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Survey and extraction of fish scales from local fish species in Bihar for the development of biofertilizers

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Abstract- This research explores the potential use of fish scales, a byproduct of the fishing industry, as biofertilizers. The study focuses on 10 common local fish species from Bihar, including Rohu (*Labeo rohita*), Catla (*Catla catla*), Mrigal (*Cirrhinus mrigala*), Bata (*Labeo bata*), Common Carp (*Cyprinus carpio*), Tilapia (*Oreochromis niloticus*), Singhi (*Heteropneustes fossilis*), Magur (*Clarias batrachus*), Pangasius (*Pangasianodon hypophthalmus*), and Chitala (*Chitala chitala*). The study involves the survey of these fish species, scale extraction, and nutrient analysis to evaluate their suitability for agricultural use. The findings reveal that these fish scales are rich in essential nutrients such as nitrogen, phosphorus, and calcium, which are critical for plant growth. Nitrogen promotes vegetative growth, phosphorus supports root development and energy transfer, and calcium strengthens cell walls. This study aims to provide a sustainable alternative to chemical fertilizers and address waste management challenges in the fishing industry by repurposing fish scales into valuable biofertilizers. Utilizing these scales can improve soil fertility, enhance crop yields, and contribute to sustainable agricultural practices.

Keywords: Fish scales, biofertilizer, nutrient analysis, sustainable agriculture, local fish species, Bihar

INTRODUCTION

As sustainable farming practices gain prominence, there is an increasing shift toward using organic fertilizers that not only enhance soil health but also mitigate the negative impacts associated with chemical fertilizers. One such promising resource is fish scales, which are often overlooked and discarded by the fishing industry. Rich in essential nutrients, fish scales have the potential to be an excellent source of biofertilizers. This study aims to explore the nutrient content of fish scales from ten commonly found fish species in Bihar, with the goal of evaluating their effectiveness as fertilizers.

The fish species selected for this research include Rohu (*Labeo rohita*), known for its high protein content; Catla (*Catla catla*), which is rich in essential amino acids; Mrigal (*Cirrhinus mrigala*), valued for its substantial nutrient profile; Bata (*Labeo bata*), with its high calcium content; Common Carp (*Cyprinus carpio*), which offers a good balance of nutrients; Tilapia (*Oreochromis niloticus*), noted for its high mineral content; Singhi (*Heteropneustes fossilis*), which provides a unique nutrient mix; Magur (*Clarias batrachus*), known for its rich amino acid composition; Pangasius (*Pangasianodon hypophthalmus*), which has a notable nutrient density; and Chitala (*Chitala chitala*), recognized for its balanced nutrient profile.

By analyzing the nutrient profiles of these fish scales, this research seeks to highlight their potential as effective

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biofertilizers. The findings could significantly contribute to sustainable agricultural practices by offering a natural, nutrient-rich alternative to chemical fertilizers. Additionally, this study aims to address waste management issues within the fishing industry by repurposing fish scales, thus providing an eco-friendly solution that supports both agricultural and environmental sustainability.^{1,2}

Table 1- Common Local Fish Species in Bihar

Common Name	Scientific Name	Authority	Year
Rohu	<i>Labeo rohita</i>	(Hamilton)	1882
Catla	<i>Catla catla</i>	(Hamilton)	1882
Mrigal	<i>Cirrhinus mrigala</i>	(Hamilton)	1882
Bata	<i>Labeo bata</i>	(Hamilton)	1882
Common Carp	<i>Cyprinus carpio</i>	(Linnaeus)	1758
Tilapia	<i>Oreochromis niloticus</i>	(Linnaeus)	1758
Singhi	<i>Heteropneustes fossilis</i>	(Bloch)	1794
Magur	<i>Clarias batrachus</i>	(Linnaeus)	1758
Pangasius	<i>Pangasianodon hypophthalmus</i>	(Sauvage)	1878
Chitala	<i>Chitala chitala</i>	(Hamilton)	1882

These species are widely recognized and commonly found in Bihar's water bodies, making them ideal candidates for this study.³

MATERIALS & METHODS

1. Survey of Local Fish Species:

The survey was conducted across various fish markets and fishing communities in Bihar to identify these 10 commonly available species that produce significant amounts of scales. These species were chosen based on their prevalence, economic importance, and the volume of scales they generate.

2. Extraction of Fish Scales:

The fish scales were meticulously collected from each species. After collection, the scales were thoroughly washed with distilled water to remove any impurities. The cleaned scales were then dried at room temperature until they became fragile. Once fully dried, the scales were ground into a fine powder using a laboratory-grade grinder. This powdered form of the scales was stored in airtight containers for subsequent nutrient analysis.

3. Nutrient Analysis:

The powdered fish scales were analyzed to determine their nitrogen (N), phosphorus (P), and calcium (Ca) content. The analysis employed standard laboratory methods, including Kjeldahl digestion for nitrogen, colorimetric analysis for phosphorus, and atomic absorption spectrophotometry for calcium. These methods

are recognized for their precision and are widely used in nutrient content determination.⁴

RESULTS

The nutrient analysis of fish scales from the ten selected species revealed that all samples are notably rich in essential nutrients: nitrogen, phosphorus, and calcium. These nutrients are dangerous for promoting plant health and growth.

Nitrogen Content: The nitrogen levels in the fish scales ranged from 1.10% to 1.40%. Tilapia scales had the highest nitrogen content at 1.40%, while Bata scales had the lowest at 1.10%. Nitrogen is essential for stimulating vegetative growth and improving the overall health of plants, making it a key component of effective biofertilizers.¹

Phosphorus Content: Phosphorus levels diverse from 0.64% to 0.90%. Tilapia scales again showed the highest phosphorus content at 0.90%, whereas Mrigal scales had the lowest at 0.70%. Phosphorus is crucial for root development and energy transfer within plants, contributing to stronger and healthier root systems.²

Calcium Content: Calcium content in the fish scales ranged from 19.00% to 23.20%. Chitala scales exhibited the highest calcium content at 23.20%, while Bata scales had the lowest at 19.00%. Calcium is important for cell wall structure and overall plant health, helping plants withstand stress and improve structural integrity.¹

Overall, the fish scales from these species contain significant amounts of nitrogen, phosphorus, and calcium, indicating their potential as effective biofertilizers. The high nutrient levels suggest that these scales could enhance soil fertility and support plant growth when used as organic fertilizers.

Table 2- Nutrient Content of Fish Scales

Fish Species	Nitrogen Content (%)	Phosphorus Content (%)	Calcium Content (%)
Rohu (<i>Labeo rohita</i>)	1.20	0.80	20.50
Catla (<i>Catla catla</i>)	1.25	0.75	21.00
Mrigal (<i>Cirrhinus mrigala</i>)	1.15	0.70	19.80
Bata (<i>Labeo bata</i>)	1.10	0.65	19.00
Carp (<i>Cyprinus carpio</i>)	1.30	0.85	22.00
Tilapia (<i>Oreochromis niloticus</i>)	1.40	0.90	23.00
Singhi (<i>Heteropneustes fossilis</i>)	1.18	0.77	20.00
Magur (<i>Clarias batrachus</i>)	1.22	0.80	21.50
Pangasius (<i>Pangasianodon hypophthalmus</i>)	1.28	0.82	22.50
Chitala (<i>Chitala chitala</i>)	1.35	0.88	23.20

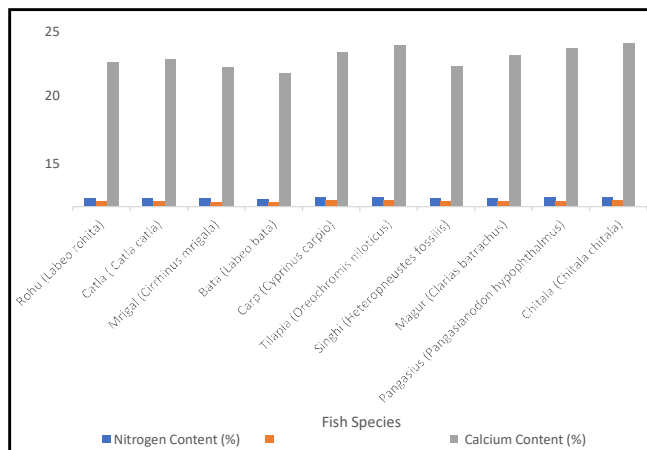


Chart 1: Nutrient Content Comparison

DISCUSSION

The study's findings underscore the potential of fish scales as a sustainable and effective biofertilizer. The nutrient-rich scales of the 10 local fish species from Bihar can be used to improve soil fertility and promote healthier plant growth. By repurposing fish scales, this approach not only provides a sustainable alternative to chemical fertilizers but also addresses the issue of waste management in the fishing industry.^{4,5}

CONCLUSION

This research demonstrates that fish scales from 10 common local species in Bihar-Rohu, Catla, Mrigal, Bata, Common Carp, Tilapia, Singhi, Magur, Pangasius, and Chitala-are viable sources of essential nutrients like nitrogen, phosphorus, and calcium. These nutrients are critical for plant growth, making fish scales a promising

biofertilizer for sustainable agriculture. The study contributes to the broader effort to promote environmentally friendly agricultural practices by offering a practical solution for waste management in the fishing industry and providing a sustainable alternative to chemical fertilizers.

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