



Effect of Mango Leaf Meal as Supplementary Feed on Growth Parameters of Rohu (*Labeo rohita*) Fingerlings

**Komal Khatik ^{a++}, Rakhi Das ^{b#*}, Deepak Kher ^{c†}
and Shriparna Saxena ^{d‡}**

^a Department of Aquaculture, Sanjeev Agrawal Global Educational University, Bhopal, M.P., India.

^b Department of Aquaculture, School of Agriculture, Sanjeev Agrawal Global Educational University, Bhopal, M.P., India.

^c School of Agriculture, Sanjeev Agrawal Global Educational University, Bhopal, M.P., India.

^d Department of Aquaculture, SAGE University, Bhopal, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/acri/2025/v25i61283>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://pr.sdiarticle5.com/review-history/138049>

Original Research Article

Received: 12/04/2025

Accepted: 14/06/2025

Published: 18/06/2025

⁺⁺ PG Research Scholar;

[#] Assistant Professor;

[†] Dean;

[‡] HOD;

*Corresponding author: Email: rakhi.d@sageuniversity.edu.in;

Cite as: Khatik, Komal, Rakhi Das, Deepak Kher, and Shriparna Saxena. 2025. "Effect of Mango Leaf Meal As Supplementary Feed on Growth Parameters of Rohu (*Labeo Rohita*) Fingerlings". Archives of Current Research International 25 (6):410-15. <https://doi.org/10.9734/acri/2025/v25i61283>.

ABSTRACT

The incorporation of different feed ingredients in fish diets contributes to protein sparing while improving palatability and energy utilization. The present study was conducted to evaluate the effect of mango leaf meal as supplementary feed on growth parameters of rohu (*Labeo rohita*) fingerlings at different inclusion levels. An experiment was conducted to evaluate the effect of mango leaf meal (MLM) as supplementary feed on growth parameters of rohu (*Labeo rohita*) fingerlings. Four different concentrations of MLM were incorporated into the basal diet at 2%, 4%, 8%, and 16% levels. The experiment was conducted for 60 days using a completely randomized design with triplicate treatments. Results showed that MLM supplementation significantly improved fish growth parameters while maintaining optimal water quality conditions across all treatments. The 8% MLM supplementation (T3) demonstrated superior performance with the highest weight gain (19.31 ± 0.136 g), percentage weight gain ($59.77 \pm 1.557\%$), specific growth rate (0.036 ± 0.016), and best feed conversion ratio (2.92 ± 0.071). Water quality parameters remained within acceptable ranges throughout the experimental period. Based on these findings, MLM supplementation at 8% in the basal diet is recommended for enhancing growth performance of rohu fingerlings. Future research should focus on field trials with different stocking densities and extended culture periods to validate these findings under commercial conditions. Additionally, studies on the economic feasibility and long-term effects of MLM supplementation would provide valuable insights for the aquaculture industry.

Keywords: Aquaculture; feed additive; growth enhancement; *Labeo rohita*; mango leaf meal; supplementary feed.

1. INTRODUCTION

Fisheries is an essential area of food production that ensures the nations nutritional security while also providing a source of income for a substantial portion of the population, particularly the country's fisherman (Meghraj et al., 2023). Indian fisheries and aquaculture contributed approximately 17.45 million metric tons (MMT) of fish production during the 2023 financial year, representing an important food production sector that supports the livelihoods of more than 19 million people and contributes around 8% of the agricultural GDP (FAO, 2024). India possesses vast aquatic resources that contribute 10% of the world's fish biodiversity. Since independence, the sector has achieved sustainable and continuous growth at 8.92% annually as of 2023 (PIB, 2025). Carp are used as food in many areas but are also regarded as a pest in several regions due to their ability to out-compete native fish stocks (Meghraj et al., 2023). Culture practices currently contribute around 49% of total global fish production, with the remainder supported by capture fisheries (Anonymous, 2023). Among the three Indian major carp species, rohu is the most significant and favourite fish of farmers due to its higher market demands and consumer preference (Nair & Salin, 2007). Mango (*Mangifera indica* L.) ascribed to the family Anacardiaceae has been adjudged as the vital traditionally significant and one of the most

economically important tropical fruit crop globally (Choudhary et al., 2024). Mango is an evergreen tree with a lot of traditional medicinal resources apart from its very famous fruits. Mango leaves are a potential source of minerals, viz. nitrogen, potassium, phosphorus, iron, sodium, calcium, magnesium, and vitamins, viz. A, B, E, and C. A major bio-macromolecule present in mango leaves is protein (Meghraj et al., 2023; Troell et al., 2023).

The incorporation of different feed ingredients in fish diets contributes to protein sparing while improving palatability and energy utilization (Sahu et al., 2007). Several studies have demonstrated that protein, fat, and other nutrients have effects similar to fish oil on the development of salmonids (Bell et al., 2001, 2002). Olusola et al. (2020) studied the efficacy of tamarind and mango leaves with oxytetracycline on growth and immunological parameters of *Clarias gariepinus*, concluding that experimental diets containing tamarind leaves, mango leaves, and oxytetracycline at 10% showed significantly higher mean weight gain (7.74 ± 0.69 g) and specific growth rate (0.97 ± 0.01 g).

Rohu (*L. rohita*) is a fast-growing species that can attain body lengths of 35-45 cm and weights of 700-800 g in one culture period under suitable conditions. In polyculture systems, its growth rate

is higher than that of mrigala but lower than catla (FAO, 2009). Feed accounts for 60-70% of total production costs in any culture system, making cost-effective feed management crucial for successful fish farming. Production efficiency is directly correlated with feed quality (Banik & Kumar, 2022). To achieve maximum net returns, farmers must ensure complete feed consumption, avoid excess feed supply, and minimize feed waste to maintain system sustainability.

This study was conducted to evaluate the effect of mango leaf meal as supplementary feed on growth parameters of rohu (*L. rohita*) fingerlings at different inclusion levels.

2. MATERIALS AND METHODS

2.1 Experimental Design

The study was conducted in 2024 at Shree Vinayak Fish Farm, Baruwali, Sirsa, Haryana. Healthy and disease-free fingerlings of *Labeo rohita* (Hamilton, 1822) were obtained from the same farm and acclimatized for 15 days in 1000-liter plastic tanks.

The experiment was conducted in 500-liter rectangular plastic tanks, with each tank thoroughly cleaned before fish introduction. Each tank was stocked with 10 fingerlings, and the experiment was conducted in triplicate following a completely randomized design (CRD) for 60 days. Implied Pearson Square feed for making artificial diet. The basal diet consisted of groundnut oil cake (400 g/kg), rice bran (400 g/kg), wheat flour (190 g/kg), and plant protein mixture (10 g/kg). Growth and water quality parameters were monitored at 15-day intervals. Fish were fed at 3% of body weight twice daily (10:00 AM and 5:00 PM) in split doses.

2.2 Experimental Feed Preparation

Experimental diets were prepared by incorporating mango leaf powder (MLP) into the basal diet. Fresh mango leaves and other

ingredients were procured from local markets. The control diet (C) contained no MLP, while treatments T1, T2, T3, and T4 incorporated MLP at 2%, 4%, 8%, and 16% levels, respectively, replacing equivalent amounts of the basal diet.

Dry ingredients of the basal diet were thoroughly mixed and formed into dough. After cooling, MLP and mineral mixture were added, and pellets (2.0 mm diameter) were prepared using a hand pelletizer. The pelleted feed was air-dried and stored in airtight containers.

2.3 Growth Parameters

Growth parameters were evaluated at 15-day intervals using the (Bagenal & Tesch, 1978) formulas which are given below:

Weight gain (g) = Final weight (g) - Initial weight (g)

Specific Growth Rate (SGR) = $[(\ln W_t - \ln W_0) / D] \times 100$ Where: \ln = natural logarithm, W_0 = initial weight (g), W_t = final weight (g), D = duration (days)

Feed Conversion Ratio (FCR) = Feed given (g) / Weight gain (g)

Survival rate (%) = (Number of survivors / Initial stocking) \times 100

2.4 Water Quality Parameters

Water samples were collected initially and subsequently every 15 days for analysis following standard APHA (2005) methods.

Temperature: Measured directly using a digital thermometer.

pH: Determined using a standardized digital pH meter model number G LAB original Hanna.

Dissolved Oxygen (DO): Analyzed using the modified Winkler's method with sodium thiosulfate titration.

Alkalinity: Measured as CaCO₃ equivalent.

Table 1. Composition of experimental diets (g/kg)

| Treatment | Basal Diet (%) | Mango Leaf Powder (%) | Total (%) |
|-------------|----------------|-----------------------|-----------|
| C (Control) | 100 | 0 | 100 |
| T1 | 98 | 2 | 100 |
| T2 | 96 | 4 | 100 |
| T3 | 92 | 8 | 100 |
| T4 | 84 | 16 | 100 |

Basal diet composition: groundnut oil cake (40%), rice bran (40%), wheat flour (20%)

2.5 Statistical Analysis

Data were analyzed using one-way ANOVA followed by Duncan's multiple range test using SPSS 16.0. Significance was set at $P < 0.05$.

3. RESULTS AND DISCUSSION

3.1 Water Quality Parameters

Water quality parameters remained within acceptable ranges throughout the experimental period, indicating that MLM supplementation did not adversely affect the culture environment.

Temperature: The experimental record was carried out in most monsoons and Probably post-monsoons period. Water temperature ranged from 25.10-26.60°C across all treatments, with minimal variation between treatments (25.74-25.83°C). These values fall within the optimal range recommended for carp culture.

pH: All treatments maintained alkaline conditions with pH values ranging from 7.8-8.4. Treatment T1 showed the highest average pH (8.25), while T2 had the lowest (8.1).

Alkalinity: Total alkalinity varied between 110.0-134.0 mg/L across treatments. The control group showed the minimum average alkalinity (117 mg/L), while T3 had the maximum (128 mg/L).

Dissolved Oxygen: DO concentrations remained above the critical minimum level of 4.0 mg/L in all treatments. The control group maintained the highest mean DO (7.15 mg/L), while T3 showed the lowest (5.2 mg/L), though still within acceptable limits.

3.2 Growth Parameters

MLM supplementation significantly improved all growth parameters compared to the control group, with T3 (8% MLM) showing optimal performance.

Weight Gain: Net weight gain was significantly higher in all treatments compared to control. T3

achieved the highest weight gain (19.31 ± 0.136 g), while the control showed the lowest (9.43 ± 0.043 g). ANOVA confirmed significant differences between treatments and control ($P < 0.05$).

Percentage Weight Gain: T3 demonstrated the highest percentage weight gain ($59.77 \pm 1.557\%$), significantly superior to the control ($34.96 \pm 0.422\%$). All treatments showed significantly better performance than control.

Specific Growth Rate (SGR): The highest SGR was recorded in T3 (0.036 ± 0.016), while the control showed the lowest (0.022 ± 0.005). Statistical analysis confirmed significant differences between treatments.

Feed Conversion Ratio (FCR): T3 exhibited the most efficient feed utilization with the lowest FCR (2.92 ± 0.071), while the control showed the poorest performance (5.31 ± 0.052). Lower FCR values indicate better feed efficiency.

3.3 Discussion

The significant improvement in growth parameters with MLM supplementation can be attributed to the nutritional and bioactive compounds present in mango leaves. These findings align with previous studies demonstrating the growth-promoting effects of plant-based feed additives in aquaculture.

The effects of Mango Seed (*Mangifera indica*) powder on Growth Performance, Immune Response, Gut Morphology, and Gene Expression of Nile Tilapia (*Oreochromis niloticus*), found a significant effect on growth, immunity, and immuno-oxidant gene expression in Nile tilapia (Fontana *et al.*, 2024).

The optimal performance observed at 8% MLM inclusion (T3) suggests that this level provides the best balance of nutritional benefits without adverse effects. Higher inclusion levels (16% in T4) showed reduced performance, possibly due to the presence of anti-nutritional factors or reduced palatability.

Table 2. Growth performance of rohu fingerlings fed different levels of mango leaf meal

| Parameter | Control | T1 (2%) | T2 (4%) | T3 (8%) | T4 (16 %) |
|-----------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Weight gain (g) | 9.43 ± 0.043^a | 12.54 ± 0.089^b | 15.67 ± 0.112^c | 19.31 ± 0.136^d | 16.82 ± 0.124^c |
| % Weight gain | 34.96 ± 0.422^a | 42.18 ± 0.756^b | 51.23 ± 0.934^c | 59.77 ± 1.557^d | 54.32 ± 1.128^c |
| SGR | 0.022 ± 0.005^a | 0.027 ± 0.008^b | 0.031 ± 0.011^c | 0.036 ± 0.016^d | 0.033 ± 0.013^c |
| FCR | 5.31 ± 0.052^d | 4.12 ± 0.034^c | 3.45 ± 0.028^b | 2.92 ± 0.071^a | 3.18 ± 0.045^b |

Values with different superscripts in the same row differ significantly ($P < 0.05$)

Water quality parameters remained within acceptable ranges throughout the study, indicating that MLM supplementation does not negatively impact the culture environment. The slight variations observed were minimal and did not affect fish health or growth.

Previous research by Olusola et al. (2020) reported similar growth enhancement with mango leaf supplementation in catfish, supporting the broader applicability of mango leaves as feed additives in aquaculture. The improved FCR in MLM-supplemented groups indicates better feed utilization efficiency, which has significant economic implications for commercial aquaculture operations.

4. CONCLUSION

This study demonstrates that mango leaf meal supplementation significantly enhances the growth performance of rohu (*L. rohita*) fingerlings. The optimal inclusion level of 8% MLM in the basal diet (T3) resulted in superior weight gain, percentage weight gain, specific growth rate, and feed conversion efficiency while maintaining acceptable water quality parameters.

The findings suggest that MLM can serve as an effective, cost-efficient feed additive for rohu culture, potentially reducing production costs while improving growth performance. The 8% inclusion level is recommended for practical application in rohu fingerling production.

Future research should focus on field trials with different stocking densities and extended culture periods to validate these findings under commercial conditions. Additionally, studies on the economic feasibility and long-term effects of MLM supplementation would provide valuable insights for the aquaculture industry.

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 writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Anonymous. (2023). *Fisheries statistics of India*. Ministry of Fisheries, Government of India. <https://dof.gov.in/fisheries-statistics>
- Bagenal, T. B., & Tesch, F. W. (1978). Age and growth. In *Methods for assessment of fish production in freshwater* (3rd ed., pp. 101–136). Blackwell Scientific Publication.
- Banik, A., & Kumar, A. (2022). Perspective on utilization of leaf meal as fish feed ingredient for fish in future aquaculture. In *International Traditional Foods and Sustainable Food Systems Symposium* (pp. 120–150). Toros University Publisher.
- Bell, J. G., Henderson, R. J., Tocher, D. R., McGhee, F., Dick, J. R., Porter, A., Smullen, R. P., & Sargent, J. R. (2002). Substituting fish oil with crude palm oil in the diet of Atlantic salmon (*Salmo salar*) affects muscle fatty acid composition and hepatic fatty acid metabolism. *The Journal of Nutrition*, 132(2), 222–230.
- Bell, J. G., McEvoy, J., Tocher, D. R., McGhee, F., Campbell, P. J., & Sargent, J. R. (2001). Replacement of fish oil with rapeseed oil in diets of Atlantic salmon (*Salmo salar*) affects tissue lipid compositions and hepatocyte fatty acid metabolism. *The Journal of Nutrition*, 131(5), 1535–1543.
- Choudhary, P., Muddalingaiah, S. G., Mohanty, S., Paul, A., Mishra, S. S., & Das, R. (2024). Effects of dietary *Moringa oleifera* leaf extract on growth performance, enzyme activity and non-specific immune parameters in rohu *Labeo rohita* (Hamilton, 1822): Dietary *Moringa oleifera* leaf extract improves fish immunity and health. *Indian Journal of Fisheries*, 71(4).
- FAO. (2009). *Cultured aquatic species fact sheets*. Food and Agriculture Organization of the United Nations.
- FAO. (2024). *India's fisheries and aquaculture sectors critical for its nutrition security: FAO ADG*.
- Fontana, C. M., Sumon, M. A. A., Wannavijit, S., Lubis, A. R., Khongdee, N., Linh, N. V., Phimolsiripol, Y., Hosseinifar, S. H., & Doan, H. V. (2024). Effects of mango seed (*Mangifera indica*) powder on growth performance, immune response, gut morphology, and gene expression of Nile tilapia (*Oreochromis niloticus*). *Advancing Aquaculture Health and Performance*, 9(12), 514.

- Meghraj, Y., Sharma, B. K., Sharma, S. K., & Upadhyay, B. (2023). Effect of mango leaf meal as supplementary feed on growth and digestibility of common carp (*Cyprinus carpio* Linnaeus, 1758) fingerlings (Doctoral dissertation, MPUAT, Udaipur). *The Pharma Innovation Journal*, 12(3), 1239–1241.
- Nair, C. M., & Salin, K. R. (2007). Carp polyculture in India—Practices, emerging trends. In *Global Aquaculture Advocate* (pp. 53–56).
- Olusola, S. E., Ajiwoju, I. J., & Emikpe, B. O. (2020). Efficacy of tamarind (*Tamarindus indica*) leaves and mango (*Mangifera indica*) leaves as feed additives on growth, blood status and resistance to *Aeromonas hydrophila* in juvenile African catfish *Clarias gariepinus*. *Croatian Journal of Fisheries*, 78(1), 11–20.
- PIB. (2025). “Eco fishing Ports” in focus: Department of Fisheries and AFD hold technical dialogue in New Delhi.
- Sahu, S., Das, B. K., Pradhan, J., Mohapatra, B. C., Mishra, B. K., & Sarangi, N. (2007). Effect of *Mangifera indica* kernel as a feed additive on immunity and resistance to *Aeromonas hydrophila* in *Labeo rohita* fingerlings. *Fish & Shellfish Immunology*, 23(1), 109–118.
- Troell, M., Costa-Pierce, B., Stead, S., Cottrell, R. S., Brugere, C., Farmery, A. K., Little, D. C., Strand, Å., Pullin, R., & Soto, D. (2023). Perspectives on aquaculture’s contribution to the Sustainable Development Goals for improved human and planetary health. *Journal of the World Aquaculture Society*, 54, 251–342.

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2025): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://pr.sdiarticle5.com/review-history/138049>