to mass mortality
c. Birds' predation would also be a big consideration in this operation.

Conclusion and recommendation

Based on the trial result, (FCR-1.38) it can be concluded that the cost of production can be considerably minimized through bio floc operating system. Another important benefit through Bio floc system would be the reduction of environmental impact (Zero water Exchange).This system also bio secured and the epidemic loss could be avoided. Trials with high stocking density could be conducted

المستخلص

أجريت تجربة تسمين الربيان الأبيض المحلي *Fenneropenaeus indicus* بهدف تقييم أداء نموه في أوساط تربية قائمة على تقنية الخثرات الحيوية الميكروبية Biofloc . ويعتبر من الأنواع الرئيسية المستزرعة على نطاق واسع في المملكة العربية السعودية. تمثل الهدف الرئيسي للتجربة على محاولة إنتاجه بتقنية الخثرات الحيوية الميكروبية.

نفذت التجربة في أحوض إسمنتية مربعة الشكل بمساحة ٢٢٥ متر٢، مع إخضاع الربيان في أحواض التجارب للتغذية بعليقة بنسبة ٥٠% في حين تمت تغذية ربيان ضابط التجربة وفقاً لبروتوكول التغذية التقليدية (أظهرت النتائج عن فروق إحصائية ملموسة فيما بين أحواض التجارب وضابط التجربة فيما يخص بنسبة التحول الغذائي). سجلت أحواض تجارب الربيان نمواً لأوزان مكتسبة بلغت ٠,٧٢جم/ أسبوع بينما سجل ربيان ضابط التجربة نمواً مكتسباً قدره ٠,٩٦جم/ أسبوع.

بلغت نسبة التحول الغذائي في أحواض التجارب بتقنية الخثرات الحيوية بواقع ١,٣٨ ولضابط التجربة ٢,٤٣، مع نمو ربيان أحواض التجارب بمتوسط وزن قدره ١٥جم خلال فترة تربية مدتها ١٦٤ يوماً ولضابط التجربة بواقع ١٤جم خلال الفترة ذاتها. سجلت أحواض التجراب مستويات ثابتة للأكسجين الذائب بتركيز تراوح من ٤,٥ ملجم/ لتر إلى ٥,٥ ملجم/ لتر مع تذبذبها الكبير في حوض ضابط التجربة من ٢,٥ ملجم/ لتر إلى ٧,٥ ملجم/ لتر. خلصت النتائج إلى فعالية أداء تقنية الخثرات الحيوية من حيث الكلفة المرتبطة بنسبة التحول الغذائي البالغ ١,٣٨ وسرعة أداء النمو وجودة المياه مع عدم وجود فروقات متباينة في معدلات البقاء في كافة الأحواض والمؤمنة حيوياً.