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Studies on Production of Singhi (*Heteropneustes fossilis*) in Fresh Water Biofloc Aquaculture System

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ABSTRACT

Biofloc technology (BFT) is one of the innovative methodologies for waste management and nutrient retention that offers a solution to solve environmental problems in aquaculture, because it doesn't use water exchange to solve nitrogen compound elimination, but it utilizes microbial assimilation, stimulated for addition of material rich in carbon, to transform those compounds. However, two trials of ten months period each (2021-2023) were performed to investigate the growth and production of Singhi in fresh water Biofloc System at Krishi Vigyan Kendra, IGKV, Raipur, Chhattisgarh, India. Three circular and rectangular cemented tanks (10,000 liter capacity each) were used in each trial under this purpose. Probiotic was used for developing beneficial bacterial colonies and controlling ammonia in confined water system. Healthy advanced fry of Singhi (Avg weight 1.3 g) were stocked @ 1500 nos/tank with treatment of potassium permanganate. Floating feed with 40-45% protein level was fed in twice in a day by following standard feeding chart. Molasses was applied for proper microbial growth and maintained C:N ratio. Physico-chemical parameters were studied weekly and maintained properly during whole period. Floc volume range was recorded between 13-33 ml/liter water sample, FCO was periodically applied for bacterial growth. The average yield was recorded 212.50 kg/tank after a period of 11 months from stocking, average growth was 154 g and FCR was found to be 1.3. Experiments were conducted during 2021-2023, so the variation of temperature was very high. The other important parameters recorded were- average pH value 7.6, dissolved oxygen 5.7 ppm, TDS 684 ppm and C:N ratio 12:1. Probocare & Medifish unique were applied weekly @ 75 ml/tank for maintaining floc and water parameters as well. Unique growth was applied @ 100 g/tank as growth promoter in fortnight interval. The results obtained in this experiment suggest that the biofloc system in fresh water aquaculture improves growth performances of Singhi in almost zero-water exchange system.

Keywords Biofloc technology (BFT), Probiotics, Singhi.

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INTRODUCTION

Biofloc is comprised of various beneficial microbial

communities, but the mechanism of action of some probiotics which leads to increase in biofloc is unknown in aquaculture system. On the other hand, probiotics are single, known live microbial strains and their actions to farm animals and humans are well established. Probiotic is a greek word derivative of pro and bios; "pro means promoting and bio means life". Probiotics are considered bio-friendly agents that can be administered in aquatic culture environments to control pathogens and enhance feed utilization, survival and growth rate of farmed species reported by Mohapatra *et al.* (2015), Huynh *et al.* (2017) and De *et al.* (2014). The first probiotics discovered is the fermented milk, which contains lactic acid bacteria (LAB). Lactic acid bacteria (LAB) such as some *Lactobacillus* species (e.g., *Lactobacillus plantarum*, *Lactobacillus acidophilus*, *Lactobacillus thermophillus*, *Lactobacillus bulgaricus*, *Lactobacillus casei*) are frequently used as probiotics in fish nutrition reported by Monroy *et al.* (2015). The use of LAB has been shown to have the most promising effects on disease resistance, survival, and growth parameters for a wide variety of fish species reported by Muñoz-Atienza *et al.* (2014) and Dawood *et al.* (2016). In Biofloc systems, nitrogen compounds transformation is more efficient, because this process is made by facultative heterotrophic bacteria that correspond principally to *Bacillus* and *Pseudomonas* species, which allow increasing their population abundances quickly and oxide-reduction process explained by Nayak (2010). Under these experiments, high value fish species like Singhi was taken to study their production and culture under fresh water Biofloc Technology.

MATERIALS AND METHODS

Two trials were conducted in the KVK Raipur Fish Farm during August 2021 to June 2023 and each culture period was 11 months. Three circular & rectangular cemented tanks (10000 lit capacities) in each trial were brought in use. Proper aeration was provided throughout the culture period and it was made by magnetic air pump (130 Watt & 120 LPM) with air stone (4.0''). Probiotic mainly composed of bacillus and lactobacillus groups was used to maintain the floc and molasses for controlling of ammonia in culture tanks and maintaining C:N. Advanced fry of Singhi (*Heteropneustes fossilis*) (avg weight 1.3 g) were stocked @ 1500 nos/ tank treated with potassium permanganate @ 0.5 g/100 liter of water. On the stocking day, feeding to the fishes was stopped, next day onwards, floating feed with 40-45% protein level was fed in twice in a day by following standard feeding chart in every trials. Molasses was applied daily basis @ 40% of given feed through drip method upto 21 days (as per C:N ratio) for proper microbial growth. After 22 days, molasses and FCO was applied when required. Physico-chemical parameters were studied through analysis kits daily and maintained properly during whole period. Floc volume range was recorded in imhoff cone (ml/lit of water sample). Water exchange was almost zero and outlet was opened weekly only for 8-10 seconds to remove waste materials. Growth of fish was randomly recorded on a fortnightly basis.

RESULTS AND DISCUSSION

In each trial, three tanks (each 10000 liter capacity) were used for 11 months culture of Singhi and average yield was 212.50 kg/tank recorded. Stocking density was @1500 nos/tank and it can be raised up to double in further studies. Feed conversion ratio (FCR), in its simplest form a comparison of the amount of feed used per unit weight gain of the species being grown, offers a measure of aquaculture production efficiency reported by Waite *et al.* (2014). Typical FCRs for raised using commercial feeds and intensive production farmed fish and shrimp: 1.0–2.4 reported by Tacon and Metian (2008). In convection method of fish culture, the FCR value which is very high compare to FCR value 1.3 in the present studies. During whole experimental period, floating feed with 40-45% crude protein level was fed in twice in a day by following standard feeding chart. Feed conversion ratio of cirrhinus mrigala fingerlings calculated for three treatments was highest for barley (2.59), followed be fish meal (2.02) and cotton seed meal (1.55) reported by Browdy (2006) and Sahoo *et al*. (2015). During whole study period, the water temperature was very much fluctuated, lowest temperature was recorded 11.4^{o}C in December and 34.2^{o}C in May. The recorded pH range was 6.8-8.6 and average pH value was 7.6. There was no problem of Dissolved Oxygen because of 24 hrs running blowers in the tanks, the average value was 5.7 ppm recorded. The recorded average

Table 1. Growth and economic performance of Singhi species in different trials.

Parameters	Trial-1	Trial-2	Average
Survival of Singhi (%)	91.20	92.80	92.00
Average weight at harvest (g)	153.70	154.30	154.00
Yield of Singhi (kg) in 3 tanks (kg/tank)	210.50	214.50	212.50
Average weight of Singhi at harvest (g)	152.00	156.00	154.00
Total yield (kg) in three tanks	631.50	643.50	637.50
Benefit cost ratio (B : C)	**1.33**	**1.38**	**1.35**

TDS was 684 ppm where as the average C:N ratio was 12:1 during culture period. Initially the average floc density was 13 ml and the highest density was 33 ml/ liter sample recorded.

The each trial was conducted in three cemented tanks with high value species - Singhi, the average survival rate was 92.0%, mean weight was 154 g whereas average production was 212.50 kg per tank was recorded. The average Benefit Cost ratio (B:C) was 1.35 during experimental periods (Table 1). Biofloc technology application offers benefits in improving aquaculture production that could contribute to the achievement of doubling of farmer's income in short period of time. This technology could result in higher productivity with less impact to the environment. In places where water is scarce or land is expensive and possibility of theft increases vulnerability of profitable aquaculture exists more intensive forms of aquaculture like biofloc technology has been reported to be a cost-effective production system previously as observed by the present trial. This technology needs more investigation with high value fishes under different agro-climatic conditions.

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