Enhancing Common carp farming by Optimizing growth conditions and using probiotic bacteria as water additive

Gajender Singh and Priyanka Joshi

Department of Zoology, College of Basic Sciences and Humanities, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004
Corresponding Authors:

Introduction

Pisciculture, fish farming, has become an essential way to meet the growing global demand for food. One of the most popular species in fish farming is the common carp, known scientifically as *Cyprinus carpio*. This fish is widely farmed because it adapts well to different environments and has a high market value. Our aim is to enhance the economic significance of *C. carpio* in India and globally, aiming to provide insights for better management practices and enhanced production. *C. carpio* holds substantial economic value in India and globally. In India, common carp is a major species in freshwater aquaculture, contributing to food security and livelihood. Globally, it is one of the most cultured fish species, with high demand in various markets. However, like all farmed animals, ensuring the best conditions for growth and health is crucial.

In aquaculture, the environment in which fish are raised plays a significant role in their growth. Factors like water temperature, pH (how acidic or alkaline the water is) and the amount of oxygen in the water can greatly impact how well the fish grow. If these conditions aren't just right, the fish might grow slowly, become unhealthy or be more susceptible to diseases. In our study various parameters including temperature, pH, dissolved oxygen were optimized to create the best conditions for the growth of *C. carpio*. Optimal culture conditions were established, resulting in enhanced growth performance of *C. carpio*.

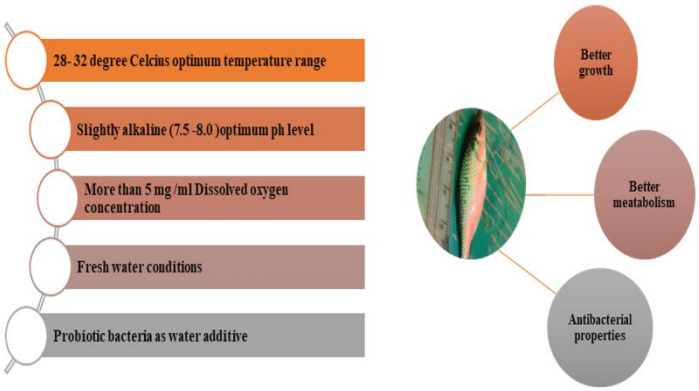

Fig 1. Optimum conditions that lead to better carp growth and production

In addition to maintaining optimal conditions, certain beneficial bacteria, called probiotics, to improve the health and growth of fish also may be used by fish farmers. Probiotics are similar to the "good bacteria" found in yogurt that help humans digest food better. In fish, these probiotics can improve their digestion, help them grow faster, and protect them from harmful bacteria that cause diseases. The probiotic culture containing *Weissella cibaria, Leuconostoc mesenteroides*, and *Pediococcus pentosaceus* was prepared and introduced in water directly. A control group and a probiotic-treated group were maintained to evaluate the impact of the probiotic culture on common carp in our study. Fish in the probiotic-treated group showed improved growth rates and better health indicators compared to the control group. The antimicrobial activity was tested using the agar well diffusion method. The antimicrobial properties of probiotic culture comprising *Weissella cibaria, Leuconostoc mesenteroides* and *Pediococcus pentosaceus* is observed against various fish bacteria.

The antimicrobial activity of the probiotic culture suggests its potential in preventing bacterial infections in aquaculture. The improved growth rates and health of *Cyprinus carpio* in the probiotic-treated group indicate the benefits of incorporating probiotics into aquaculture practices. These findings are significant for the aquaculture industry, providing a sustainable approach to enhancing fish production and health.

Applications and advantages for fish farmers: The findings of our research have practical applications in the field of aquaculture, particularly for fish farmers who want to maximize the growth and health of their fish in a sustainable and efficient way.

- **Improved growth conditions**: By following the optimized conditions identified in this study like maintaining the right water temperature, pH, and oxygen levels, fish farmers can significantly boost the growth rates of their common carp. This means the fish will reach market size faster allowing farmers to increase their production and profits.

- **Healthier Fish**: The use of probiotics as part of the fish farming can make a big difference in keeping the fish healthy. Probiotics help the fish digest their food better and strengthen their immune system, making them less likely to get sick. This is especially important because healthier fish require fewer medications and have a higher survival rate, reducing costs for the farmer.
- **Cost effective natural probiotic source**: The bacteria used are derived from natural fruit peels making them a cheaper alternative compared to commercial probiotics. This reduces the overall cost for fish farmers allowing for more affordable and sustainable fish farming practices. Along with this there is no risk of toxicity due to natural origin.
- **Ease of application**: The probiotics are administered as a water additive, which is simpler and more convenient than incorporating them into fish feed. This method saves time and effort, making it easier for fish farmers to integrate into their daily routines.
- **Minimized feed waste**: Since the probiotics are introduced as water additive, there is less risk of wastage compared to mixing them into feed. This method reduces the chances of uneaten feed contaminating the water maintaining water quality and reducing feed costs.
- **Sustainable farming**: Incorporating probiotics into fish farming practices is also a step towards more sustainable aquaculture. Since probiotics are a natural way to enhance fish health, they reduce the need for antibiotics, which is better for the environment and the long-term health of the fish population.

Overall, these strategies can help fish farmers produce more robust and healthier fish while minimizing costs and environmental impact contributing to the sustainable growth of the aquaculture industry.

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