**Effects of Water and Soil Probiotics on Pangasius pangasius on Growth Parameters**

**ABSTRACT**

The present study was conducted to evaluate the effect of different probiotic applications specifically water probiotics, and soil probiotics on the growth performance of Pangasius (*Pangasius pangasius*) and the quality of water parameters during the culture period. The experiment aimed to determine the most effective probiotic treatment to enhance aquaculture productivity in an eco-friendly and sustainable manner.The experiment was conducted in 4 earthen pond and they denoted as control (C), T1 (MRS agar for Lactobacillus), T2 (TCBS agar for *Vibrio spp*) and T3 (Tryptic Soy Agar) pond with different compositions of soil and water probiotics. The result was indicating that the treatment T3 show best result in terms growth and survivals of experimental fishes. The mean average weight gain, Specific Growth Rate (SGR), and Feed Conversion Ratio (FCR) also best found in treatment T3 followed by T2, T1 and control group. On the basis of above findings it is concluded that Tryptic Soy Agar (TSA) is not directly affect the fish growth but TSA is a general-purpose microbiological growth medium used for cultivating a wide variety of bacteria and fungi. It provides a nutrient-rich environment for cultured fish.

**Keywords:** Heteronitrogenous, Heterolipidic, Digestibility, Amino Acid and Enzyme

**Introduction**

Aquaculture, known as the fastest-growing food-producing sector globally, is heading towards new directions, intensifying and diversifying. Water and soil probiotics are a combination of enzymes and microbes that can be used to improve the health of aquatic animals and the quality of water and soil in aquaculture ponds (**Zhang *et al.,* 2025**). The term "probiotics" comes from the Greek words "pro" and "bios", which mean "beneficial microbes". It is a water and soil probiotic formulated designed to maintain a healthy environment in aquaculture pond. It contains natural and highly beneficial microorganism well suited to the aquatic environments. Water and Soil probiotics is a highly potent probiotics and multi enzymes mixture specially designed for Shrimps and Fish production (**Yadav *et al.,* 2022; Yadav *et al.,* 2021)**. The synergistic and potent combination of concentrated enzymes leads to a strong improvement in digesting the feed consumed by fish. Soil-based probiotic supplements contain strains of spore-based microbes, which are hardier and more resilient than other forms of probiotics and offer numerous health benefits, immune function which plays an important role in immune function. Aquaculture, known as the fastest-growing food-producing sector globally, is heading towards new directions, intensifying and diversifying. The industry is now facing many challenges with the increase in the intensification and commercialization of aquaculture production. **Pragnya *et al.,* 2020** reported bioaccumulation of heavy metals in different organs of fish *Pangasius Pangasius*, from Visakhapatnam, India, because coastal areas are prone to heavy metal pollution. Probiotics are also regarded as an eco-friendly method in aquaculture. The probiotics may be added to experimental diet feed as live microorganisms to create a balanced indigenous microfloral community in the gastrointestinal tract. The use of probiotics is increasingly viewed as an alternative source of antibiotic treatment, which controls pathogens through various mechanisms. The term probiotic is derived from a Greek word that means “for life”. It was described as a live microbial feed supplement that benefits the host animal by improving its intestinal microbial balance. **Fuller, 2012** proposed that a good probiotic has the following characteristics: Effectiveness in the application; Non-pathogenic and nontoxic; Existing as viable cells, preferably in large numbers; Survival and being actively involved in the metabolism of the gut environment and Being stabilized and remaining viable during long periods of storage and under field conditions. The differences in the microbial flora within the intestine of the aquatic and terrestrial animals are due to the effect of their surroundings. Regular use of probiotics in the feed of fish will be useful to have several health benefits such as efficient digestion of food, effective incorporation of nutrients into body parts, improved growth, elevated immunity, and more survival. The accumulation of organic wastes deteriorates water and soil quality and, in turn, decreases the growth. A supplementation trial was conducted to avoid this problem to determine the effect of commercial soil probiotic in the water quality maintenance and growth of *Pangasius pangasius* culture in a freshwater pond **Bazar *et al.,*** **(2021**). Probiotic bacteria are known to improve water quality in many ways. These are primarily benthic omnivores that depend on bacteria, detritus, vegetative material, macroalgae, zooplankton, crustaceans and some fishes for their nutrition. It has good market value as a food fish due to its taste and deliciousness with high protein, minerals, and fat content. Catfish *Pangasius pangasius* is considered one of the most successful aquaculture species due to its relative ease in culture, fast-growing fish, high-market demand, and suitability to local climate conditions. Probiotics are holds significant promise for enhancing microbiological load in fish culture environment and its help in improving water quality improving, and ensuring the sustainable production of this valuable food fish.

**2.0 Materials & Methods**

**2.1 Study Site and Experimental Units**

Four ponds were used to evaluate growth performance, feed utilization, survival and the economic production of *Pangasius pangasius* fish. The study was conducted in Rova fish farm in Distt. Lucknow, Uttar Pradesh and latitude 26.8467⸰ and Longitude were 80.9462⸰. The water depth was 0.8 M during the study period 25 Sep to 25 Nov 2024. During the study period freshwater was regularly added in treatments.

**2.2 Experimental Fish**

The healthy and active fingerlings of uniform size (25 g) were randomly distributed in four experimental groups i.e. Control (C), treatment T1, T2, T3. For using different types of Probiotics before Stocking as for required dose. The stocking density of fingerlings was 15000 per acre (0.4 ha). The feeding was done at the rate of 5 percent of experimental fishes. The samplings were done 15 days basis.

**2.3 Water Quality Parameters**

To maintain optimal water quality throughout the experimental period, water parameters such as dissolved oxygen (DO), pH, temperature, total alkalinity were monitored on weekly basis.

**2.6 Growth parameters and survival rate**

The growth parameters was expressed as weight gain (g), percent weight gain (%) and specific growth rate (SGR) over the time of observation from the start of experiment. The growth performance of the fish was assessed by using measuring parameters such as weight, length and specific growth rate SGR and FCR.

**1. Weight gain (g)** = Final weight – Initial weight

**2. Length gain (cm)** = Final length – Initial length

**3. Specific Growth Rate (SGR):**

**4. Feed conversion ratio (FCR)**

**5**. **Survival Rate (SR):**

**2.7 Statistical Analysis**

All the statistical analysis was performed using SPSS (Version 25.0). The data were expressed as mean ± SE and differences were considered significant at *P < 0.05*.

**3.0 Results and Discussion**

The present study was conducted to evaluate the growth parameters and water quality parameters in of *Pangasius pangasius*.

**3.1 Physico-Chemical Parameters of Water**

The current was designed for 60 days; water quality parameters remained stable across all the treatment tanks. Water temperature ranged from 25.0 ± 0.35 °C to 27.0 ± 0.3 °C, and pH values varied minimally, between 7.9 ± 0.05 and 8.8 ± 0.03. Dissolved oxygen levels were maintained between 8.0 ± 0.09 mg L⁻¹ and 8.7 ± 0.04 mg L⁻¹. Alkalinity ranged from 150.0 ± 3.65 mg L⁻¹ to 230 ± 3.06 mg L⁻¹. The maximum water temperature was measure in treatment T3 and followed by T2, T1 and control group. The maximum water dissolved oxygen was measure in treatment T3 and followed by T2, T1 and control group. The maximum pH value was observed in treatment T3 and followed by T2, control and T1. The maximum alkalinity was observed in treatment T2 and followed by T3, T1 and control group. In water quality parameters there is a significant relationship between treatment and control group. Water quality parameters—temperature, pH, dissolved oxygen remained within optimal ranges for trout growth (**Boyd, 1998; Baird *et al*., 2015**), confirming that environmental conditions did not constrain performance. The water quality parameters data are presented in table 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatment** | **Water temperature** | **pH** | **Dissolved Oxygen** | **Alkalinity** |
| **C** | 25 ± 0.35 | 8.1 ± 0.05 | 8 ± 0.40 | 150 ± 0.5 0 |
| **T1** | 26.3 ± 0.25 | 7.9 ± 0.05 | 8.3 ± 0.05 | 156 ± 0.05 |
| **T2** | 26.5 ± 0.56 | 8.5 ± 0.56 | 8.5 ± 0.50 | 230 ± 0.05 |
| **T3** | 27 ± 0.30 | 8.8 ± 0.25 | 8.7 ± 0.35 | 178 ± 0.80 |

**Table No1;** Water quality Parameters of Different Treatments

**3.2 Growth Parameters**

The growth parameters of present study were recorded after two weeks. On the sampling day feeding was stopping. In the termination time of experiment, we found the significant relation between the treatment and control group (p<0.05). The maximum weight gain was observed in the treatment T3 (44e±0.36) and the followed by T2 (41.6d±0.057), T1 (39.6c±0.46) and control group (37.2b±0.60). The percent weight was maximum observed in treatment T3 (81.07e±0.05) and the followed by T2 (75d±0.57), T1 (70.93c±0.05) and control group (65.86b±0.05). The maximum net length gain was maximum measured in treatment T3 (5.96d±0.051), and the followed by T2 (5.86c±0.050), T1 (4.60b±0.050) and control group (4.12b±0.051). Specific growth rate (1.21e±0.01), also maximum was found in treatment T3 and the followed by T2 (1.18d±0.01), T1 (1.12c±0.05) and control group (1.08b±0.02). The feed conversion rate (FCR) was maximum was found in control group then T1, T2 and T3 treatment. The minimum FCR was found treatment T3 (1.75a±0.005) and followed by T2 (1.85ab±0.53), T1 (2.08ab±0.577) and control group (2.27ab±0.005). The maximum survival rate was found in treatment T3 (95%) and followed by T1 (92), T2 (94), and control group (90). The growth parameters have a significant relationship between the treatment and control group for net weight gain, net length gain, SGR and FCR. The growth parameters data were presented in the table no: 2. The results were clearly indicating that the T3 (Tryptic Soy Agar) shown the maximum net average weight gain, Specific Growth Rate (SGR), and Feed Conversion Ratio (FCR) also best found in treatment T3 followed by T2, T1 and control group. On the basis of above findings it is concluded that Tryptic Soy Agar (TSA) is not directly affect the fish growth but TSA is a general-purpose microbiological growth medium used for cultivating a wide variety of bacteria and fungi. It provides a nutrient-rich environment for cultured fish. There are some studies have stated that the solicitation of probiotics in aquaculture rises growth, subsistence, improves feed ingestion, and augments the immune system (**Huerta-Rabago *et al.,* 2019; Ahsan, 2015**). By way of, utmost investigators exploring the effects of probiotics in aquaculture must rummage-sale of dietary additives. But, minute consideration has been given to the prospective favourable effects of administrating probiotics in water (**Jahangiri and Esteban, 2018; Aly *et al.,* 2008**). These findings strongly support our study. In this study, the effect of different types of probiotics enhancing the different activity like phagocytic activity of leucocytes is variable and dependent on the communication between the dose and the period of applies process as shown in the results and table no two and this study supported by **Duc *et al.* (2003)**. On the basis of above findings it is concluded that Tryptic Soy Agar (TSA) is not directly affect the fish growth but TSA is a general-purpose microbiological growth medium used for cultivating a wide variety of fishes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Net length gain** | **Net weight gain** | **Percentage weight gain** | **Specific growth rate** | **Feed conversion rate** | **Survival Rate** |
| **C** | 4.12b±0.051 | 37.2b±0.60 | 65.86b±0.05 | 1.08b±0.02 | 2.27ab±0.005 | 90±0.05 |
| **T1** | 4.60b±0.050 | 39.6c±0.46 | 70.93c±0.05 | 1.12c±0.05 | 2.08ab±0.577 | 94±0.53 |
| **T2** | 5.86c±0.050 | 41.6d±0.057 | 75d±0.57 | 1.18d±0.01 | 1.85ab±0.53 | 92±0.46 |
| **T3** | 5.96d±0.051 | 44e±0.36 | 81.07e±0.05 | 1.21e±0.01 | 1.75a±0.005 | 95±0.57 |

**Table No2;** Growth Parameters of Different Treatments

**Conclusion**

In conclusion, the inclusions of different types of soil and water probiotics were shown the significantly impacted growth performance *Pangasius pangasius*. On the basis of above findings it is concluded that Tryptic Soy Agar (TSA) is not directly affect the fish growth but TSA is a general-purpose microbiological growth medium used for cultivating a wide variety of bacteria and fungi. It provides a nutrient-rich environment for cultured fish. This study will help in making the strategy for culture based farming system. Authors are recommend some field trials also.

**Availability of data and Materials**

The data will be provided upon request to the journal.

**Ethical Statement:**

In the present study, *Pangasius pangasius* were collected from the School of School, Sanjeev Agrawal Global Educational (SAGE) University, and Bhopal India). Ethical approval, specimen collection, and maintenance were performed in strict agreement with all the recommendations India.

**Disclaimer (Artificial Intelligence)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

**Reference**

**Ahsan, M. K. (2015).** Isolation and Molecular Characterization of Bacteria from Diseased Farm Fish (Doctoral dissertation, University of Rajshahi).

**Aly, S. M., Mohamed, M. F., & John, G. (2008).** Effect of probiotics on the survival, growth and challenge infection in Tilapia nilotica (Oreochromis niloticus). Aquaculture research, 39(6), 647-656.

**Baird, J., Plummer, R., Dupont, D., & Carter, B. (2015).** Perceptions of water quality in First Nations communities: Exploring the role of context. Nature and Culture, 10(2), 225-249.

**Bazar, K. K., Pemmineti, N. J., & Mohammad, S. A. (2021).** Effect of soil probiotic on water quality and soil quality maintenance and growth of freshwater fish *Pangasius hypophthalmus*. *Lett. Appl. NanoBioScience*, 11(1), 3291-3304.

**Boyd, C. E., & Gross, A. (1998).** Use of probiotics for improving soil and water quality in aquaculture ponds. *Advances in shrimp biotechnology*, 101-105.

**Duc LH, Hong HA, Fairweather N, Ricca E, Cutting SM (2003)**. Bacterial spores as vaccine vehicles. *Infection and Immunology* 71: 2810–2818.

**Fuller, R. (Ed.). (2012).** Probiotics 2: applications and practical aspects. *Springer Science & Business Media*.

**Huerta-Rabago, J. A., Martínez-Porchas, M., Miranda-Baeza, A., Nieves-Soto, M., Rivas-Vega, M. E., & Martínez-Cordova, L. R. (2019).** Addition of commercial probiotic in a biofloc shrimp farm of *Litopenaeus vannamei* during the nursery phase: effect on bacterial diversity using massive sequencing 16S rRNA. *Aquaculture*, 502, 391-399.

**Jahangiri, L., & Esteban, M. Á. (2018).** Administration of probiotics in the water in finfish aquaculture systems: a review. Fishes, 3(3), 33.

**Pragnya, M., Kumar, S. D., Raju, A. S., & Murthy, L. N. (2020).** Bioaccumulation of heavy metals in different organs of *Labeo rohita*, *Pangasius hypophthalmus*, and Katsuwonus pelamis from Visakhapatnam, India. *Marine pollution bulletin*, 157, 111326.

**Yadav MK, Khati A, Chauhan RS, Arya P, Semwal A (2021)** A review on feed additives used in fish diet. *Int J Environ Agric Biotechnol* 6(2):184–190. <https://doi.org/10.22161/ijeab.62.21>.

**Yadav, M. K., Kumari, I., Singh, B., Sharma, K. K., & Tiwari, S. K. (2022).** Probiotics, prebiotics and synbiotics: Safe options for next-generation therapeutics. *Applied microbiology and biotechnology*, 106(2), 505-521.

**Zhang, Z., Yang, Q., Liu, H., Jin, J., Yang, Y., Zhu, X., & Xie, S. (2025).** Potential functions of the gut microbiome and modulation strategies for improving aquatic animal growth. *Reviews in Aquaculture*, *17*(1), e12959.