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Profile characteristics of cultivators of two major makhana ecosystems in Katihar District of Bihar State

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Abstract

The present study was conducted in Kadwa and Korha block of Katihar district of Bihar state to study the profile characteristics of the cultivators of two major makhana ecosystems *viz.*, makhana as sole crop and makhana with fish. A total of 120 respondents (60 from each ecosystem) were randomly selected for the study. Ex-post-facto research design was used for the present study. It was found that in both the ecosystems, most of the respondents were middle aged, educated up to middle school, had 5 to 7 members in the family, medium role of family members in makhana farming, marginal land under makhana cultivation, medium input usage, medium participation in farmers' group, medium source of information, no credit availed, high application of ICT tools, no trainings received, no processing and value addition done, medium market accessibility, no avilment of government support and subsidies, low implements and machinery possessed, medium perceived drudgery and net returns between 1-2 lakh (46.67%).

Keywords: Ex-post facto, makhana cultivation, role of family member, processing and value addition, ICT tools, market accessibility

1. Introduction

Makhana (*Euryale ferox*) also known as Fox Nut, Gorgon Nut or Black Diamond (Sundaram *et al.* 2014) ^[13], is a unique, nutritious non-cereal aquatic crop native to South-East Asia, including countries like China, Japan, Korea, and India. In India, while it's found in multiple states, commercial cultivation predominantly occurs in Bihar, Manipur, parts of West Bengal, and Madhya Pradesh. Bihar alone accounts for over 85 percent of global makhana production, particularly in districts like Darbhanga, Madhubani, Saharsa, Katihar, Purnea, Supaul, Kishanganj, Araria and Sitamadhi. Its cultivation follows two systems. In ponds, it is planted in December and harvested in September after 9-10 months. In fields, seeds are sown in December and transplanted between February to April, ready for harvest by August. The global makhana market is growing, with a predicted CAGR of 7 percent from 2019 to 2023. Major importers are the US, Canada, and Australia, while India leads in exports, followed by China and Hong Kong. Between 2012 and 2022, the cultivation area in India surged by 171 percent from approximate 13000 ha in to 35224 ha, and popped makhana production rose by 152 percent from approximate 9360 tonnes to 23,656 tonnes (DOH, 2022). In recognition of its importance, Mithila Makhana received a Geographical Indication (GI) tag in August, 2022. As demand rises, insights into makhana cultivators and ecosystems become crucial for guiding related initiatives.

2. Materials and Methods

The study was carried out in the year 2023 in Bihar state. Ex-post facto research design was employed. Katihar district was selected purposively as it has the highest area under makhana cultivation. A total of two blocks having largest area under makhana cultivation *viz.*, Korha and Kadwa were selected purposively for the study. From each block, from the list of villages having 2 selected ecosystems *viz.*, makhana as sole crop and makhana with fish, two villages were selected randomly, thus making a total sample of four villages.

The villages selected were Basgarha and Pawai (From Korha block), Kumhari and Sonaili (From Kadwa block). 15 makhana cultivators were selected randomly from each village from each of the 2 major ecosystems i.e. makhana as sole crop and makhana with fish making a sample of 60 from makhana as sole crop ecosystem and 60 from makhana with fish ecosystem to make a total of 120 makhana cultivators. Data were collected from the respondents using pre-tested interview schedule by personal interview method and were coded and tabulated for statistical analysis.

3. Results and Discussion

3.1 Age: The data in Table 1 revealed that more than half (51.67%) of the respondents in makhana as sole crop ecosystem were categorized into middle age group, followed by young age (25.00%) and old age (23.33%) categories. With respect to makhana with fish ecosystem the more than half (53.33%) of the respondents were middle age, followed by young age (30.00%) and old age (16.67%) categories. The probable reason for majority of respondents falling under middle age category might be that young farmers in that area have less interest in farming as they were more interested in non-agricultural practices like business, owning stores and private enterprises because of low profitability and more drudgery involved in farm works. Also old farmers were moving away from farming by leasing out their land to other farmers. These findings were similar to the findings of Kumar *et al.* (2015) [6].

3.2 Education: From the Table 1 it was evident that most of the respondents (28.33%) of makhana as sole crop ecosystem were educated up to middle school, followed by primary school (26.67%), higher secondary school (13.33%), high school (10.00%), graduation (8.33%), illiterate (6.67%) and post-graduation and above (6.67%) categories. Whereas in case of makhana with fish ecosystem, most of the respondents (25.00%) were educated up to middle school, followed by primary school (20.00%), high school (16.67%), illiterate (15.00%), higher secondary school (10.00%), graduation (10.00%) and post-graduation and above (3.33%) categories. The probable reason could be that it helped farmers to open and enlighten their mind to seek knowledge and adoption of better methods of farming and production technologies conversant with farming needs of changing world. This is in conformity with the results of Mathuabirami and Kalaivani (2021) [8].

3.3 Family size: An overview of Table 1 portrayed that most of the respondents (45.00%) of makhana as sole crop ecosystem had 5 to 7 members in their family, followed by 3 to 5 members (40.00%) and 7 to 9 members (15.00%). Whereas, in case of makhana with fish ecosystem, more than half of the respondents (51.67%) had 5 to 7 members in their family, followed by 3 to 5 members (35.00%) and 7 to 9 members (13.33%). These findings were similar to the findings of Dechamma *et al.* (2020) [2].

3.4 Role of family members in makhana farming: The result shown in the Table 1 revealed that more than half (53.33%) of the respondents of makhana as sole crop ecosystem had medium role of family members in makhana farming, followed by low (31.67%) and high (15.00%). Whereas in case of makhana with fish ecosystem, majority (61.67%) of the respondents had medium role of family members in makhana farming, followed by low (30.00%) and

high (8.33%). This could be because of the fact that family members were majorly involved in few activities such as insect/pest and disease management, fertilizer application, irrigation and marketing in makhana as sole crop ecosystem whereas in makhana with fish ecosystem, they were majorly involved in cleaning the pond, marketing of makhana, introduction of fingerlings, feeding, separating and grading and marketing of fish. Other operations were mostly done by hired labour. This is in conformity with the results of Shimran and Choudhary (2021) [12].

3.5 Area under makhana cultivation: From the given Table 1, it is clear that more than half (56.67%) of the respondents of makhana as sole crop ecosystem had marginal area under makhana cultivation, followed by small (35.00%) and semi medium (5.00%). Whereas in case of makhana with fish ecosystem, majority (65.00%) of the respondents had marginal area under makhana cultivation, followed by small (28.33%) and semi medium (6.67%). It might be due to farm land fragmentation and subdivision from one generation to another. The average size of land holding in the state is only 0.224 hectares, which is one of the lowest land holding size among other states of India. This is in conformity with the results of Prashanthi and Ashokan (2022) [9].

3.6 Input usage: It could be indicated from Table 1 that more than two-third (65.00%) of the respondents of makhana as sole crop ecosystem had medium input usage, followed by high (23.33%) and low (11.67%). Whereas in case of makhana with fish ecosystem, more than half (51.67%) of the respondents had medium input usage, followed by low (31.67%) and high (16.66%). The variation in input usage arised because in makhana with fish ecosystem, the inputs such as fertilizers and chemical pesticides were used less by most of the farmers as they followed traditional cultivation system and the chemical pesticides were harmful for the fishes whereas in makhana as sole crop fertilizers and chemical pesticides were used by most of the farmers to increase the production and reduce the losses caused by insects, diseases or weeds as it was grown as a sole crop. These findings were similar to the findings of Shamna (2014) [11].

3.7 Participation in farmers' group: The result shown in the Table 1 revealed that more than two-third (65.00%) of the respondents of makhana as sole crop ecosystem had medium participation in farmers' group, followed by low (20.00%) and high (15.00%). Whereas in case of makhana with fish ecosystem, than half (56.67%) of the respondents had medium participation in farmers' group, followed by high (23.33%) and low (20.00%). The farmers' groups available for respondents of both the ecosystems were same though some variations arised as the respondents of makhana with fish ecosystem were participants in groups related to fish production as well as makhana production, thus they had slightly higher participation. This is in conformity with the results of Madhuri *et al.* (2020) [7].

3.8 Sources of information: The result shown in the Table 1 revealed that in makhana as sole crop ecosystem, under formal sources of information, half (50.00%) of the respondents had medium sources of information exposure, followed by low (35.00%) and high (15.00%). In case of informal sources, more than half (55.00%) of the respondents were expose to information sources to medium extent,

followed by high (33.33%) and low (11.67%). In case of mass media sources, more than half (55.00%) of the respondents had medium extent of information source exposure, followed by low (31.67%) and high (13.33%). Whereas in case of makhana with fish ecosystem, under formal sources of information, slightly less than half (48.33%) of the respondents had medium sources of information exposure, followed by low (26.67%) and high (25.00%). In case of informal sources, less than half (46.67%) of the respondents were exposed to information sources to medium extent, followed by high (45.00%) and low (8.33%). In case of mass media sources, more than half (51.67%) of the respondents had medium extent of information source exposure, followed by low (26.67%) and high (21.66%). The probable reason for more contact with different sources of information could be that makhana cultivation provides higher return on investment, thus rendering more profit, so cultivators were eager to know about the various packages of practices and information related to makhana. This result is in conformity with findings of Avinash (2018) [14].

3.9 Amount of credit availed: The Table 1 depicts that majority (86.67%) of the respondents of makhana as sole crop ecosystem had no credit, followed by credit up to 1 lakh rupees (8.33%) and 1 lakh rupees and above (5.00%). Whereas, in case of makhana with fish ecosystem, majority (80.00%) of the respondents had no credit, followed by up to 1 lakh rupees (13.33%) and 1 lakh rupees and above (6.67%). The reasons stated by respondents were that majority had savings from previous makhana and other crops while some respondents expressed lack of collateral, high rate of interest charged by informal financial institutions, paperwork involved in formal financial among other reasons which impeded them from availing credit. This result is in conformity with findings of Kumar *et al.* (2018) [14].

3.10 Application of ICT tools: From the Table 1, it is evident that majority (61.67%) of the respondents of makhana as sole crop ecosystem had high application of ICT tools, followed by medium (28.33%) and low (10.00%). Whereas in case of makhana with fish ecosystem, less than half (46.67%) of the respondents had high application of ICT tools, followed by medium (38.33%) and low (15.00%). This could be because most of the farmers used social media platforms such as Facebook, WhatsApp and YouTube and google for browsing information on makhana cultivation but the exposure to other mobile apps and portals related to makhana such as Makhana guide, makhana on call, makhana food, shakti sudha, madhubani makhana to name a few are negligible and thus needs more knowledge and awareness about these. This result is in conformity with findings of Vikas *et al.* (2020) [15].

3.11 Trainings undergone: The result shown in the Table 1 revealed that, majority (81.67%) of the respondents of makhana as sole crop ecosystem did not receive any training, followed by one training (15.00%) and two trainings (3.33%) received. Whereas in case of makhana with fish ecosystem, majority (70.00%) of the respondents did not receive any training, followed by one training (25.00%) and two trainings (5.00%) received. The reason could be as less number of improved technologies, implements or inputs were researched, number of trainings conducted for dissemination of the same were also less and the trainings were mostly conducted in block offices covering all villages, thus all the

farmers could not participate as limited number of farmers can only be trained in a training session hence majority of the respondents had not undergone any training related to makhana cultivation. This is in conformity with the results of Avinash (2018) [14] and Alagappan and Kumaran (2020) [1].

3.12 Processing and value addition facilities: From the Table 1, it was found that majority (91.67%) of the respondents of makhana as sole crop ecosystem did not perform processing and value addition of makhana products whereas processing and value addition was performed by 8.33 percent of the respondents. In case of makhana with fish ecosystem, majority (93.33%) of the respondents did not perform processing and value addition of makhana products whereas processing and value addition was performed by 6.67 percent of the respondents. The reason could be because processing is highly skilled operation that is done manually by the people of *Mallah* community that migrate to the study area every year. They are hired by the processors which involves very high wage rate as well as living expenses.

3.13 Market accessibility: From the Table 1, it was concluded that majority (60.00%) of the respondents of makhana as sole crop ecosystem had medium market accessibility, followed by low (28.33%) and high (11.67%). Whereas in case of makhana with fish ecosystem, more than half (53.33%) of the respondents had medium market accessibility, followed by low (25.00%) and high (21.67%). The probable reason could be that most of the farmers were selling their makhana to middleman in the village itself. Only few farmers were able to sell their produce in big mandis such as Gulabghat and Khuskhabagh located in Purnia and Katihar districts. Whereas fish was mostly sold in village market, nearby markets and district markets, thus increasing the market accessibility. Makhana was mostly transported by private or own vehicles whereas for fish it was by private, own and public transport.

3.14 Availment of government support and subsidies: From the Table 1, it was revealed that majority (76.67%) of the respondents of makhana as sole crop ecosystem had not availed any government support and subsidies, followed by one government support and subsidies availed (16.67%) and two government support and subsidies availed (6.66%). Whereas in case of makhana with fish ecosystem, majority (81.67%) of the respondents had not availed any government support and subsidies, followed by one government support and subsidies availed (15.00%) and two government support and subsidies availed (3.33%). It might be due to the fact that limited budget was allocated for makhana development scheme per district which was further divided into blocks, the process of filling form for subsidy is online and opens for a certain period of time about which farmers are not aware and they do not know the process to fill the form, one farmer can avail the subsidy under makhana development scheme only once in 3 years i.e. if he avails subsidy this year, he will not be eligible for the next two years and the improved seeds are also provided in limited quantity to limited numbers of farmers (5 per village).

3.15 Implements and machinery possessed: The Table 1 depicts that majority (63.33%) of the respondents of makhana as sole crop ecosystem had low level of implements and machinery possessed, followed by medium (31.67%) and high (5.00%). Whereas in case of makhana with fish ecosystem, slightly less than half (48.33%) of the respondents had low

level of implements and machinery possessed, followed by medium (45.00%) and high (6.67%). This might be due to the reason that majority of the respondents are marginal and small farmers with low income and less capital to invest. This is in conformity with the results of Raghuwanshi *et al.* (2022) ^[10].

3.16 Perceived drudgery: It could be indicated from the Table 1 that majority (76.67%) of the respondents of makhana as sole crop ecosystem perceived drudgery to medium extent, followed by high (15.00%) and low (8.33%). Whereas in case of makhana with fish ecosystem, more than half (56.67%) of the respondents perceived drudgery to medium extent, followed by high (36.67%) and low (6.66%). Makhana with fish cultivation was considered to be more difficult than makhana as sole crop due to more depth of water which leads to difficulty in performing various operations and also cause

health issues related to skin due to prolonged exposure to water.

3.17 Net returns: The results of the Table 1 indicated that more than two-fifth (46.67%) of the respondents of makhana as sole crop ecosystem had net returns of 1 lakh to 2 lakh, followed by less than 1 lakh (31.67%), 2 lakh to 3 lakh (8.33%), 3 lakh to 4 lakh (8.33%) and more than 4 lakh (5.00%). Whereas in case of makhana with fish ecosystem, slightly more than two-fifth (41.67%) of the respondents had net returns of 1 lakh to 2 lakh, followed by 2 lakh to 3 lakh (25.00%), less than 1 lakh (16.67%), 3 lakh to 4 lakh (8.33%) and more than 4 lakh (8.33%). Makhana cultivation gives higher benefits to farmers than other crops due to higher market price in most of the year thus attracting more farmers towards makhana cultivation. Makhana cultivation with fish gives additional income to farmers, thus increasing their net returns from the same piece of land.

Table 1: Distribution of respondents of two major makhana ecosystems based on their profile characteristics, (N=120)

S. No.	Characteristics	Makhana as sole crop		Makhana with fish	
		Frequency	Percentage	Frequency	Percentage
1	Age (Years)				
	Young age (Up to 35 years)	15	25.00	18	30.00
	Middle age (35-50)	31	51.67	32	53.33
	Old age (Above 50)	14	23.33	10	16.67
2	Education				
	Illiterate	4	6.67	9	15.00
	Primary school (1 to 5 standard)	16	26.67	12	20.00
	Middle school (6 to 8 standard)	17	28.33	15	25.00
	High school (9 & 10 standard)	6	10.00	10	16.67
	Higher secondary school (11 & 12 standard)	8	13.33	6	10.00
	Graduation	5	8.33	6	10.00
	Post-graduation and above	4	6.67	2	3.33
3	Family size				
	3-5	24	40.00	21	35.00
	5-7	27	45.00	31	51.67
	7-9	9	15.00	8	13.33
4	Role of family members in makhana cultivation				
	Low	19	31.67	18	30.00
	Medium	32	53.33	37	61.67
	High	9	15.00	5	8.33
5	Area under makhana cultivation				
	Marginal (Up to 1.00 ha)	33	56.67	39	65.00
	Small (1.01 to 2.00 ha)	22	35.00	17	28.33
	Semi medium (2.01 to 4.00 ha)	5	8.33	4	6.67
	Medium (4.01 to 10.00 ha)	0	0.00	0	0.00
	Large (10.01 and above ha)	0	0.00	0	0.00
6	Input usage				
	Low	7	11.67	19	31.67
	Medium	39	65.00	31	51.67
	High	14	23.33	10	16.66
7	Participation in farmers' group				
	Low	12	20.00	12	20.00
	Medium	34	56.67	39	65.00
	High	14	23.33	19	15.00
8	Sources of information				
	Formal sources				
	Low	21	35.00	16	26.67
	Medium	30	50.00	29	48.33
	High	9	15.00	15	25.00
	Informal sources				
	Low	7	11.67	5	8.33
	Medium	33	55.00	28	46.67
	High	20	33.33	27	45.00
	Mass media sources				
	Low	12	10.00	19	31.67
	Medium	61	50.83	33	55.00
	High	47	39.17	8	13.33

9	Amount of credit availed				
	No credit	52	86.67	48	80.00
	Up to 1 lakh rupees	5	8.33	8	13.33
	1 lakh rupees and above	3	5.00	4	6.67
10	Application of ICT tools				
	Low	6	10.00	9	15.00
	Medium	17	28.33	18	30.00
	High	37	61.67	33	55.00
11	Trainings undergone				
	No training received	49	81.67	42	70.00
	One training received	9	15.00	15	25.00
	Two trainings received	2	3.33	3	5.00
12	Processing and value addition facilities				
	No processing and value addition done	55	91.67	56	93.33
	Processing and value addition done	5	8.33	4	6.67
13	Market accessibility				
	Low	17	28.33	15	25.00
	Medium	36	60.00	32	53.33
	High	7	11.67	13	21.67
14	A ailment of government support and subsidies				
	No government support and subsidies availed	46	76.67	49	81.67
	One government support and subsidies availed	10	16.67	9	15.00
	Two government support and subsidies availed	4	6.66	2	3.33
15	Implements and machinery possessed				
	Low	38	63.33	29	48.33
	Medium	19	31.67	27	45.00
	High	3	5.00	4	6.67
16	Perceived drudgery				
	Low	5	8.33	4	6.66
	Medium	46	76.67	34	56.67
	High	9	15.00	22	36.67
17	Net returns				
	Less than ₹1,00,000	19	31.67	10	16.67
	₹1,00,001-₹2,00,000	28	46.67	25	41.67
	₹2,00,001-₹3,00,000	5	8.33	15	25.00
	₹3,00,001-₹4,00,000	5	8.33	5	8.33
	More than ₹4,00,001	3	5.00	5	8.33

4. Conclusion

The study's results indicated that a significant proportion of the respondents fell within the medium category for most profile characteristics. Planners and development agencies should prioritize this aspect when organizing capacity-building initiatives or implementing schemes and programs to fully harness the potential of makhana cultivators in the two major ecosystems.

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