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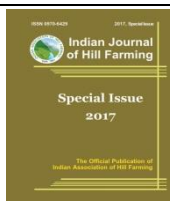

Demonstration of Aeration: Assessment of Fish Growth and Survival at Field Condition

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ABSTRACT

The study examined the effect of aeration on growth and production of Indian major carps in earthen ponds (each of 0.1 ha in size and 1.5-2 m water depth) for 6 months (May-October 2015). Total six ponds were used, of which, three were provided with aeration using fountain aerator and remaining three kept non-aerated and served as control. Catla (40%), rohu (30%) and mrigal (30%) were stocked (10,000 fingerlings/ha) into the ponds and mustard oil cake and rice bran was fed to them (2-3% of body weight). Aeration was provided daily twice (7-8 am and 5-6pm) for one hour during each time. The water quality and fish growth was assessed on monthly intervals which showed significant increase in DO, pH and total alkalinity level of water of the aerated pond. Ammonia was in safe limit and plankton production was higher through aeration. Growth (in terms of wet weight) was 4.3% higher at catla, 4.9% higher at rohu and 16% higher at mrigal in aerated pond in comparison with non-aerated pond. Survival was 8% higher, thus production was 17% higher in aerated pond when compared with non-aerated pond. Feed conversion ratio in aerated pond (2.8) was better than non-aerated pond (3.3). Thus, the study concluded that aeration could be a potential mean for further enhancement of the fish production of Tripura from current level for doubling farmers' income and livelihood security.

1. Introduction

Fisheries contribute significantly to the economy and livelihood of more than 1.7 lakh people of Tripura besides backstopping the nutritional security of more than 95% population. But the local production (61259.10 MT) at 2785 kg/ha is unable to meet the demand (73144.84 MT) at 20 kg/capita/annum. Thus, fish are being imported from outside which causes drain-out of State funds besides providing potential routes for introduction of adulterated/infected fish into the State. Despite Tripura is having untapped water resources and indigenous fish germplasms, the local fish production is below country's average (3000 kg/ha). In the face of increasing fish production, major emphasis has been lent on quality fingerlings, feed, fertilizers *etc.,* very little attention is paid on improved water and soil health management, thus, the fish production is hampered .

Water quality has significant bearing on fish growth and health. Abruption of water quality due to overstocking or supplementary feeding leads to economic loss in fish farming (Sultana *et al.,* 2017). Among the water quality parameters, dissolved oxygen (DO) is the most important limiting factor in aquaculture because it leads to hypoxia which affects fish growth and food conversion (Mallya, 2007). Thus, it is of prime importance to monitor and manage the DO level of water properly. Fish shows better growth and feed efficiency when DO remains at optimum level (Boyd, 1998). In absence of sufficient DO, concentration of nutrients raises in water which causes eutrophication and worsening of water quality. In the recent years, many chemicals are being suggested for enhancing DO, but they are not eco-friendly and it affect the sustainability of plankton populations and pond productivity. (Le Jeune *et al.,* 2006). Under this circumstance, aeration is the most effective and alternative means to get rid of the problem of hypoxia and organic pollution in fish production systems (Boyd, 1995).

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It is a cost effective approach (Sultana *et al.*, 2017). But, no study was conducted to see its efficacy in Tripura condition. Therefore, the present study was undertaken using the composite culture of Indian major carps (IMCs) as model farming system.

2. Materials and Methods

The study was conducted at Lembucherra, West Tripura over a period of 6 months (June-November 2015). Total 6 ponds (each of 0.1ha in size and 1.5-2.0m in water depth) belonging to selected tribal farmers of the Tripura Tribal Area Autonomous District Council (TTTAADC) were used. The ponds were under low-input management with intermittent manuring, fertilization and feeding with rice bran and mustard oil cake (1:1). The ponds were randomly stocked (10,000 numbers/ha) with the fingerlings (of same age and stock) of catla- 40% (8.5g), rohu- 30% (5.6g) and mrigal- 30% (4.5g) produced at ICAR farm. Three of the ponds were aerated using fountain aerator and remaining three were non-aerated and served as control. Aeration was provided daily twice (7-8 am and 5-6pm) for one hour during each time. The water quality parameters of the ponds (temperature, dissolved oxygen, pH, total alkalinity and ammonia) were assessed fortnightly following the Standard Methods (APHA, 1998) and plankton density was evaluated by filtering 50-L water through plankton net. Fish growth (wet weight) and survival were assessed monthly by cast netting. Data were analysed in SPSS (v21) using one-way analysis of variance (ANOVA) and the significant difference ($p \leq 0.05$) between the means was compared using the Duncan's multiple range test.

3. Results and Discussion

The values of water quality parameters are presented in Table 1. Water temperature was normal for culturing fish (Debnath *et al.,* 2015) and it followed seasonal trend of variation with insignificant difference between the aerated and non-aerated ponds. The dissolved oxygen was higher and at optimum level in aerated pond (Debnath *et al.,* 2014) than non-aerated pond due to periodical and continuous aeration (Qayyum *et al.,* 2005). Similarly, the pH level was higher in aerated pond than non-aerated pond because of proper mixing and circulation of water (Debnath *et al.,* 2016). The improved level of the pH led to improve the total alkalinity level of water in the aerated pond. Based on the alkalinity level, aerated pond was more productive than non-aerated pond (Debnath *et al.,* 2015). Ammonia level was in safe limit in aerated pond (Debnath *et al.,* 2015) because of faster oxidization of ammonia to non-toxic nitrate in aerobic condition. Thus, the plankton volume was higher in aerated pond.

Table 1. Water quality parameters in different treatments

Parameters/ Treatments	Aeration	Without aeration
Temperature (^{0}C)	22.6-33.4	22.7-33.5
DO (mg/1)	5.8-9.5	2.3-4.2
pH	7.5-8.5	6.8-7.5
Total alkalinity (mg/l)	75-96.5	55.3-75.4
Ammonia (mg/l)	0.44-0.85	0.95-1.65
Plankton (ml/50-L)	3.5-4.8	1.2-1.8

The growth and survival of the fish are presented in Table 2. Catla dominated the size followed by rohu and mrigal irrespective of treatment effect (Figure 1) which is typical representation of the grow-out performance of Indian major carps during composite culture (Debnath *et al.,* 2014). The weight gains of the fish were significantly higher in aerated pond than non-aerated pond because of higher DO and lower ammonia deposition in the former which led to better feed efficiency and FCR in the aerated pond (Duan *et al.,* 2011). The survival of fish was 8% higher at aerated pond than non-aerated pond because of higher fish food organisms (plankton) in the former, thus the production was 17% higher in the aerated pond.

The study concluded that regular aeration improves DO content of pond and when DO level improves, pH and alkalinity level are also improved and ammonia level is reduced . The growth and survival of fish increases with aeration. Therefore, it can be said that aeration is a potential mechanism to enhance production of aqua-farming. In absence of mechanical aerator, splashing of water with hands or bamboo or pumping of same water through an obstacle are suggested. Further action is required for building awareness among the farmers on aeration and improving pond productivity for doubling income and livelihood security.

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Table 2. Growth and production of fish in ponds with aeration and without aeration

Treatments	Fish	FW (g)	AMG (g)	SR (%)	Total yield (kg/ha)	FCR
Aeration	Catla	531.6[a]	87.2[a]	81.4[a]	3808.5[a]	2.8[a]
	Rohu	428.3[a]	70.4[a]	81.4[a]		
	Mrigal	418.3[a]	68.9[a]	82.3[a]		
Without aeration	Catla	510[b]	83.6[a]	73.4[b]	3255.9[b]	3.3[b]
	Rohu	408.3[b]	67.2[a]	72[b]		
	Mrigal	359.6[b]	59.2[a]	81.4[a]		

Fw-final weight; AMG-average monthly gain; SR-survival rate; FCR-feed conversion ratio; BCR- benefit-cost ratio

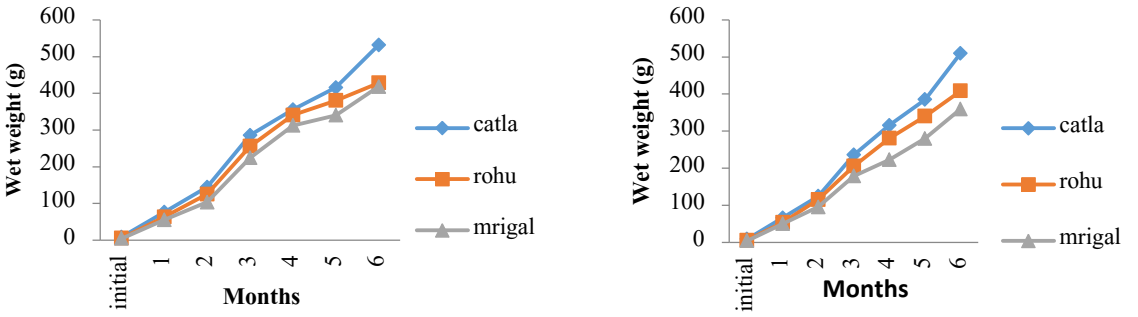

Figure 1. The weight gain of the fishes in aerated pond (left) and non-aerated pond (right) over a period of 6 months

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