

A preliminary study on the effectiveness of organic fertilizers for the survival rate of *Catla catla*

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Introduction

Fish can be considered as one of the main sources of animal protein (26.2%) in human diet (Khan *et al.*, 2004). Fish also become a popular source of food in Asia and developing countries. Both aquaculture and fisheries activities conducting in marine and inland waters, cater the protein requirement of people in Sri Lanka. Indian and Chinese Carp species are commonly used today in inland aquaculture. *Catla catla* (Catla) is a zooplankton feeding Indian major carp species which was introduced to reservoirs in Sri Lanka to uplift the inland fishery production. This species has become a very popular fish species among the fish farmers due to higher growth rate, ability to co-exist with other major carps and consumer preference. Aquaculture Development Center (AQDC), Udawalawa belongs to National Aquaculture Development Authority (NAQDA) is producing fish seeds of carp species including Catla, for the development of inland aquaculture and fisheries. The problem identified in fish seed production in the AQDCs was the low survival rate of *Catla* at rearing of post larvae (PL) to fry stage. Moreover, it was observed that survival rate in mud ponds is lower than the survival rates in cement tanks. In the AQDC Udawalawa, cow dung is commonly used for fertilization of rearing tanks and ponds. This study was carried out to find out what the best effective organic fertilizer for the higher survival rate and growth of *Catla catla*. Cow dung, *Leucaena leucocephala* (Ipilipil) and *Oriza sativa* (rice) straw were selected as organic fertilizers as they are of low cost and readily available in the area of the study.

Materials and Methods

The experiment was conducted in nursery ponds (mud ponds) and nursery cement tanks in AQDC, Udawalawa. A mud pond and a cement tank which were already fertilized during five days (as normal practice in the AQDC) using cow dung (250g/m³) were selected and plankton densities (individuals per liter) were recorded by assuming ponds were reached optimum plankton density. Mean value of those densities was calculated and used as baseline value. Dried cow dung (250g/m³) was selected as control for the study as it was the normal practice in the AQDC. Rice straw (30g/m³) and dried Ipilipil (30g/m³) were the selected treatments for the study. These are the commonly used fertilizer concentrations in the field. Initially, the time taken to reach the plankton density to the baseline value was recorded for Rice straw and Ipilipil fertilizer types.

The surrounding of three mud ponds was cleaned and four hapa net cages were fixed to the bottom of the three mud ponds to prepare four replicates. All the four replicates were fixed in same way to maintain the same volume of water. Firstly the ponds were filled up to 50 cm with water. Complete Randomized Design (CRD) was conducted as the experimental design.

Four days old PL in a single cohort, who spent seven days in hatchery were stocked in the morning in cement tanks and hapa net cages in mud ponds. The recommended stocking density in tanks and ponds was 250-300 PLs per square meter (FAO, 2014). Three hundred PL were stocked in cement tanks per square meter and 250 PL per square meter were stocked in hapa net cages in mud ponds. Altogether 54 000 PL were stocked in nine cement tanks including 6 000 PL in each tank (20 m) and 6 000 PL were stocked in 12 hapa net cages fixed in three mud ponds including 500 PL in each cage (2 m). Harvesting of fry (2.5 cm) was done after three weeks rearing time period. Total length (TL) and weight were measured weekly using randomly taken samples (10% of population) of PLs from each tank and happa, until harvesting. Analytical balance (± 0.001 g) was used in measuring the weights of PL. Venire caliper (± 0.01 cm) was used for measuring the total length of PL. Average weight and average TL was calculated using the data obtained.

Temperature and pH were measured daily using electronic pH meter and thermometer. Dissolved oxygen (DO) level was observed using Winkler method to keep the treatment units at the optimum DO level during the study period. Secchi disk values were taken weekly by using secchi disk. Percentage survival rate, percentage weight gain (PWG) and percentage length gain (PLG) were calculated (Okunsebor and Ayuma, 2011). Obtained data were analyzed using analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of MINITAB 16 and Excel 2010 office package.

Results

The highest value of survival rate could be observed in the treatment of rice straw as 80.02 % ($P < 0.05$) in cement tanks. The highest value of survival rate in mud ponds could be observed in the treatment of rice straw as 36.45 % ($P < 0.05$). The highest percentage length gain (PLG) (309.29 ± 2.50 cm) and the highest percentage weight (PWG) gain (4667 ± 252 g) were observed in the treatment of rice straw in cement tanks ($P < 0.05$). Further the highest PWG (14950 ± 173) and the highest PLG (305.73 ± 2.60) were observed in the mud ponds fertilized by rice straw ($P < 0.05$). In considering the values of plankton count, the highest mean value of phytoplankton number in cement tanks could be observed in the ponds fertilized by cow dung (control). The lowest mean value was observed in the ponds fertilized by rice straw. In mud ponds also the same results were obtained at the date of stocking PL for rearing up to fry. The highest zooplankton count in cement tanks could be observed in the ponds fertilized by rice straw while the lowest value was observed in the ponds fertilized by rice straw. In mud ponds also the highest zooplankton count was observed in the treatment of rice straw at the date of stocking PL. As *Catla catla* was a zooplankton feeder the highest survival rate, the mean values of highest PWG and highest PLG were observed in the treatment unit of rice straw that included highest zooplankton amount in the water. The highest zooplankton amount in the water could provide more live feed and it might be the reason for the highest survival and growth of fry at harvesting. The highest secchi disk value was observed in the treatment of rice straw throughout the study period in both cement tanks and mud ponds.

Discussion

European Inland Fisheries Advisory Commission indicates that turbidity can have a harmful impact on freshwater fish by reducing food supplies and affecting gill function, killing them or reducing their growth rate, preventing successful development of fish egg and larvae and affecting the efficiency of methods for catching fish (MPCA, 2008). Very high phytoplankton blooms create high turbidity and it causes negative effects on survival of larvae. In this study also shows that both cement tanks and mud ponds fertilized by rice straw shows lower phytoplankton and higher zooplankton community. Fluten *et al.* 2002 found that feeding and growth rates reduced due to more turbid water. The lower turbidity could be observed in the treatment of rice straw than two other treatments. Catla PL can easily find out their live feed in low turbid water. It was commonly found copepods, daphnia and rotifers as zooplankton in water sampled in the mud ponds and cement tanks fertilized by rice straw.

That might be the reason for highest survival rate and growth (PWG and PLG) of *Catla catla* as a zooplankton feeder in the units fertilized by rice straw.

Shahabuddin et al., 2012 mentioned that rice straw extract showed allelopathic activity to *Microcystis* to improve the water quality. Few researches have been explored the potential of using rice straw to improve water quality, algal control and enhance *Tilapia* fish production. It was found that covering pond dikes with rice straw reduced the clay turbidity and enhanced growth of *Tilapia*. Therefore, use of rice straw should be one of the best alternatives for water quality management and microbial production. Above mentioned details will cause low turbidity, improve water quality, maintain phytoplankton density and leads to high survival and better growth of *Catla* fry. PL could find their feed of zooplankton easily in clear water.

As mentioned by Kasper, 2012 most fish survive 2-5 ppm DO level, but the growth may be retarded if the above level continues for some period. Throughout the study period the DO level was higher than 5 ppm. It emphasizes that rice straw might not cause for the reduction of DO and rice straw could provide favorable condition for higher growth and survival of *Catla catla*. Therefore in fertilizing ponds or cement tanks using rice straw in rearing *Catla catla* (PL to fry), provides live feed through better zooplankton growth and maintain better water quality with lower turbidity. Ultimately it leads to the better growth and higher survival of *Catla catla* fry comparing with other two fertilizers

Conclusion

The highest survival rate could be observed in PL to fry rearing in the mud ponds as well as in cement tanks that were fertilized with Rice straw and the highest growth rate could be observed in the mud ponds and in cement tanks that were fertilized with Rice straw

Reference

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