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Research Article

Constraints encountered by Makhana-cum-fish culturist in adoption of improved practices

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Abstract

The adoption of improved fish and Makhana culture practices is an important factor in the sustainable production of fish and Makhana in India. However, the adoption of improved practices is often hindered by various constraints encountered by fish and Makhana farmers. This paper explores the constraints encountered by Makhana-cum-fish culturists in the adoption of improved practices. Qualitative data were collected from 180 randomly selected Makhana-cum-fish culturists in the Katihar district of Bihar, India, through a semi-structured interview schedule. The data were processed using the rank-based quotient (RBQ) method. The result of the study indicated that the main constraints encountered by the respondents in adopting improved practices include a lack of processing machinery and equipment (RBQ: 91.21), followed by getting lower price for their produce (RBQ: 87.31), a high cost of cultivation and less labour availability (RBQ: 81.53), and a high cost of input materials and labour (RBQ: 81.42). The findings of this study provide valuable insights into the challenges faced by the respondents in adopting improved practices and can be used to inform policymakers so that they can plan a programme in a realistic way. Furthermore, farmers also gave some suggestions for improving Makhana-cum-fish production, such as the government providing processing facilities and strengthening market infrastructure so that farmers can get a remunerative price for the produce.

Keywords: Constraints, Improved practice, Makhana-cum-fish farming, Sustainable production

Highlights

- Key constraints in adopting improved Makhana-cum-fish culture practices include a lack of processing machinery (RBQ: 91.21), low produce prices (RBQ: 87.31), high costs and limited labour (RBQ: 81.53), and high input costs (RBQ: 81.42).
- Research suggests enhancing market infrastructure, providing processing facilities, and offering financial support to improve practice adoption.
- Policymakers should focus on improving access to training, affordable inputs, and rural infrastructure to support sustainable development in the sector.

INTRODUCTION

Makhana-cum-fish culture is an innovative way of farming that combines the cultivation of Makhana (*Euryale ferox*) with fish and is an essential part of the agricultural system in India. This system of farming is a relatively new concept that combines the cultivation of two crops in the same space based on the principles of intercropping and utilises water resources more efficiently. It has the potential to improve the productivity of both crops while minimising the environmental impact of traditional monoculture farming. In this system, Makhana plants are grown in the water, and fish are reared in the same space. The combination of these two activities provides a sustainable and profitable agricultural practice. An integrated culture of airbreathing, predatory, and carnivorous fishes is the best practice to harness the potentialities of such derelict wetlands (Verma *et al*., 1996). Fish contribute to the control of Makhana pests, and their faeces act as an organic manure for the Makhana crop (Verma *et al*., 2008). It is a cash crop and is marketed in the form of popped Makhana, commonly known as Makhana Lawa. In India, the cultivation of Makhana is distributed in Bihar, West Bengal, Assam, Manipur, Tripura, Eastern Odisha, Madhya Pradesh and Eastern Uttar Pradesh. Makhana is grown in an area of almost 15,000 ha in Bihar, which produces nearly 10,000 metric tonnes of popped Makhana (ICAR, 2019). Despite its wide adoption, the farmers who practice Makhana-cum-fish culture faced several constraints in their efforts to adopt improved practices. Keeping these facts in mind, a study was conducted to identify various

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constraints encountered by Makhana-cum-fish culturists in adopting improved practices and suggest strategies to overcome these challenges.

MATERIALS AND METHODS

The research methodology used in this paper is a qualitative approach to explore the constraints encountered by the respondents in adoption of improved practices. The present study was conducted in the Katihar district of Bihar. A list of all four major Makhana-producing blocks was prepared, and four blocks, namely Barari, Pranpur, Kadwa, and Manihari of Katihar district, were purposely selected for the study, as Makhana has always been the major crop of the district. A list of all the villages practising the Makhana crop in the selected block was prepared, and out of this list, 12 villages were selected by random sampling: Raunia, North Bhandartal, South Bhandartal, Panki, Dharahan, Bastaul, Nijhara, Sikorna, Jaja, Bolia, Nababganj, and Kumaripur. The list of Makhana cultivators from all the selected villages was prepared with the help of Kisan Salahkar. Thus, 180 farmers were constituted as samples for the present study by simple random sampling without replacement techniques from these 12 villages. A semi-structured interview schedule was employed to collect the primary data from the respondents in the study area. The tabular analysis was done by using suitable statistical tools and the rank-based quotient (RBQ) method to draw a definite conclusion.

RESULTS

Technical constraints

The results, along with the constraints encountered by the respondents in the adoption of improved Makhana-cum-fish culture practice were categorised and presented. Table 1 depicts the technical constraints encountered by the respondents in the study area, which were selected through six statements.

Lack of processing machinery, equipment, and skilled labour (RBQ: 91.21): The first-ranked constraint is associated with technical constraints because, till now, Makhana processing has been a labour-intensive process that requires many steps and a lot of manual labour. It was seen in the study area that there were fewer uses of processing machinery and equipment. The process involves soaking the Makhana in water, grinding, sieving, tempering, drying, and sorting. All of these steps take a significant amount of time and manual labour, making Makhana processing a difficult task. The result is in agreement with the findings of Ahmad (2020), Atal *et al*. (2020) and Kumar *et al*. (2020).

High cost of cultivation and less labour availability (RBQ: 81.53): The high cost of cultivation and lack of labour availability in Makhana-cum-fish farming had a negative impact on the production of Makhana and fish. The high cost of inputs and the large number of labourers required, particularly during harvesting, results in lower yields and lower profits for farmers. It also leads to higher prices for the consumer, making it less attractive for them to purchase the produce. Additionally, the lack of labour availability leads to inefficient production and harvesting practices, which further affect yields and profits. The findings are in line with the results of Khadatkar *et al*. (2015), Kumar *et al*. (2020) and Uddin *et al*. (2021).

Inadequate infrastructure and resources (RBQ: 76.12): In the study area, farmers possessed less land and limited capital, as Makhana-cum-fish farming requires adequate infrastructure and resources such as land, water, and access to markets in order to be successful. It was difficult for farmers to produce quality crops and fish, as well as market their products. Inadequate infrastructure and resources also limit the quantity of fish that can be produced and lead to a decrease in overall profits. Limited resources also make it harder for farmers to access the latest technology and techniques, which reduces their productivity and profitability.

Lack of access to quality inputs (RBQ: 72.34): This is due to the fact that these inputs are often expensive and difficult to obtain. Furthermore, these inputs are often in short supply as they are not always readily

Table 1. Technical constraints

Sl. No.	Statements	RBQ value	Rank
1	Lack of processing machinery, equipment, and skilled labour	91.21	I
2	Inadequate technical support	64.82	V
3	High cost of cultivation and less labour availability	81.53	II
4	Lack of technical and scientific knowledge and awareness	52.15	VI
5	Lack of access to quality inputs	72.34	IV
6	Inadequate infrastructure and resources	76.12	III

Table 2. Marketing constraints

Sl. No.	Statements	RBQ value	Rank
1	High price fluctuations of produce	61.52	IV
2	Getting less selling price for the produce	87.31	I
3	Lack of access to market channels and involvement of middlemen	79.16	II
4	High cost of transportation	67.21	III

available in the markets. The lack of quality inputs has a significant impact on the farming of both crops. The findings of the economic constraints are in consonance with the findings of Kumar *et al*. (2011), Khadatkar *et al*. (2015) and Ahmad (2020).

Inadequate technical support (RBQ: 64.82): The lack of technical support leads to inefficient and low-yielding production, resulting in low incomes and a poor standard of living. This is further exacerbated by the lack of access to credit facilities and markets. Makhana-cum-fish farmers faced the problem of inadequate technical support due to a lack of access to the necessary resources and knowledge. Many of these farmers are not well-versed in the latest farming techniques, and as a result, they are unable to maximise their production.

Lack of technical and scientific knowledge and awareness (RBQ: 52.15): Makhana-cum-fish farmers are facing a severe lack of technical and scientific knowledge and awareness. This lack of knowledge and awareness is having a major impact on the farmers' ability to make informed decisions about their production and management practices. Without the knowledge and awareness of such changes, these farmers were not able to adapt their farming practices to the changing environmental conditions. This lack of adaptation to changing environmental conditions could lead to reduced yields and productivity. A similar result was also reported by Kumari *et al*. (2016) and Khadatkar *et al*. (2020).

Marketing constraints

Makhana-cum-fish farmers faced a variety of marketing-related constraints like lower selling prices for the produce, price fluctuations of produce, etc. Table 2 depicts the marketing constraints encountered by the respondents in the study area.

Getting less selling price for the produce (RBQ: 87.31): The main marketing constraint of Makhana-cum-fish farming was the lower selling price for the produce. The cost of production is higher due to the cost of fish feed and the labour required to manage the farm. This leads to lower profits for the farmer and makes it difficult to sustain the business. Furthermore, the cost of inputs such as feed and equipment may also be higher due to the constraints, which add to the cost of production and reduce profit margins. The result is in consonance with the findings of Ahmad (2020).

Lack of access to market channels and involvement of middlemen (RBQ: 79.16): The lack of access to market channels and the involvement of middlemen had a major negative impact on Makhana-cum-fish farming. Without access to the right markets, farmers are not able to sell their produce at a fair price or find enough buyers. Furthermore, middlemen take a large portion of the profits, leaving farmers with less money than they should receive. This makes it difficult for farmers to continue their farming practices and make a profit. A similar report was also given by Pandey (2009).

High cost of transportation (RBQ: 67.21) and price fluctuations of produce (RBQ: 61.52): The high cost of transportation and price fluctuations of produce negatively affect Makhana-cum-fish farming in a number of ways. Transportation costs increase the cost of inputs, such as feed and seed, for the farm. Price fluctuations also cause income instability for the farmer, as prices can be unpredictable and volatile. This makes it difficult to plan and budget for the farm and can reduce profits. Additionally, price fluctuations make it difficult to determine the best time to harvest crops and can lead to losses if crops are harvested at the wrong time. The result is in line with the findings of Nandi *et al*. (2014) and Ahmad (2020).

Table 3. Economic constraints

Sl. No.	Statements	RBQ value	Rank
1	The high interest rate of local money lender	73.51	II
2	High cost of input materials and labour	81.42	I
3	Lack of support from the government and proper government price policy	62.72	III
4	Bank loans are hard to obtain	58.35	IV

Economic constraints

Economic-related constraints faced by the respondents include lack of access to capital, high cost of inputs, and lack of support from the government and proper government price policy. Table 3 depicts the

economic constraints encountered by the respondents in the study area.

High cost of input materials and labour (RBQ: 81.42): Makhana-cum-fish farming requires a considerable amount of investment in terms of input materials and labour. The high cost of these inputs results in a decrease in profitability and makes it difficult for farmers to sustain their operations. Additionally, the high cost of labour causes a shortage of skilled workers, which further affects the productivity and quality of farming. In the long run, this could lead to lower yields and ultimately decreased profits. A similar result was found by Pandey (2009), Atal *et al*. (2020) and Khadatkar *et al*. (2020).

The high-interest rate of local money lenders (RBQ: 73.51): The high interest rate of local money lenders has a negative effect on Makhana-cum-fish farming as it will increase the cost of borrowing money, which will limit the ability of farmers to invest in necessary inputs such as quality Makhana and fish seed, fertilizers, and modern farming equipment. Also, high interest rates lead to high levels of debt and reduce farmers' profit margins.

Lack of support from the government and proper government price policy (RBQ: 62.72): The lack of government support and proper government pricing policies also affects Makhana-cum-fish farming negatively. Farmers may be unable to access the necessary resources and technology to successfully pursue Makhana-cum-fish farming, as well as proper market access for their products, if the appropriate policies are not in place. Additionally, without adequate pricing policies, farmers may not be able to make a reasonable profit from their efforts, leading to a lack of motivation and potentially even to the abandonment of the practice altogether.

Bank loans are hard to obtain (RBQ: 58.35): The Makhana-cum-fish farmers face difficulty in accessing bank loans individually due to several factors like lack of collateral, no credit history, low financial literacy, bureaucratic processes and limited rural banking services.

Social and extension service-related constraints

Social and extension service-related constraints faced by Makhana-cum-fish farmers refer to the various challenges they face in terms of accessing reliable sources of extension services, resources, and networks that can help them with their production and management of Makhana and fish. Table 4 depicts the social and extension service-related constraints encountered by the respondents in the study area.

Table 4. Social and extension service-related constraints

Sl. No.	Statements	RBQ value	Rank
1	Poaching and poisoning	69.21	I
2	Lack of adequate extension support system	57.29	II
3	Lack of cooperation from family members and social stigma	48.64	III

Poaching and poisoning (RBQ: 69.21): Poaching of fish or Makhana leads to a decrease in the population of both, resulting in a lower yield of Makhana and fish. Additionally, poisoning also leads to a decrease in the population and a decrease in yield. This resulted in financial losses for the farmers as well as a negative impact on the environment. The result is in consonance with the findings of Pandey *et al*. (2014).

Lack of adequate extension support system ((RBQ: 57.29): Makhana-cum-fish farming is a complex process that requires knowledge and expertise from both the fish and Makhana farming disciplines. Without adequate extension support systems, farmers struggle to access the necessary information and resources to optimise their production. This led to lower yields, reduced quality of the final product, and a lack of economic benefits. Additionally, without access to proper advice, farmers may make costly mistakes in their farming practices, leading to further losses. Without adequate capital and technical know-how, farmers may not be able to scale up their operations or take advantage of new opportunities. The result is similar to the findings of Adebayo (2012) and Pandey *et al*. (2014).

Lack of cooperation from family members and social stigma (RBQ: 48.64): It led to a lack of commitment and motivation to invest in the business, resulting in reduced productivity and profitability. Moreover, the social stigma associated with this type of farming leads to a lack of acceptance among local communities, which in turn leads to reduced demand for the product and, thus, lower profits.

Table 5. Overall top-rated constraints faced by the respondents

Sl. No.	Statements	RBQ value	Rank
1	Lack of processing machinery, equipment, and skilled labour	91.21	I
2	Getting less selling price for the produce	87.31	II
3	High cost of cultivation and less labour availability	81.53	III
4	High cost of input materials and labour	81.42	IV
5	Lack of access to market channels and involvement of middlemen	79.16	V
6	Inadequate infrastructure and resources	76.12	VI

DISCUSSION

Technical constraints: Addressing the technical constraints faced by Makhana-cum-fish culturists and enhancing the adoption of improved practices require a holistic and comprehensive approach. Collaboration among policymakers, researchers, agricultural experts, and stakeholders is crucial. This approach involves investing in processing infrastructure, providing technical support, reducing costs, promoting knowledge dissemination, ensuring access to quality inputs, and improving rural infrastructure. These measures contribute to the growth and sustainability of the sector, improve farmers' livelihoods, and foster overall agricultural development. By empowering farmers to overcome these challenges, productivity and overall sustainability can be enhanced.

Marketing constraints: Addressing the marketing constraints faced by Makhana-cum-fish farmers is essential for their economic prosperity and market competitiveness. These constraints hinder their ability to sell their produce effectively and obtain fair prices. To overcome these challenges, a comprehensive approach is needed, including the dissemination of market information, implementing price stabilisation mechanisms, establishing direct market linkages, reducing the involvement of intermediaries, and investing in infrastructure development. By creating a favourable marketing environment, Makhana-cum-fish cultivators can secure fair prices, access better market channels, and enhance their overall profitability and sustainability.

Economic constraints: Collaborative efforts from policymakers, financial institutions, and stakeholders are necessary to address the economic constraints faced by Makhana-cum-fish farmers. Actions such as reducing borrowing costs, promoting cost-effective inputs, enhancing government support, and simplifying loan processes are essential. By addressing these constraints, Makhana-cum-fish farmers can improve their economic stability, viability, and sustainability. Prioritising these interventions is crucial for supporting sector growth, ensuring farmers' livelihoods, and fostering a thriving agricultural ecosystem.

Social and extension service-related constraints: Addressing social and extension service-related constraints is crucial for the successful adoption of improved practices in Makhana-cum-fish culture. Promoting social acceptance, strengthening extension services, providing training and capacity building, and facilitating farmer-to-farmer interactions are key strategies to overcome these constraints and drive sector growth and sustainability. The involvement of communities, agricultural institutions, and stakeholders is essential for the effective implementation of these interventions and for supporting the development of Makhana-cum-fish culturists.

Suggestive measures: During data collection, the researcher asked the respondents to give a few suggestions for improving the adoption of Makhana-cum-fish culture practices. They gave the first suggestion that the government should provide financial assistance to the farmers at the right time so that they can adopt the practice properly, followed by a remunerative price for the produce, irrigation facilities that should be developed, and smoothing of credit facilities. Suggestive measures were studied and presented in Table 6.

Table 6. Suggestive measures for improving Makhana-cum-fish farming

Sl. No.	Suggestive measures	Frequency (Nos.)	Percentage (%)	Rank
1	The government should provide processing facilities to process the Makhana	165	91.66	1st

Cont. Table 6.

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Sl. No.	Suggestive measures	Frequency (Nos.)	Percentage (%)	Rank
2	There is a need to strengthen market infrastructure so that farmers get remunerative prices for the produce	150	83.33	2nd
3	As the cost of cultivation is increasing day by day and Makhana cultivation is labour-intensive, the government should provide a minimum support price for their produce	135	75.0	3rd
4	There is a need for infrastructure for proper transportation so that products can be transported to the desired location	130	72.23	4th
5	Banks should disburse loans at the right time, and transactions should be smooth	103	57.22	5th
6	Availability of quality inputs should be provided at a subsidised rate to the farmers so that they can run their businesses smoothly	98	54.44	6th
7	Poaching and poisoning threaten biodiversity, so concerted educational efforts are needed to encourage the farmers to refrain from poaching	93	51.67	7th
8	Irrigation facilities should be developed to irrigate fields/ponds for Makhana production	85	47.22	8th
9	The government should provide proper facilities for disease diagnosis at the right time at the farmer's door	81	45.0	9th
10	Organizing need-based and proper training programs and providing technical guidance on scientific Makhana and fish culture	75	41.66	10th
11	The extension system should be strengthened	71	39.44	11th
12	Common ponds and canals should be allotted to the co-operative	68	37.77	12th

In conclusion, the research paper sheds light on the constraints encountered by Makhana-cum-fish culturists in the adoption of improved practices. The findings provide valuable insights into the challenges faced by these farmers and highlight the need for targeted interventions and support to enhance the adoption of improved practices in this sector. The major constraints identified by the study include a need for more processing machinery and equipment, a high cost of input materials and labour, limited access to markets, lower prices for their produce, and inadequate infrastructure and resources. To address these constraints, policymakers, researchers, and stakeholders need to collaborate and devise comprehensive strategies. These strategies should focus on improving access to information and training, enhancing the availability and affordability of inputs, strengthening rural infrastructure, and facilitating market linkages. Additionally, financial incentives and subsidies can be introduced to incentivize the adoption of improved practices and alleviate the financial burden on Makhana-cum-fish culturists. By addressing these constraints and providing the necessary support, the agriculture sector can achieve higher productivity, increased income for farmers, and sustainable development.

Conflict of interest: The authors declared that they have no conflict of interest.

Author's contributions: NK, SSD, AHM: Conceptualization and designing of the research work; NK: Execution of field/lab experiments and data collection; AHM, SS: Analysis of data and interpretation; AHM, MRS, SS, NH: Preparation of manuscript.

Data availability statement: Raw data of this study are available from the corresponding author.

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