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An empirical analysis of costs and returns of makhana (*Euryale ferox Salisb*) in Malda district of West Bengal

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Abstract

The economic aspects of makhana (*Euryale ferox Salisb.*) cultivation in Harishchandrapur-I block of Malda district, West Bengal, during the agricultural year 2019–2020 were examined in the present study. Primary data were acquired from 30 randomly selected farmers in two purposively selected villages, including those with marginal, small, semi medium, medium and large farm sizes, using a pre-tested survey schedule. Makhana cultivation was found to be extremely labor-intensive, with contracted labor averaging 134.52 man-days per hectare and imputed value of family labor valued at Rs. 50,937.50 per hectare. Cost A₁ (paid-out costs, including hired labour, machinery, inputs, irrigation, taxes, depreciation, interest, and miscellaneous expenses) and Cost D (Cost A₁ plus imputed value of family labour) had an average of Rs.72,843.51 and Rs.1,26,653.32 per hectare, respectively. However, the average farmer price increased from Rs.92.06/kg (marginal) to Rs.101.45/kg (large), while the average yield remained consistent at 1,744.94 kg/ha across farm sizes. Gross returns averaged Rs.1,67,840.82/ha, resulting in surpluses over Cost A₁ (Rs.94,997.30) and Cost D (Rs.41,187.50). The output-input ratios were 2.31 for Cost A₁ and 1.32 for Cost D. Higher input intensity (fertilizers, irrigation) and greater profitability were observed in larger farms. Makhana farming's economic viability, employment generation potential, and potential for expansion in wetland areas of West Bengal and Bihar were all confirmed by the results.

Keywords: *Euryale ferox Salisb.* Labor-intensive, paid-out costs, economic viability, West Bengal, Bihar

1. Introduction

Euryale ferox, also known as makhana, gorgon nut, or fox nut, is a valuable aquatic crop that belongs to the Nymphaeaceae family. It is usually produced in ponds, oxbow lakes, and swamps that don't move. It is thought that Southeast Asia and China are where the crop first grew. It is mostly found in tropical and subtropical areas, such as Japan, Korea, Russia, Nepal, Bangladesh, and portions of India. Makhana is grown in many states in India, including West Bengal, Bihar, Manipur, Tripura, Assam, Jammu and Kashmir, Odisha, Madhya Pradesh, Rajasthan, and Uttar Pradesh. However, most of the commercial growing of makhana happens in North Bihar, Manipur, and some parts of West Bengal and Madhya Pradesh. Bihar is the biggest producer of makhana. The main producing districts are Darbhanga, Sitamarhi, Madhubani, Saharsa, Supaul, Araria, Kishanganj, Purnia, and Katihar. These are where most of the processed makhana in the country comes from. Because makhana farming is so important to the economy, a regional research center was set up in Darbhanga by the ICAR Research Complex for Eastern Region to study several

elements of it. One makhana plant can produce around 100 seeds, and one hectare of pond space can hold about 10,000 plants, which can produce about 1.8 to 2.0 tonnes of raw seeds per hectare (Kumar *et al.*, 2011a, Khadatkhar *et al.*, 2015) [3, 2]. Makhana is a good food source since it has carbs, protein, minerals, and important micronutrients. It also has about the same number of calories as basic foods like rice and wheat. Makhana is important for nutrition, but it also has therapeutic characteristics and is utilized a lot in the food and drug industries. Farmers grow the crop in low-lying, swampy areas that aren't good for growing regular crops. This makes good use of underused resources and gives farmers another way to make money. In this context, the current study was conducted to analyze the financial dimensions of makhana cultivation, specifically aiming to assess the cultivation and production costs of makhana.

2. Research Methodology

For the present study, the state of West Bengal was purposively selected. Within the state, Malda district was also purposively chosen for the investigation. Further,

Harishchandrapur-I block of the district was purposively selected for detailed analysis. At the village level, a cluster of two villages, namely Rampur and Baghmara, was purposively selected for the study. From the complete list of Makhana producers in the selected villages, a total of thirty sample producers were finally selected using the Simple Random Sampling Without Replacement Method.

2.1 Collection of data

All the data for this research were collected by Survey Method. For this purpose a schedule was prepared with all objectives, related with this research and the schedule has been tested by conducting pilot survey. Collection of data was conducted by visiting each farm/market personally and interviewing the farmers/ market intermediaries on the basis of pre-tested survey schedule. The above research study related to the agricultural year 2019-20.

2.2 Methods of calculating cost

The study used primary data on the input utilization, cost of cultivation, and returns are collected from the selected growers and other relevant information was collected through a survey method with the help of pre-tested questionnaire. Simple tabular analysis was done to accomplish the objectives.

Data will be analyzed w.r.t. level of labour utilization, other input utilization, cost of cultivation, cost of production and output-input ratio of makhana on the basis of different cost concepts.

1. Cost 'A₁' includes the following 16 items of cost-

- A. Value of hired human labour.
- B. Value of consumed bullock labour.
- C. Value of hired bullock labour.
- D. Value of owned machinery.
- E. Hired machinery charges.
- F. Value of fertilisers.
- G. Value of manures.
- H. Value of seed.
- I. Value of insecticides and pesticides.
- J. Irrigation charges.
- K. Casual water charges.
- L. Land revenue and other taxes.
- M. Depreciation on farm implements.
- N. Depreciation on farm building, farm machinery and irrigation structure.
- O. Interest on working capital.

P. Miscellaneous expenses.

2. Cost D = Cost A₁ + Imputed value of family labour.

Cost of cultivation

Total cost incurred for growing any crop in unit of area of land on the basis of different crop concepts. E.g. Rs/ ha.

Cost of Production

Total cost incurred for growing any crop per unit of output on the basis of different cost concepts. E.g. Rs/quintal.

3. Results and Discussion

The Table.1 depicted the per-hectare use of primary input materials for Makhana (fox nut) cultivation in the Malda District of West Bengal during the agricultural year 2019–2020. The data were categorized by various farm size groups: marginal, small, semi medium, medium and large farms, accompanied with aggregated averages. The findings indicated that the employment of hired labor remained consistently elevated across all agricultural categories, fluctuating between 134 and 135 man-days per hectare, thereby highlighting the labor-intensive characteristics of makhana cultivation, especially owing to the manual harvesting in aquatic settings. The employment of hired machinery in cultivation was consistently comparable across all farm sizes, averaging approximately 29–30 hours per hectare, indicating minimal difference in automation levels. The application of fertilizer had a direct correlation with farm size, rising from 112.5 kg per hectare on marginal farms to 153.75 kg per hectare on large farms, yielding a pooled average of 130.92 kg per hectare. The application of organic manure was consistently similar among various farm groups, with a combined average of 147.63 kg per hectare, reflecting a sustained dependence on conventional soil fertility management techniques. The seed rate remained consistent at 37.5 kg per hectare across all farm sizes, indicating compliance with prescribed growing procedures. The application of plant protection agents shown a modest reduction as farm size increased, decreasing from 15 kg per hectare on marginal farms to 12.9 kg per hectare on large farms, with a combined average of 13.97 kg per hectare. Irrigation hours significantly rose with the increase in farm size, escalating from 168.75 hours per hectare on marginal farms to 262.5 hours per hectare on large farms, yielding a pooled average of 206.4 hours per hectare.

Table 1: Application of Input Materials for Makhana cultivation in Malda District of West Bengal (2019-2020) Unit per hectare

Size Group	Marginal (< 1 ha)	Small (1-2 ha)	Semi medium, Medium & large (> 2ha)	Pooled
No. hired Man days	135	133.57	135	134.52
No. of hired Mechinary (Cultivating time)	30	29.02	29.25	29.42
Fertilizer (Kg)	112.5	126.52	153.75	130.92
Manure (Kg.)	146.25	148.2	148.5	147.63
Seed (Kg.)	37.5	37.5	37.5	37.5
Irrigation (Hours)	168.75	187.95	262.5	206.4

The data indicated modest input intensification in larger farms, especially regarding fertilizer application and irrigation usage, whereas labor and seed inputs remained comparatively consistent across farm types. The results indicated that makhana cultivation is a labor-intensive

aquatic cropping system with minimal reliance on external inputs in the flood-prone wetland regions.

The Table.2 provided a breakup of the cost of Makhana cultivation in Malda District during the agricultural year 2019–2020, presenting the cost per hectare across different

farm size groups. The results indicated that the cost of hired labour had been a significant component of the total cost, with a pooled average of Rs.36,728.10 per hectare, which reflected the labour-intensive nature of Makhana cultivation. The expenses for machinery and seed had remained relatively similar across all farm size categories. However, the costs of fertilizers, manures, and irrigation had shown a slight increase with the expansion of farm size. The expenditure on plant protection chemicals had decreased marginally as the farm size increased. Meanwhile, the

amount paid as land revenue and other taxes had remained constant across all farm groups. The imputed value of family labour had also constituted a substantial portion of the total cost, with a pooled value of Rs.50,937.50 per hectare. Consequently, the pooled values of Cost A₁ and Cost D had been estimated at Rs.72,843.51 and Rs.1,26,653.32 per hectare, respectively, reflecting the overall cost structure of Makhana cultivation in the study area.

Table 2: Size group wise Break-up of Cost of Cultivation of Makhana in Malda (2019-2020) (Rs. Per hectare)

Size Group (Total Size of Holdings)	Marginal (< 1 ha.)	Small (1-2 ha.)	Semi medium, Medium & Large (>2 ha.)	Pooled
Value of Hired Labour (Rs.)	37,125.00	34,921.87	38,137.50	36,728.10
Machine Charges (Rs.)	12,000.00	11,625.00	11,550.00	11,725.00
Value of Fertilizer (Rs.)	2,962.50	3,150.00	3,528.75	3,213.75
Value of Manure (Rs.)	3,159.00	3,999.00	4,009.50	3,722.50
Value of Seed (Rs.)	7,500.00	7,500.00	7,500.00	7,500.00
Value of Chemical (Rs.)	1,556.00	1,542.15	1,432.50	1,510.20
Irrigation Charge (Rs.)	5,250.00	6,187.50	9,150.00	6,862.50
Land Revenue other Taxes (Rs.)	1,125.00	1,125.00	1,125.00	1,125.00
Miscellaneous (Rs.)	3,000.00	3,164.02	3,075.00	3,079.60
Interest on working capital (3% p.a. for Six months)	1,117.01	1,104.80	1,191.49	1,137.76
Depreciation	0	0	0	0
Imputed Value of family labour (Rs.)	48,750.00	51,562.50	52,500.00	50,937.50
Cost A ₁ (Rs.)	75,584.51	69,896.30	73,049.74	72,843.51
Cost D (Rs.)	1,23,209.51	1,24,750.72	1,31,999.74	1,26,653.32

The Table.3 delineated the yield by size group, gross return, surplus over Cost A₁ and Cost D, and output–input ratios of Makhana agriculture in Malda district for the year 2019–2020. The findings demonstrated that the production of Makhana was consistently comparable across various farm size categories, with a collective average of 1,744.94 kg per hectare. The average price obtained by farmers escalated with farm size, varying from Rs. 92.06 per kg on marginal farms to Rs. 101.45 per kg on large farms. As a result, gross returns were observed to be greater for larger farms, with a

combined average of Rs. 1,67,840.82 per hectare. The excess over Cost A₁ and Cost D likewise escalated with farm size, signifying comparatively enhanced profitability for larger enterprises. The output–input ratio at Cost A₁ fluctuated between 2.13 on marginal farms to 2.43 on large farms, but the ratio at Cost D ranged from 1.30 to 1.35. The data indicated that Makhana cultivation was economically advantageous for all farm size categories in the research area.

Table 3: Size Group-wise Yield, Gross Return, Surplus over Cost A₁ & Cost D and Output-input Ratios of Makhana in Malda District of West Bengal (2019-2020)

Size Group	Marginal (<1 ha)	Small (1-2 ha)	Semi Medium, Medium & Large (>2 ha)	Pooled
Cost A ₁ (Rs.)	75,584.51	69,896.30	73,049.74	72,843.51
Cost D (Rs.)	1,23,209.51	1,24,750.72	1,31,999.74	1,26,653.32
Yield (Kg/ha.)	1,745.62	1,737.19	1,752.00	1,744.94
Average Price (Rs./Kg.)	92.06	95.02	101.45	96.18
Gross Return (Rs.)	1,60,709.51	1,65,063.22	1,77,749.74	1,67,840.82
Surplus over Cost A ₁ (Rs.)	85,125.00	95,166.92	1,04,700.00	94,997.30
Surplus over Cost D (Rs.)	37,500.00	40,312.50	45,750.00	41,187.50
Output- input Ratio Cost A ₁ (Rs.)	2.13	2.31	2.43	2.31
Output- input Ratio Cost D (Rs.)	1.3	1.32	1.35	1.32

4. Summary and Conclusion

The study's main conclusions showed that hired machine charges, labor costs, incidental charges, Cost A₁, and yield in Makhana cultivation did not correlate with size class. The amount and cost of fertilizers, manures, irrigation hours, irrigation charges, imputed value of family labor, Cost D, price received, gross returns and surpluses over Cost A₁ and Cost D, as well as the output–input ratios, were found to positively correlate with size class. One hectare of Makhana crop required an average of 37.5 kg of seed, and in older

ponds, the previous year's remaining seeds served as seed material for the current year. The use and value of plant protection chemicals, as well as the cost of rented machinery, were found to be negatively correlated with size class. Additionally, the survey showed that the average land revenue charge was Rs.1,125 per hectare and the cost of seed was approximately Rs.7,500 per hectare. Overall, the results showed that Makhana cultivation had been beneficial for farmers and created a large number of job opportunities, with a large use of family labor. The study indicated that

there was significant potential for increasing the area and production of Makhana in India, especially in Bihar and the surrounding areas of West Bengal, given its significant commercial significance.

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