



Water quality impact in fish yield in different categories of carp ponds at eastern Terai region of Nepal

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Abstract

The quality of water is changing in response to daily, seasonal, climatic rhythms and characteristics of the surrounding environment of fish ponds. Water retention duration, man-made intervention and characteristics of pond bottom also affect the water quality and fish productivity in different ponds. This study was designed to assess the water quality of different types of ponds and their impact on fish productivity. Water quality of four different types of ponds viz. perennial, drainable, seasonal and new ponds in eastern Terai of Nepal was monitored and fish yield was recorded during November to December 2015 to establish correlation among pond types, water quality and fish productivity. The water samples were analysed for various physico-chemical characteristics like temperature, DO, pH, turbidity, total dissolved solids (TDS), total suspended solids (TSS), phosphate, ammonium, total nitrogen (TN), acidity, BOD, COD, CO₂, total alkalinity (TA) and total hardness (TH). The ranges obtained for the parameters DO (5.1-5.6 mg/L), pH (7.9-8.6), TDS (127.6-225.6 mg/L), TSS (54.6-80 mg/L), phosphate (0.06-0.4 mg/L), ammonium (0.77-1.19 mg/L), TN (5.4-7.3 mg/L), acidity (5-15 mg/L), BOD (12.6-35.6 mg/L), COD (26.6-66.6 mg/L) and CO₂ (8.8-14.6 mg/L) were not significantly different ($p>0.05$) among pond types. The ranges obtained for temperature (19.7-21.6 °C), turbidity (34.8-236 NTU), TA (90.3-186.9 mg/L) and TH (82.6-173.3 mg/L) were significantly different ($p<0.05$) among pond types. Carps fish yield was significantly low ($p<0.05$) in new pond (1.17 t/ha) compared to other types of pond. The fish yield obtained from perennial (4.5 t/ha), drainable (3.5 t/ha) and seepage (3.0 t/ha) ponds was not significantly different ($p>0.05$). Water turbidity, TA and TH had the significant correlation ($p<0.05$) with fish yield irrespective of pond types. This study will aid fish farmers on the necessary treatment needed to effectively use water for carp fish farming in different types of pond.

Keywords: carp, eastern terai, pond types, water quality, yield

1. Introduction

One of the major limiting factors in aquaculture production is poor water quality which can negatively affect the yield from aquaculture venture. Poor water quality can result in low profit, low product quality, potential human health risks and Production is reduced when the water contain contaminants that can impair development, growth, reproduction, or even cause mortality to the cultured species (Stone and Thormforde, 2003) ^[1]. There is therefore the need to study the rate of interrelationship among key water quality parameters in relation to water quality management and productivity in different ponds (Ahmed *et.al.* 2015) ^[2]. To analyse the water quality in carp ponds beside physical and chemical analysis of water phyto and zooplankton organisms can be used as bioindicators (Dulic *et al.*, 2006) ^[3]. One of the most significant influences on a fish pond ecosystem in semi-intensive carp production is changing its characteristics by adding low quality supplemental feeding (Dulic, 2010) ^[4]. The monitoring of water quality at fish farms is a mandatory element of the good production practices in aquaculture (Hadjinikolova, 2013) ^[5]. The aim of this paper is determination of different types of ponds of physical and chemical parameters of water quality and farmers needed to effectively use of treatments.

2. Materials and Methods

This study was designed to assess the water quality of different types of ponds and their impact on fish productivity. Water quality of four different types of ponds viz. perennial, drainable, seepage and new ponds in eastern Terai of Nepal was monitored and fish yield was recorded during November to December 2015 to establish correlation among pond types, water quality and fish productivity. The water samples were analysed for various physico-chemical characteristics like temperature, DO, pH, turbidity, total dissolved solids (TDS), total suspended solids (TSS), phosphate, ammonium, total nitrogen (TN), acidity, BOD, COD, CO₂, total alkalinity (TA) and total hardness (TH). The samples were collected randomly with columnar sampler in eastern Terai of Nepal.

3. Statistical Analysis

Data processing and illustrations were performed using Microsoft excel. Differences between treatments were analyzed with Ducans method.

4. Results and Discussion

The ranges obtained for the water quality parameters were DO (5.1-5.6 mg/L), pH (7.9-8.6), TDS (127.6-225.6 mg/L), TSS (54.6-80 mg/L), phosphate (0.06-0.4 mg/L), ammonium (0.77-

1.19 mg/L), TN (5.4-7.3 mg/L), acidity (5-15 mg/L), BOD (12.6-35.6 mg/L), COD (26.6-66.6 mg/L) and CO₂ (8.8-14.6 mg/L) were not significantly different ($p>0.05$) among pond types.

The ranges obtained for temperature (19.7-21.6 °C), turbidity (34.8-236 NTU), TA (90.3-186.9 mg/L) and TH (82.6-173.3 mg/L) were significantly different ($p<0.05$) among pond types. Water temperature varies with the altitudes and fish yield was decrease with high altitude (Shrestha *et. al.* 2015) [6]. Carps fish yield was significantly low ($p<0.05$) in new pond (1.17 t/ha) compared to other types of pond. The water quality management become very essential for getting maximum yield of fish in pond (Bhatnagar and Devi, 2013) [7]. The fish yield obtained from perennial (4.5 t/ha), drainable (3.5 t/ha) and seepage (3.0 t/ha) ponds was not significantly different ($p>0.05$). Water turbidity, TA and TH had the significant correlation ($p<0.05$) with fish yield irrespective of pond types. Some of the water quality factors are more likely to be involved with fish losses and are referred to as key water quality parameters, such as dissolved oxygen, temperature, and ammonia. Others, such as pH, alkalinity, hardness and clarity affect fish, but usually are not directly toxic (Ahmed *et.al.* 2015) [2]. According to Bhatnagar *et al.* (2004) [8] turbidity range from 30-80 cm is good for fish health; 15-40 cm is good for intensive culture system and < 12 cm causes stress. The recommended ideal value of hardness for fish culture is at least 20 ppm (Swann, 1997) [9]. Moyle (1946) [10] gave the range of total alkalinity as 0.0 - 20.0 ppm for low production, 20.0 - 40.0 ppm- low to medium, 40.0 - 90.0 ppm- medium to high production and above 90.0 ppm- productive.

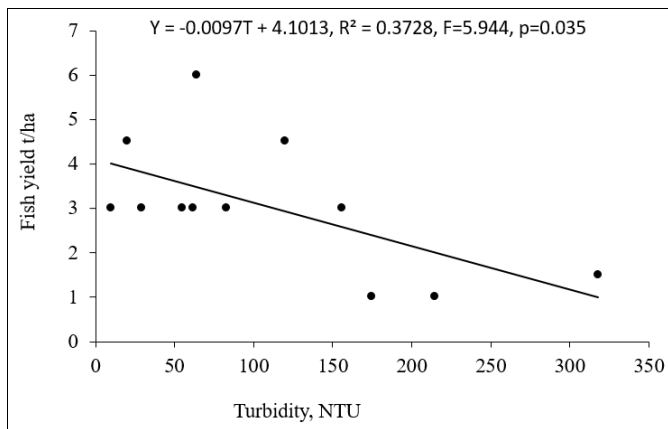


Fig 1: Regression correlation between fish yield and pond water turbidity

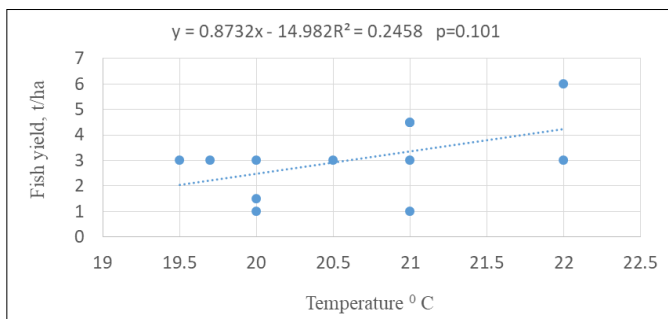


Fig 2: Regression correlation between fish yield and temperature

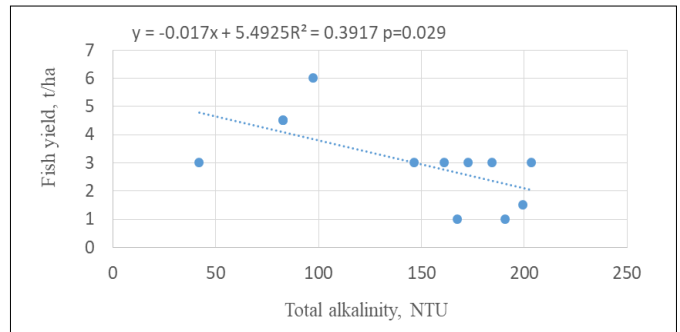


Fig 3: Regression correlation between fish yield and total alkalinity

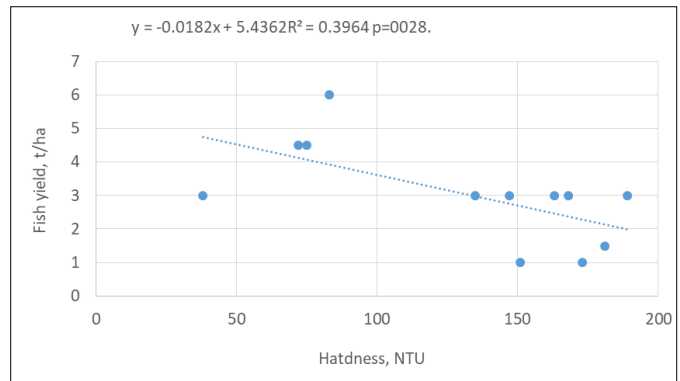


Fig 4: Regression correlation between fish yield and total hardness

Conclusion

This study will aid fish farmers on the necessary treatment needed to effectively use water for carp fish farming in different types of pond.

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