

Status of Makhana Production and Marketing in India: A Chronological Review

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ABSTRACT

Makhana has tremendous opportunities in local as well as the global market due to increased demand of nutrient-rich food across the globe. It is a major component of integrated farming as it can be cultivated with rice, water chestnut as well as fisheries. It provides livelihood to small and landless farmers of Bihar and Eastern India as the agro-climatic region of Bihar and Eastern India is most suitable for its cultivation due to the fertile land of Indo-Gangetic plains and abundance of pure water. This article provides a chronological study of 21 research articles published from the year 2010- 2021. The present article provides a theme and pattern on which research was conducted and it can be classified into six categories that is production of makhana, constraints related to production, marketing of makhana, socio-economic conditions of growers, economics of production and value chain analysis of makhana after harvesting. The finding indicates that the producers enjoy very less share in consumer's money. Also, there was very little technical and financial support to farmers which led to low productivity. Value addition and branding can be useful tools for marketing as well as the export of makhana to earn foreign revenue. Thus there is need to establish a Farmer Producer Organization of makhana growers in our country.

- *Makhana Cultivation is characterized by poor socio-economic conditions of growers.*
- *Major constraints faced by farmers are lack of land, credit facilities, technology, transportation as well as price fluctuation in the market.*
- *Value addition can be a useful tool in enhancing profitability.*

Keywords- *Makhana Production, Constraints, Socio-economic, Economics of Production, Marketing & Value Chain*

Introduction

Makhana which is one of the traditional foods of India, is also known as foxnut or Gorgon nut which is obtained from seeds of prickly water lily which is scientifically called as *Euryale ferox salisb.* It belongs to the family Nymphaeaceae. It is usually grown in stagnant water bodies like ponds, lakes, and other areas having stored water. This crop is native to south-east Asia and China but it is having high demand all over the world. It has been cultivated for long time in the Bihar state of India which produces about 85-90 percent of world total makhana production. Besides that, it is also cultivated in parts of lower Assam, Manipur, Tripura, West Bengal, Uttar Pradesh, eastern Odisha, and Madhya Pradesh. In Bihar it is mainly cultivated in the northern part which consists of the Mithila region which includes Madhubani, Darbhanga, Purnia, Saharsa, Sitamarhi, Araria, Kishanganj and Katihar. The total area under cultivation of makhana is approximately 15000 ha.

It is found that a single makhana plant produces nearly 100 seeds per plant and approximately 10000 plants can be grown in 1 hectare land which can give an estimated yield of 1.6- 2.2 tons per hectare. Due to its highly nutritive value, makhana is in high demand all over the world especially in Western countries that are more conscious about their health. It is highly demanded by diabetic and heart patients as it has low glycemic index which is useful to lower blood sugar levels. Besides that it also has low sodium and magnesium levels which is useful for heart patients. It has calorific value which is comparable to staple foods and it can be very useful in attaining food and

nutritional security across the globe. Due to its high nutrient, protein content, low sugar, fat, ascorbic and phenolic acid level, it is called as superior dry fruit. Recently in China, it is found that it has analgesics and drumming compounds which is useful to cure diarrhea, kidney problems, vaginal discharge in females as well as rheumatism.

Table 1 shows area-wise and year-wise research articles. From this, it can be interpreted that maximum work has been done in Bihar which accounts for 90 percent of the world's production as well as other makhana growing belts of eastern as well as north-eastern India.

Research Methodology

A good literature review whether qualitative or quantitative provides a good summary of works of different researchers related to that field without partiality^[16]. A literature review summarizes, synthesizes and arguments the works of others^[3]. A chronological and systematic review was done to analyze the different aspects of makhana cultivation including its production, value chain analysis, economics of production, constraints as well as marketing. A total of 21 research papers were published from year 2010-2021 and were reviewed to analyze the pattern, challenges and establish common themes and the results were broadly classified in 6 categories production, marketing, constraints, economics, value chain, and socio-economic profile of growers.

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Results and Discussion

Socio-economic background

A study on socio-economic profile revealed that the majority of farmers that was 86 percent illiterate or studied up to class 5th only^[1]. The age group of the majority of farmers was found to be above 50 years. Most of them had joint family with an average annual income of Rs. 50,000- 1 lakh. Majorities was marginal farmers and mainly cultivate makhana on leased land. Majority of makhana growers are poor farmers and due to cartelization in market they are not able to get the remuneration price of their products^[15]. A study found that around 94 percent of farmers belong to mallah community^[20].

Economics of Makhana Production

A study^[15] on the cost incurred in marketing shows that around 36-40 percent of the price given by consumers reaches to hand of producers and rest are enjoyed by middlemen. Singh & Jain, 2010^[22] found that the average cost of cultivation of a pond system was around Rs 15,540 and the return was around Rs 2,25,000 making a net return of Rs. 2,09, 460 to the growers. They also highlighted about use of fisheries in integration with makhana cultivation for additional income. The average cost of cultivation of makhana in Darbhanga and Madhubani districts of Bihar was found to be 57,370 Rs/ hectare while net return on cost A, B and C was 117344, 105739 & 103617 Rs, respectively, making B:C ratio 2.16, 1.60 & 1.52, respectively. Variable costs constitute around 81.80 percent in which human labour occupies the maximum variable cost^[17].

A study on cost and return analysis found that net return per hectare was about 42,000 for the farmers who had taken land on lease^[20].

Production of Makhana

A study on scientific methods of makhana cultivation revealed that using the scientific method of cultivation like raising seedlings, proper fencing, transplanting, and proper weed management helps in increasing productivity as well as increased revenue^{[7][9][21]}. Fencing is necessary to protect crops from floods. Makhana is grown in water bodies and the use of chemicals is negligible. Farmers being marginal and landless do not have access to money so role of financial institutions is necessary to provide credit facilities to growers^[20].

Makhana is generally sown in December and harvested in the month of August in the Morning hours. Post-harvest handling like drying, roasting and proper storage was necessary for good pop yield^{[13] [11] [21]}. Several diseases and pest infestation are occurred while cultivation makhana and A study^[10] found that due to various diseases and pest infestation the crop yield was reduced by 25-30 percent Aphids, Case worms and root borers were major insects whereas main disease was leaf blight caused by *Alternaria tenuis*. Excessive uses of chemicals needs to be avoided as it can lead to leaching.

Makhana is propagated by seed only and has rhizomatous roots which means chemical nutrient demand is very low. 80-90 kg seed is required in pond system in the direct sowing while 20 kg seed is required in transplanting in the field system of cultivation per hectare. Transplanting is done from the first week of February to last week of April. Harvesting was done in August in the morning time till 11 Am. The yield was 12-15 quintal in the pond system and 22-30 quintals in field system per hectare^{[6] [11]}. A study on integrated farming with makhana found that the integration of makhana with paddy, water chestnut as well as fisheries can increase the income of farmers^[9].

Constraints faced by growers

There are different faced by grower while cultivation makhana. A study on constraints revealed that there are various constraints faced by farmers in the production, processing and marketing of makhana^[2]. The most important production constraint was lack of ownership of land followed by labor-intensive cultivation, lack of improved varieties & lack of scientific knowledge. Lack of credit was a constraint in all production, processing as well as marketing. Other production and processing constraints were lack of types of machinery, Climate dependency and lack of transportation as well as price fluctuation in the market. High input cost was major economic constraint whereas the absence of post-harvest technology was a major technical constraint. The absence of government policy was also a major constraint in the production of makhana^[5]. Breathing time, as well as muddy eyes problem, was faced by farmers while cultivating as well as harvesting. Farmers face discomfort while going down the pond every time thus reducing efficiency of work^[4].

Marketing and Value Chain of Makhana

A study conducted by^[14] revealed that most men were involved in washing, sun drying and popping of makhana while women were mostly engaged in grading and roasting of seeds. The average pop recovery was 40-45 percent. A study on different marketing channels of makhana^{[19][23]} highlighted three different marketing channels which was **Channel-I:** Farmer → Local Aggregator/ commission agent → Processor → local wholesaler → Distant Wholesaler → Retailer → Consumer. **Channel-II:** Farmer → Processor → local wholesaler → Distant Wholesaler → Retailer → Consumer. **Channel-III:** Farmer-cum-Processor → local wholesaler → Distant Wholesaler → Retailer → Consumer. Marketable surplus was 98 percent while marketed surplus was found to be 97 percent of produce. After 2004 the percentage of branded makhana sold by wholesalers increased from 27 percent to 45 percent^[12]. No information about the packing and branding of makhana was available to farmers which caused them to fetch low price.

Processing includes the maximum percentage in the value chain (48.6%) followed by commission agent and loading and unloading charges. Different value-added products of makhana includes makhana kheer and makhana powder. Farmers share in price of consumer was around 40 percent. USA is major destination of value-added products of makhana. It's price in distant market was 60-70 percent of local market^[19]. Value addition could be done in the form of place utility using transportation, time utility using storage and form utility using post-harvest processing^[18].

Conclusion

The study was conducted to review the research articles on makhana from year 2010-2022. It was concluded that the majority of farmers were not getting the remunerative price of the produce. Also middlemen enjoy the majority of share in the consumer's price. Most of makhana growers were small and marginal farmers and some were landless labourers also who takes land on lease to cultivate makhana. It was also concluded that the majority of machined growers do not follow the scientific method of cultivation as well as inter-cropping with other crops like rice, water chestnut as well as fisheries which leads to less return from cultivation. To enhance profitability from makhana, its consumption, value addition, and export must be promoted. The government must help the willing makhana farmers in proper marketing, value addition as well as

exporting their produce by the formation of the Farmer Producer Company. This will not only earn the country handsome foreign exchange but also improve the socio-economic conditions of resource-poor farmers involved in cultivation.

Scope for future research

It is clear from the study that makhana cultivation has a huge potential in the upcoming years as the world is moving more towards nutritional security. It is having high demand in many countries and since India has nearly 95 percent of total world production provides an opportunity for researchers to find ways to increase productivity as well as market demand so that the cultivators and other players involved in it can get maximum benefit. Various studies has been conducted regarding scientific cultivation methods but still, there is scope for future study in the same field. Lastly, it can be suggested that makhana cultivation is mainly confined to eastern India, especially Bihar. So, there is a need for research to expand its cultivation to various parts of India.

Table 1: Distribution of Research Articles

S. No.	Author(s) & Year	Region
01.	Singh & Jain (2010) ^[22]	North-eastern India
02.	Mintern, Singh & Sutradhar (2010) ^[12]	Bihar
03.	Kumar <i>et al.</i> (2011) ^[6]	Eastern India
04.	Khadatkar & Gite (2015) ^[4]	Eastern India
05.	Mahawar (2016) ^[11]	Eastern India
06.	Kumar & Bhatt (2016) ^[9]	Delhi
07.	Yadav <i>et al.</i> (2016) ^[23]	Bihar
08.	Singh <i>et al.</i> (2018) ^[21]	Bihar
09.	Patil Shridhar (2019) ^[15]	Bihar
10.	Ahmad & Kumar (2020) ^[1]	Bihar
11.	Patil <i>et al.</i> (2020) ^[14]	Bihar
12.	Ahmad (2020) ^[2]	Bihar
13.	Kumar (2020) ^[7]	Bihar
14.	Kumar <i>et al.</i> (2020) ^[8]	Eastern India
15.	Singh <i>et al.</i> (2021) ^[20]	Bihar
16.	Sharma & Ahmad (2020) ^[17]	Bihar
17.	Kumar, Singh & Kumari (2021) ^[5]	Bihar
18.	Singh <i>et al.</i> (2021) ^[18]	Bihar
19.	Mir & Perveen (2021) ^[13]	Eastern India
20.	Kumar, Kumar & Ramya (2021) ^[10]	Eastern India
21.	Singh <i>et al.</i> (2021) ^[19]	Eastern India

Figure 1 shows the reviewed articles state wise which indicates that maximum research has been conducted in Bihar (12) and eastern states of India (07).



Figure 1: Distribution of Research Articles State Wise

Figure 2 shows the graphical representation of the reviewed paper year-wise. It can be seen that the maximum number of studies conducted in the year 2020 and 2021 which is (06) followed by the year 2016 (03). This graph will help to understand the trend related to interest of researchers in study of makhana.

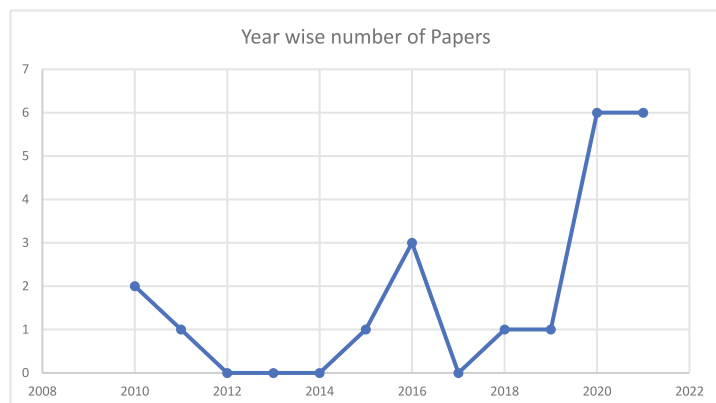


Figure 2: Distribution of number of articles on basis of year of publication

Figure 3 shows the work done by researchers on different aspects of makhana cultivation. It can be observed that maximum work has been done in production (10) followed by value chain (05) and economics of production (04).

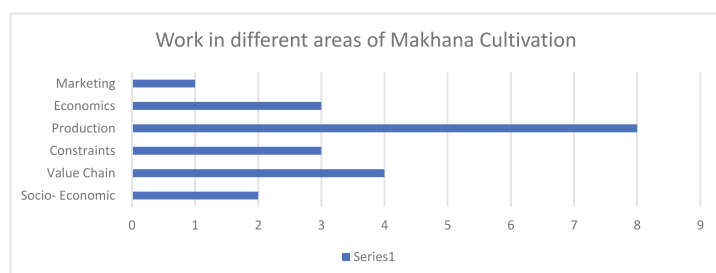


Figure 3: Work done in different areas of makhana cultivation in India

References

- Ahmad, A., & Kumar, B. (2020). A study on socio-economic condition of farmers cultivating makhana in Darbhanga district of Bihar, India. *International Journal of Current Microbiology and Applied Sciences*, 9(2), 1318-1325.
- Ahmad, A. (2020). A study on constraints of makhana cultivation and suitable measures for its better development. *Journal of Pharmacognosy and Phytochemistry*, 9(1), 984-987.
- Kabir, S. M. S. (2016). *Basic Guidelines of Research: An introductory Approach for All Disciplines*. Book Zone Publication, ISBN: 978-984-33-9565-8, Chittagong-4203, Bangladesh.
- Khadatkar, A., & Gite, L. P. (2015). Interventions to reduce drudgery of workers in the traditional method of harvesting makhana (*Euryale ferox salisb.*) seeds from ponds. *Current Science*, 109(07), 1332-1337.
- Kumar, A., Singh, A. K., & Kumari, S. (2021). Constraints faced by makhana growers of Madhubani district and suggestion to eliminate them. *Indian Journal on Extension Education*, 56(3), 177-180.
- Kumar, L., Singh, I. S., Jha, B. K. & Singh, A. K. (2011). Status of Makhana Cultivation in India. India. ICAR- Research Complex for Eastern Region, 1-31.
- Kumar, M. (2020). Makhana triumphs over flood: A success story from Darbhanga, Bihar. *Biotica International*, 2(11), 1113-1116.
- Kumar, M., Bhatt, B. P., Raut, S. M. & Kumar, L. (2020). Scientific Cultivation of Makhana for Improving Farmers' Livelihood in Eastern India. India. *Biotica International*, 2(7), 670-672.
- Kumar, M., & Bhatt, B. P. (2016). Integrated farming system: A tool for agricultural sustainability and enhancement in livelihood security for Small and marginal farmers. Agriculture Technology Application. Narendra Publishing House.
- Kumar, M., Kumar, P. V., & Ramya, N. (2021). Plant Health Issues in Fox Nut/ Makhana (*Euryale ferox*): An Agronomic Perspective. *Journal of Plant Health Issues*, 2(1), 30-35.
- Mahawar, H. K. (2016). A report on makhana (Foxnut) production, processing and supply chain. India. 1-26.
- Mintern, B., Singh, K. M., & Sutradhar, R. (2010). The makhana value chain and the fast emergence of branding in food retail: Evidence from Bihar (India), India. ICAR. 1-33.
- Mir, H., & Perveen, N. (2021). Makhana: The wetland wonder, India. *Indian Horticulture*. 28-29.
- Patil, S., Lata, S., Kumar, S., & Roy, S. (2020). Processing of makhana and value chain financing in Bihar, India. *International Journal of Current Microbiology and Applied Sciences*, 9(5), 1322-1326.
- Patli, S., (2019). Economics of makhana production and socio-economic profile of makhana growers in Bihar, India. *Current Journal of Applied Science and Technology*, 8(28), 89-92. 10.9734/cjast/2019/v38i630396
- Rhoades, E. (2011). Literature reviews. *The Volta review*, 111(1), 61-71.
- Sharma, A., & Ahmad, N. (2020). Economic analysis of makhana cultivation in Darbhanga and Madhubani districts of Bihar. *International Journal of Current Microbiology and Applied Sciences*, 9(4), 1097-1102
- Singh, D. K., Kumar, A., Kumar, U., & Raman, R. K. (2021). A study on value addition in makhana for enhancing farmers income (Hindi), India. *Fasal Kranti*, 8(4), 44-45.
- Singh, D. S., Kumar, A., Singh, I. S., Kumar, U., Chandra, N., & Bhatt, B. P. (2021). Value chain analysis of makhana, India. *ICAR- Research Complex for Eastern Region*. 1-24.
- Singh, D., Kumar, U., Kumar, A., & Singh, I. S. (2021). Production and profitability of makhana (*Euryale Ferox Salisb.*) in aquatic ecosystem of North Bihar. *Indian Journal on Extension Education*, 57(2), 62-66. 10.5958/2454-552X.2021.00056.6.

21. Singh, D., Kumar, U., Singh, I. S., & Kumar, A. (2018). Traditional wisdom of mallah community regarding makhana production and processing in North Bihar. India. *Indian Journal of Extension Education*, 54(02), 76-82.
22. Singh, H. B., & Jain, A. (2010). Economics of foxnut (*Euryale ferox Salisb.*) cultivation: A case study from Manipur in northeast India. *Indian Journal of Natural Products and Resources*, 1(1), 63-67.
23. Yadav, P. K., Kumar, A., Nath, P., Nath, S., & Kumari, U. (2016). Marketing and branding of fox nut as high value crops in abroad from Bihar (India): A review. *International Journal of Advances in Agricultural Science and Technology*, 3(2), 16-20.

Web References

24. Market Intelligence Report: Makhana. APEDA, Retrieved from <https://agriexchange.apeda.gov.in>, 2019
25. Production of Makhana. Retrieved from <https://makhana.org>, 2023
26. 12 Proven Health Benefits Of Makhana (Fox Nuts). Retrieved from <https://pharomeasy.in>, 2023