Wetland Ecosystem: Sustaining Livelihood through Makhana Cultivation in Bihar

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ABSTRACT

Makhana is also known as fox nut which is derived from the aquatic plant *Euryale ferox*. It acts as vital livelihood option for rural household of the state. Being a nutrient rich crop with low fat content, it is suitable for modern dietary pattern. With the increased consumer's awareness, the demand for makhana is increasing day by day. The increased demand is facilitating the area expansion under makhana. The income earned by small and marginal farmers is high as compared to other traditional crops which is inclining their interest towards this. It is also supporting wetland sustainability as makhana growing water bodies are ideal reservoir for air breathing fishes. Thus, makhana cultivation is providing economic benefit as well as environmental benefits.

INTRODUCTION

Wetlands are among the most productive ecosystems and provide a wide range of ecosystem services such as water purification, nutrient cycling, flood control, groundwater recharge, and biodiversity conservation. These ecosystems also support various livelihood activities, including fisheries and aquatic crop cultivation. In eastern India, particularly in Bihar, wetlands play a significant role in sustaining rural livelihoods through the cultivation of makhana, an aquatic crop derived from the plant *Euryale ferox*. Wetlands provide ideal ecological conditions for makhana cultivation and contribute to both environmental sustainability and local economic development (Kumar, 2017). Bihar contributes around 85 per cent of the country's

total production**.** Makhana cultivation is primarily concentrated in the wetland-rich districts of the Mithila region such as Darbhanga, Madhubani, Purnia, and Katihar. These regions have abundant ponds, and floodplain wetlands that are suitable for makhana cultivation and have supported traditional production systems (Kumar and Jha, 2026). Makhana cultivation plays an important socio-economic role in the region by generating employment and income for farmers, labourers, and traders involved in cultivation, harvesting, processing, and marketing activities. Studies have shown that wetland-based makhana farming systems contribute significantly to rural livelihoods and can also be integrated with fisheries to improve farm profitability and resource use efficiency. Integrated fish–makhana farming systems have been found to increase gross income and benefit–cost ratios compared to monoculture systems, highlighting the economic potential of wetland-based production systems (Kumar, 2025). In recent years, makhana has gained increasing recognition as a healthy and nutritious food product due to its high protein, low fat, and mineral content (Praveen and Ansari, 2024). This growing demand in domestic and international markets has created new opportunities for value addition, branding, and market expansion. At the same time, increasing environmental awareness among consumers has led to greater demand for environmentally friendly products. Since makhana is traditionally cultivated in natural wetlands with relatively low chemical inputs, it has strong potential to be promoted as an eco-friendly product for improving livelihood (Singh *et al.,* 2020).

However, despite its economic importance, many wetlands in Bihar are facing degradation due to pollution, encroachment, sedimentation, and climate variability. The decline in wetland ecosystems threatens the sustainability of makhana cultivation and the livelihoods dependent on it. Research also highlights that variation in agro-ecological and socio-economic conditions influence makhana farming practices and productivity across different regions of Bihar (Kumar and Jha, 2026).

Nutritional Value of Makhana

Makhana is a hydrophytic plant widely cultivated in wetlands of Darbhanga district of Bihar. The seeds are rich in carbohydrate, dietary fiber and essential minerals. The rich carbohydrate content makes the crop an excellent source of energy (Ghosh and Sharma, 2018). It is considered as dry fruit and is comparable with almond, walnut, cashew nut and coconut.

Table 1: Nutritional Value of Makhana

Sl.No.	Parameters	Makhana
1	Total Carbohydrates (g/100g)	75.2
2	Total Protein (g/100g)	9.5
3	Dietary Fiber (g/100g)	5.0
4	Fat (g/100g)	0.1
5	Minerals (g/100g)	0.5

Source: Parveen & Ansari, 2024; Directorate of Horticulture, Bihar, 2020

The carbohydrate content of Makhana is 75.2 g per 100 g making it as energy dense food and can be used in the areas where energy needs are high. The protein content is 9.5 g per 100 g of makhana which shows it acts as an important source of protein especially for vegetarians. The dietary fiber and fat is 5 and 0.1 g per 100 g of Makhana. The low fat level makes it appropriate for modern dietary trends. The mineral content in this is 0.5 g per 100 g of Makhana. Thus it is close to staple foods like wheat, rice and other cereals.

The seed is analgesic and aphrodisiac. It is taken internally in the treatment of chronic diarrhoea, vaginal discharges, diabetes, gonorrhoea, and stomachache, kidney weakness associated with frequent urination, impotence, premature ejaculation and nocturnal emissions. It has been traditionally used to treat diseases like beri-beri also. Its medicinal properties are documented in the ancient literatures of India.

Economics of Makhana Production for Sustaining Livelihood

Makhana is a unique livelihood option for farmers having access to ponds. The economics of the crop highlight its importance as a source of livelihood. It supports small and marginal farmers of the state by providing higher returns as compared to paady. The studies indicated that the harvesting is the most costly operation in Makhana cultivation as it is a laborious work involves skill (Atal *et al.,* 2019). The harvesting was done generally in 2-3 rounds and the cost is increasing with every subsequent rounds. It requires skill as well as physical strength of labour as the harvesting operation is done manually. The laborious nature of harvesting provides opportunity of employment generation. A large population of a specific community *mallah* is getting employment as they have the hereditary skill of harvesting and processing in the region. Women also play important role in processing and contributing in household income and empowerment. The crop also promotes livelihood diversification when it is integrated with other aquatic crops or fish. With growing demand of Makhana, it provides scope in value addition, entrepreneurship and rural enterprise development. The export potential of Makhana is improving the country's GDP. It increased from 6700 MT in 2020 to 25130 MT in 2024 with 39 per cent of CAGR. The major importer of Indian Makhana is US 40 per cent share of total export from India. Thus, along with the environmental benefit, it has vast economic and social opportunity that aligns with sustainable development goal (SDG).

Environmental Benefits

Cultivating Makhana in wetlands provide several important environmental benefits. It requires shallow, perennial water bodies therefore encourages the conservation and restoration of wetlands. These cultivated wetlands serve as rich habitats that support fish, amphibians, aquatic insects, and birds, thereby enhancing biodiversity. At the same time, Makhana plants help improve water quality by absorbing excess nutrients like nitrogen and phosphorus, reducing pollution and eutrophication. Wetland-based cultivation also contributes to carbon sequestration, as these ecosystems store carbon in their sediments and plant biomass, helping mitigate climate change. Additionally, traditional Makhana farming relies on minimal chemical inputs, which reduces harmful runoff into aquatic systems. The structure of roots stabilizes sediments, preventing erosion and maintaining ecological balance. In regions such as Bihar, this form of cultivation not only supports livelihoods but also preserves the ecological integrity and climate resilience of wetland environments.

CONCLUSION

Makhana, derived from Euryale ferox, stands out as both an economically viable and environmentally sustainable crop, especially in wetland-rich regions. It provides strong livelihood support to farmers through high market demand, export potential and value-added products, while requiring relatively low external inputs. At the same time, its cultivation helps conserve wetlands, supports biodiversity, improves water quality, and contributes to carbon sequestration. By combining income generation with ecosystem preservation, Makhana farming represents a

balanced model of sustainable agriculture. In states like Bihar, it clearly demonstrates how traditional practices can promote economic growth without compromising environmental health, making it a promising crop for future climate-resilient farming systems.

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